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HSIA, Han Min, 1932–
RADIATIVE TRANSFER IN AN ABSORBING, EMITTING, ANISOTROPIC SCATTERING, AND NON–ISOTHERMAL MEDIUM BETWEEN PARALLEL PLATES.

The University of Oklahoma, Ph.D., 1965
Engineering, mechanical

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

RADIATIVE TRANSFER IN AN ABSORBING, EMITTING, ANISOTROPIC SCATTERING, AND NON-ISOTHERMAL MEDIUM BETWEEN PARALLEL PLATES

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

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Norman, Oklahoma

1965

RADIATIVE TRANSFER IN AN ABSORBING, EMITTING,

ANISOTROPIC SCATTERING, AND NON-ISOTHERMAL

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APPROVED BY

DISSERTATION COMMITTEE

ACKNOWLEDGEMENTS

The research was sponsored by the Aerospace Research Laboratories, United States Air Force, (contract AF 33(657)-8859). The financial and computer support of this organization is gratefully acknowledged.

The author wishes to acknowledge his indebtedness to Dr. Tom J. Love, Jr., whose guidance, patience and understanding made possible the success of this investigation, and also to all members of the author's graduate committee, including Dr. D. G. Harden, Dr. A. S. Davis, and Dr. E. L. Secrest.

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NOMENCLATURE

a' = quadrature weight factor with m^{th} approximation

a = quadrature weight factor with n^{th} approximation

A,B = matrices defined in Equation (2c)

c_o = velocity of light, ft/hr

c,c' = constants

C = boundary constant matrix

d = diameter of a spherical particle, ft

D = matrix defined in Equation (26)

e = emissive power, Btu/hr-ft^2

E = idempotents defined in Equations (5) and (6)

f = the characteristic function of a matrix

f' = the first derivative of f

G = matrix defined in Equation (26)

h = Planck's constant, Btu/hr

H = matrix defined in Appendix I

I_ν = monochromatic intensity of radiation, Btu/ft^2-stearad

k = Boltzman constant, Btu/°R; elements of the matrix K

K = the matrix defined in Equation (51)

K^e = extinction cross section

L = matrix defined in Equation (28)

m = order of approximation; refraction index; elements of matrix M defined in Equation (51)

M = matrix defined in Equation (26) and Equation (51); a parameter defined in Love's work (4)

N = a parameter defined in Love's work

P = matrix defined in Equation (30)

pt. = point

q = another expression for idempotents as indicated in Equation (5) and Equation (6)

Q = net heat flux, Btu/hr-ft^2

Q_{bb} = net heat flux for black walls without a medium, Btu/hr-ft^2

r, r_I, r_{II} = radius of sphere between the boundaries, radius of inner wall, radius of outer wall, ft

R_ν = monochromatic radiosity, Btu/ft^2

s = distance along a ray as in Figure (2), ft

S = scattering function

S_o = heat source, Btu/hr-ft^3

S' = a function defined in Equation (2d)

t = a dummy variable in Equation (14)

T = temperature, °R

T_a = temperature of an isothermal gas, °R

U = unit matrix

V = matrix defined in Appendix I

W = a polynomial

x = normal coordinate distance as in Figure (2), ft; elements of the matrix X

x' = quadrature coordinate points

X = the matrix defined in Equation (51)

y = elements of the matrix Y

Y = normalized eigenvector; the matrix defined in Equation (51)

Z = matrix defined in Appendix I

α_M = eigenvalue of the matrix M^2

α = particle size parameter

β = monochromatic mass extinction coefficient, ft^2/lb_m

ϵ = surface emissivity

θ = polar angle as indicated in Figure (2); the angle between the radius vector and the vector of distance along a ray as defined in the spherical case, radians

κ, κ_t = monochromatic mass absorption coefficient, total mass absorption coefficient, ft^2/lb_m

λ = radiation wave length, ft

λ_M = eigenvalue of the matrix M

μ = cosine θ

$\bar{\mu}$ = matrix defined in Equation (2b)

ν = frequency of radiation, 1/hr

ρ = mass density, lb_m/ft^3; surface reflectivity

η = temperature distribution parameter

σ = monochromatic mass scattering coefficient

τ = optical depth = $\int_0^x \rho\beta \, dx$

τ_o = optical spacing = $\int_0^{wall\ 2} \rho\beta \, dx$

τ^o = $\rho\beta r_I$

φ = azimuthal angle, radian; elements of the matrix Φ

Φ = matrix defined in Equation (51); a parameter defined by Usiskin and Sparrow

ξ = integration variable

Subscripts

ν = monochromatic

bb = black body

iso = isothermal

i, j = iteration indices

ℓ = order of Legendre polynomial

p = particular solution

H = homogeneous solution

m = iteration index ($\leq n$) defined in Appendix I

med = medium

z = refer to the direction perpendicular to wall 1 and wall 2

1,2 = refer to wall 1, wall 2

Superscripts

' = a distinction from no prime case

* = a matrix

e, ℓ = radiative equilibrium case, linear case

-1 = inverse of a matrix

Others

$\begin{bmatrix} \\ \end{bmatrix}$ = a column matrix

[ ] = a square matrix

[ ]= a row matrix, a parenthesis the size of a matrix will be revealed by its elements

+,- = sometime refer to a positive (or negative) direction of a ray defined in Figure (2)

o, τ_o = in () sometime refer to at wall 1, wall 2

I, II = sometime refer to the regions

CHAPTER I

ABSTRACT

The problem of radiative transfer in a pure absorbing, emitting and non-isothermal medium between parallel plates is investigated taking into account the effect of anisotropic scattering due to local inhomogeneities.

A mathematical method utilizing idempotent is applied in the discrete heat flux model. The method, which provided only a homogeneous solution, is modified to fit the specific physical conditions, and a particular solution is developed by the author. All the necessary proofs and discussion of the limiting cases are thoroughly covered.

A linear or parabolic temperature distribution, which is equivalent to the case of a variable heat source (or sink) locally distributed, is assumed in the medium. The monochromatic net heat flux at a bounding wall in a medium of a constant particle size parameter was obtained numerically by a high-speed computer. The total net heat

at a wall with a medium of a given diameter of particles is computed in an example.

CHAPTER II

INTRODUCTION

The radiant heat transfer problem involving absorbing and emitting media has been solved by Usisikin and Sparrow (1) by numerically integrating the integral equation. Deissler (2) has solved the problem by using a diffusion model with a higher order jump boundary condition, and Howell and Perlmutter (3) have investigated the same problem by utilizing a Monte Carlo method. None of the authors took into account any effect of anisotropic scattering in the media. The scattering effect may not be negligible in case of a medium having local inhomogeneities or dispersion particles which absorb, emit and scatter the radiant energy. A thorough analysis considering the scattering effect in an absorbing and emitting medium between parallel walls was developed by applying the discrete heat flux model by Love (4). The special case of radiant thermal equilibrium in an absorbing, emitting and isotropic scattering medium discussed in the latter's work actually corresponds to a pure absorbing, emitting and non-isothermal medium considered by the other workers previously mentioned, since anisotropic scattering may be treated as an emission mechanism. An appropriate comparison may be made as indicated in Figure 1 of the results of these authors. It seems that all these models are in a good agreement; however, the discrete flux model could serve more complex problem after introducing a mathematical method by Frame (5) with certain modifications to fit the physical problem as proposed in this work. Although a certain deficiency of the discrete flux model at a lower order of approximation was indicated in the special case proposed by Churchill, Chu and coworkers (6), the author would suggest that engineers and scientists in this field at least use the results hereafter as an initial estimation for further refinements, comparisons and iterations in the problem.

In general, all the cases discussed in Love's work may be considered as an effort to seek, with certain rearrangements, the solution of a set of simultaneous, homogeneous (or non-homogeneous differential equations having a constant as its particular solution) first order, linear differential equations by which the equations of radiant heat transfer are formed. The present analysis differs from Love's work in that the particular solution is not a constant due to a non-isothermal temperature distribution in a medium. This investigation may be considered as a further extension of his work.

The assumed non-isothermal temperature distribution may be interpreted as the existence of a variable heat source (or sink) in a medium or it may be considered as the combined effects of conduction and convection. In Usiskin and Sparrow's work, a certain temperature distribution may be found for a predetermined heat source if the relation between the temperature and the emissive power of gas is known. Consequently in this work, the strength of a local heat source (or sink) contained in a medium may be estimated for an assumed temperature distribution.

It is interesting to note that the approach in this investigation may be extended to the different geometries such as concentric spheres with some appropriate modifications.

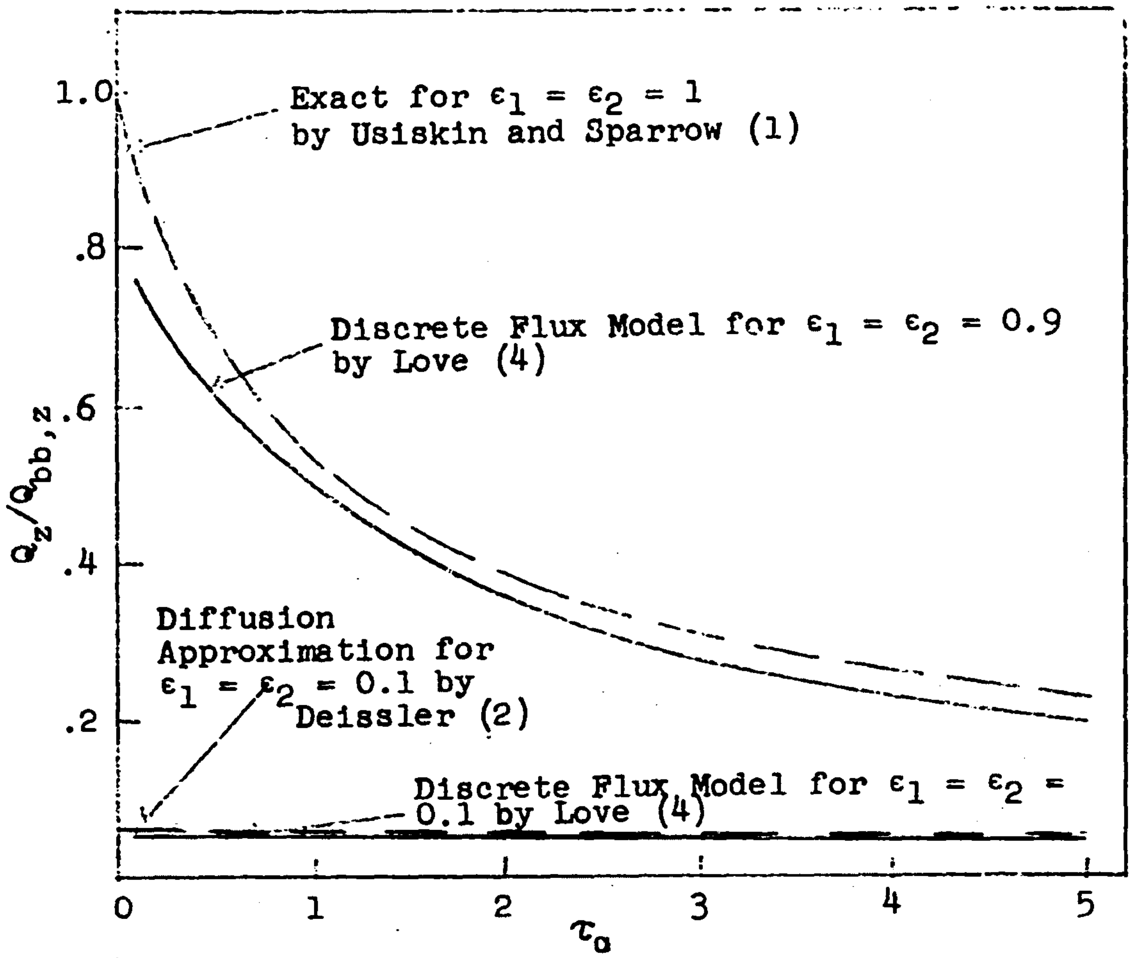


Figure 1. Radiant Heat Transfer of an Absorbing, Emitting and Isotropic Scattering Medium In Radiative Equilibrium Between Parallel Walls

CHAPTER III

ANALYSIS

(a) Description and Assumptions

The absorbing, emitting and anisotropic scattering particles are assumed to be spherical in shape with a complex refractive index. The scattering function for the discrete directions according to the double Gaussian formula may be chosen from the combination of Love's and Chu, Clark, and Churchill's work (7). The diffusely reflecting, emitting, gray (or non-gray) walls, which were also called jump boundary condition by Deissler, are considered thoroughly in the problem. The temperature at each wall is regarded uniformly constant, but one may differ from the other. The Planck function is used to represent the black body emission. The mass emission and absorption coefficients (may or may not be a function of frequency or wave length) are considered to be equal; this is especially true under thermodynamic equilibrium. A linear or parabolic form of temperature distribution is assumed between the parallel plates. The intensities for the discrete directions are evaluated on a monochromatic basis. The magnitude of scattering effect is supposed to be linearly dependent on the number of the particles (or the density of the dispersion) per unit volume. This is a special case of multiple scattering in which the scattering effect among the particles (secondary scattering) is neglected as appeared in Churchill and Chu's work. The coordinate scheme for the problem is indicated in Figure 2.

(b) Homogeneous Solution

The general radiant heat transfer equation which would satisfy the conditions described in (a) was presented by utilizing the discrete flux model by Love as follows:

$$\mu_i \frac{dI_\nu(\tau,+\mu_i)}{d\tau} = -I_\nu(\tau,+\mu_i) + \frac{\sigma}{2\beta}\sum_{j=1}^{n} a_j S(+\mu_i,+\mu_j)\cdot I_\nu(\tau,+\mu_j)$$

$$+ \frac{\sigma}{2\beta}\sum_{j=1}^{n} a_j S(+\mu_i,-\mu_j)\, I_\nu(\tau,-\mu_j) + \frac{\kappa}{\beta} I_{bb,\nu}(\tau) \tag{1a}$$

$$-\mu_i \frac{dI_\nu(\tau,-\mu_i)}{d\tau} = -I_\nu(\tau,-\mu_i) + \frac{\sigma}{2\beta}\sum_{j=1}^{n} a_j S(-\mu_i,+\mu_j)\, I_\nu(\tau,+\mu_j)$$

$$+ \frac{\sigma}{2\beta}\sum_{j=1}^{n} a_j S(-\mu_i,-\mu_j)\, I_\nu(\tau,-\mu_j) + \frac{\kappa}{\beta} I_{bb,\nu}(\tau) \tag{1b}$$

Equations (1a) and (1b) can be written in matrix form as follows:

$$\frac{dI^*_\nu(\tau,\mu)}{d\tau} - M^* I^*_\nu(\tau,\mu) = \frac{\kappa}{\beta} I_{bb,\nu}(T(\tau))\overline{\mu}^*, \tag{2}$$

where $T(\tau)$ is the temperature distribution in the medium. The starred characters represent the matrices as shown:

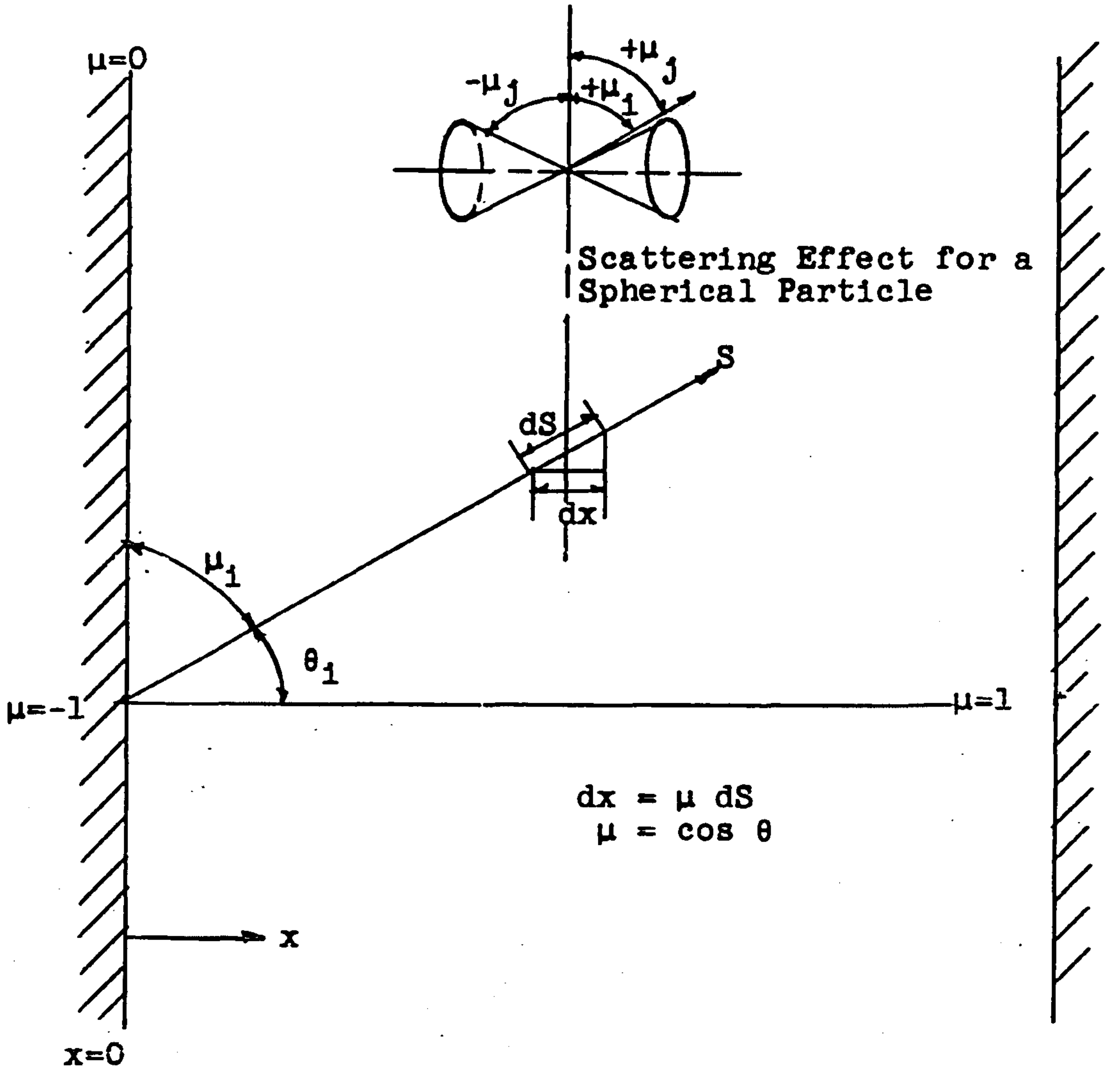


Figure 2. Coordinate Scheme for a Plane Parallel Axially Symmetrial System

$$I_\nu^*(\tau,\mu) = \begin{bmatrix} I_\nu(\tau,+\mu_1) \\ I_\nu(\tau,+\mu_2) \\ \vdots \\ I_\nu(\tau,+\mu_n) \\ I_\nu(\tau,-\mu_1) \\ I_\nu(\tau,-\mu_2) \\ \vdots \\ I_\nu(\tau,-\mu_n) \end{bmatrix} \tag{2a}$$

$$\overline{\mu^*} = \begin{bmatrix} 1/\mu_1 \\ 1/\mu_2 \\ \vdots \\ 1/\mu_n \\ -1/\mu_1 \\ -1/\mu_2 \\ \vdots \\ -1/\mu_n \end{bmatrix} \tag{2b}$$

By introducing the principle of reciprocity for single scattering,

$$\left.\begin{aligned} S(+\mu_m,+\mu_n) &= S(-\mu_m,-\mu_n) \\ S(+\mu_m,-\mu_n) &= S(-\mu_m,+\mu_n) \end{aligned}\right\} \quad \begin{aligned} m &= 1,2,\ldots n \\ n &= 1,2,\ldots n \end{aligned}$$

Then

$$M^{*} = \begin{bmatrix} A^{*} & B^{*} \\ -B^{*} & -A^{*} \end{bmatrix} \tag{2c}$$

where

$$A^{*} = \begin{bmatrix} \left(-\frac{1}{\mu_1} + \frac{a_1 S'_{1,1}}{\mu_1}\right), & \frac{a_2 S'_{1,2}}{\mu_1} & , \ldots , & \frac{a_n S'_{1,n}}{\mu_1} \\ \frac{a_1 S'_{2,1}}{\mu_2} & , \left(-\frac{1}{\mu_2} + \frac{a_2 S'_{1,2}}{\mu_2}\right), & \ldots , & \frac{a_n S'_{2,n}}{\mu_2} \\ \vdots & \vdots & \cdots & \vdots \\ \frac{a_1 S'_{n,1}}{\mu_n} & , \frac{a_2 S'_{n,2}}{\mu_n} & , \ldots , & \left(-\frac{1}{\mu_n} + \frac{a_n S'_{n,n}}{\mu_n}\right) \end{bmatrix}$$

$$B^{*} = \begin{bmatrix} \frac{a_1 S'_{1,-1}}{\mu_1} , & \frac{a_2 S'_{1,-2}}{\mu_1} , & \ldots\ldots\ldots , & \frac{a_n S'_{1,-n}}{\mu_1} \\ \frac{a_1 S'_{2,-1}}{\mu_2} , & \frac{a_2 S'_{2,-2}}{\mu_2} , & \ldots\ldots\ldots , & \frac{a_n S'_{2,-n}}{\mu_2} \\ \vdots & \vdots & \cdots\cdots & \vdots \\ \frac{a_1 S'_{n,-1}}{\mu_n} & \frac{a_2 S'_{n,-2}}{\mu_n} & & \frac{a_n S'_{n,-n}}{\mu_n} \end{bmatrix}$$

and

$$\left.\begin{aligned} S'_{m,n} &= \frac{\sigma}{2\beta} S(+\mu_m, +\mu_n) \\ S'_{m,-n} &= \frac{\sigma}{2\beta} S(+\mu_m, -\mu_n) \end{aligned}\right\} \quad \begin{aligned} m &= 1,2, \ldots n \\ n &= 1,2, \ldots n \end{aligned} \tag{2d}$$

The homogeneous part of the solution to Equation (2) by Frame is

$$I^*_{H,\nu}(\tau,\mu) = e^{M^*\tau} C^* \tag{3}$$

where $I^*_{H,\nu}(\tau,\mu)$, C^* are 2n x 1 column matrices. The latter will be determined by the boundary condition of the problem and

$$e^{M^*\tau} = \sum_{j=1}^{2n} e^{\lambda_j \tau} E^*_j \tag{4}$$

λ_j are the eigenvalues of the matrix M^* and E^*_j are the idempotents (each one is a 2n x 2n square matrix) of the matrix M^*.

The definition of idempotents (Appendix I) appears in abstract algebra texts such as Perlis' (8). However, the application of the idempotent in solving the simultaneous, homogeneous differential equations as indicated in Equations (3) and (4) and the mathematical manipulation for computing the idempotents are contributed by Frame. The expressions for the idempotents in the latter's work are as follows,

$$E^*_j = q_j(M^*) \tag{5}$$

$$q_j(\lambda) = \frac{f(\lambda)}{(\lambda - \lambda_j)\, f'(\lambda_j)} \tag{6}$$

Therefore Equation (3) becomes

$$I^*_{H,\nu}(\tau,\mu) = \sum_{j=1}^{2n} e^{\lambda_j \tau}\, q_j(M^*)\, C^* \tag{7}$$

It can be seen that M^* is a nonsingular matrix which has 2n distinctive eigenvalues. These eigenvalues can be grouped into n pairs; the components of each pair are numerically equal but opposite in sign, such that

$$|\lambda_j| = |\lambda_{n+j}| \text{ for all } j = 1,2, \ldots n \tag{8}$$

The computation of eigenvalues will be discussed later in the paper.

Both the eigenvalues and the corresponding eigenvectors of the matrix M^* are involved in the homogeneous solution introduced by Love. The relation may be written,

$$M^* Y^*_j = \lambda_j Y^*_j \qquad j = 1,2, \ldots 2n \tag{9}$$

where Y^*_j, a 2n x 1 column matrix, is the j^{th} normalized eigenvector corresponding to the j^{th} eigenvalue, λ_j, of the matrix. In the present problem, the diagonal elements of M^* are dominant over the others; it always appears that the j^{th} element of the 2n column matrix, Y_j, is 1 and the other elements are numerically less than 1.

However, the eigenvalues and idempotents are used in this approach. To the author's knowledge, an idempotent may be called an "Eigen matrix", which concept does not appear in the literature, for it has the following property,

$$M^{*}q_j(M^{*}) = \lambda_j q_j(M^{*}) \qquad j = 1,2, \ldots 2n \qquad (10)$$

The proof of Equation (10) is in Appendix II. Furthermore, it is understood that every column vector of $q_j(M^{*})$ is a product of Y_j^{*} multiplied by a constant such that

$$q_j(M^{*}) = [C_1Y_j^{*},\ C_2Y_j^{*},\ \ldots\ C_iY_j^{*},\ \ldots,\ C_nY_j^{*}] \qquad (11)$$

where C_i are distinctive constants. In the present case, it always appears that

$$C_i = 1 \qquad \text{when } i = j$$
$$|C_i| < 1 \qquad i \neq j$$

Therefore $q_j(M^{*})$ may be considered as a normalized eigenmatrix.

Evidently, Equations (10) and (11) imply the relation in Equation (9). Thus, the homogeneous solution is the same in these two methods. However, the use of idempotents may be more powerful for the developing of a particular solution for a non-isothermal medium.

It is important to note that the terms of the summation at the left-hand side of Equation (7) are dominated by the term which possesses the largest positive eigenvalue such that

$$\sum_{j=1}^{2n} e^{\lambda_j \tau}\ q_j(M^{*})\ C^{*} \approx e^{\lambda_{i,max}\tau}\ q_i(M^{*})\ C^{*} \qquad (12)$$

where $\lambda_{i,max}$ is the largest positive eigenvalue of M^{*}.

Each term of the summation at the left-hand side of

Equation (12) can be proved to be a homogeneous solution for $I_\nu^*(\tau,\mu)$ (see Appendix III). However, in utilizing a single term as the homogeneous solution, for example $I_\nu^*(\tau,\mu) = e^{\lambda_{i,max}\tau} q_i(M^*) C^*$, the solution will include the trivial components for the direction other than μ_i. This may be explained by the fact that $q_i(M^*)$ is characterized for a specific direction μ_i. In order to get the homogeneous solution without any trivial components, Equation (7) cannot be accepted directly as the solution. The final homogeneous solution was modified as follows,

$$I_{H,\nu}^*(\tau,\mu) = \left(\sum_{j=1}^{n} e^{-|\lambda_j|\tau} q_j(M^*) - \sum_{j=1}^{n} e^{-|\lambda_j|(\tau_o - \tau)} q_{j+n}(M^*) \right) C^* \qquad (13)$$

where τ_o, the optical spacing between the parallel plates, is indicated in Figure 3. The validity of the equation can be proved by a direct substitution. Each term of the summation in the equation thus contributes an appropriate amount to the solution without dominating the others. Also Equation (13) indicates that a linear differential equation in a matrix form carries the same basic characteristic of an ordinary linear differential equation. The choice of a minus sign between the two summation terms in Equation (13) was made because the elements of the matrix indicated in the outmost parenthesis

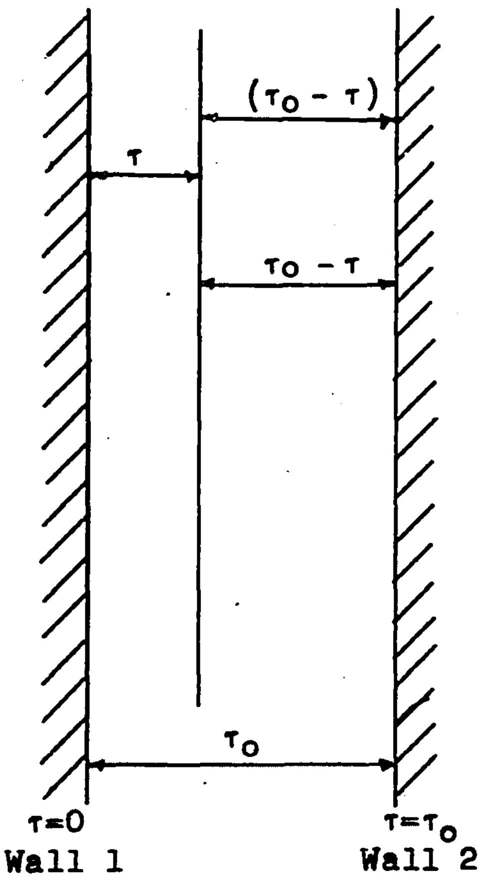


Figure 3

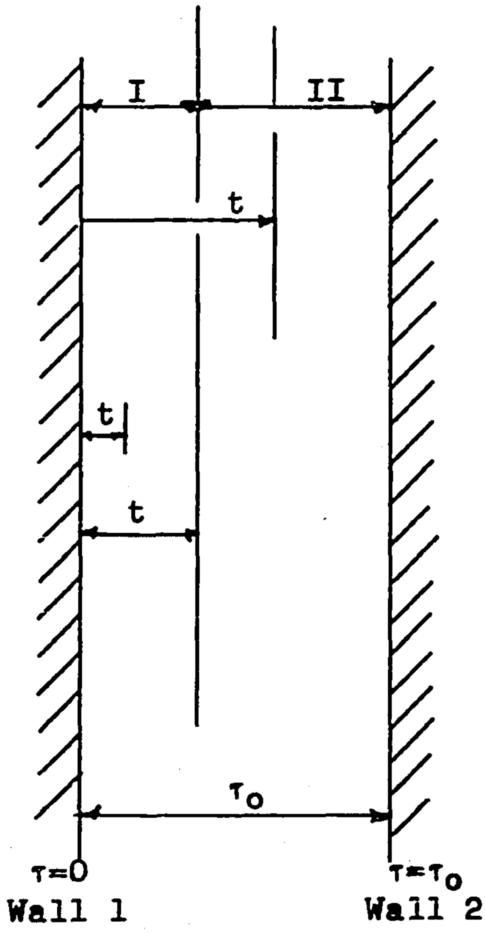


Figure 4

In region I, $0 \leq t \leq \tau$

In region II, $\tau \leq t \leq \tau_o$

Figures 3 and 4. The Relations Among τ, τ_o, and t for a Parallel Plate System at the right-hand of the equation tends to converge with increasing of τ_o under a numerical computation.

(c) Particular Solution

The particular solution of Equation (2) may be expressed as follows,

$$I^*_{p,\nu}(\tau,\mu) = \frac{\kappa}{\beta}\int_0^{\tau}\sum_{j=1}^{n} e^{-|\lambda_j|(\tau - t)} q_j(M^*)I_{bb,\nu}(T(t))dt\,\overline{\mu}^* - \frac{\kappa}{\beta}\int_{\tau}^{\tau_o}\sum_{j=1}^{n} e^{-|\lambda_j|(t - \tau)} q_{j+n}(M^*)I_{bb,\nu}(T(t))dt\,\overline{\mu}^* \qquad (14)$$

where t is a dummy variable as indicated in Figure 4. The term $I_{bb,\nu}(T(t))$ may be expressed in the form of Planck's function,

$$I_{bb,\nu}(T(t)) = \frac{2h\nu^3}{C_o^2}\frac{1}{e^{\frac{h\nu}{KT(t)}} - 1} \qquad (15)$$

In this investigation the temperature distribution was expressed as follows in referring to Schlichting (12)

$$\frac{T(t) - T_1}{T_2 - T_1} = \frac{\tau}{\tau_o} + \eta\,\frac{\tau}{\tau_o}\left(1 - \frac{\tau}{\tau_o}\right)$$

The proof of (14) was done by a direct substitution (see Appendix IV). Since the consideration of an expansion of Planck function into a convergent infinite series is not possible unless ν and T become dependent, which is not desirable in the present case, the integration is carried out by the double Gaussian formula. Combine Equations (15) and (16) with some appropriate transformations,

$$I^*_{p,\nu}(\tau,\mu) = \frac{\kappa}{\beta}\Big[\tau \sum_{j=1}^{n}\sum_{i=1}^{m} a_i' \, e^{-|\lambda_j|(\tau - x_i'\tau)} q_j(M^*)\, I_{bb,\nu}(T(t_i))$$

$$- (\tau_o - \tau)\sum_{j=1}^{n}\sum_{i=1}^{m} a_i' \, e^{-|\lambda_j|(\tau_o - \tau)x_i'} q_{j+n}(M^*)\, I_{bb,\nu}(T(t_i))\Big]\, \overline{\mu}^* \tag{16}$$

where $t_i = x_i\tau, \quad 0 \le t \le \tau$

$t_i = x_i'\tau_o + (1 - x_i')\tau, \quad \tau \le t \le \tau_o$

a_i', x_i' (for $i = 1,2, \ldots m$, where m may differ from n) are weight factors and ordinates of the double Gaussian formula for m degree of approximation.

In a particular case of an isothermal medium of temperature T_a,

$$I_{bb,\nu}(T(\tau)) = I_{bb,\nu}(T_a) = \text{a constant}$$

Equation (14), after being integrated, becomes

$$I^*_{p,\nu,iso}(\tau,\mu) = \frac{\kappa}{\beta} I_{bb,\nu}(T_a)\Big(\frac{1}{|\lambda_j|} q_j(M^*) - \frac{1}{|\lambda_j|} e^{-|\lambda_j|} q_j(M^*)$$

$$+ \frac{1}{|\lambda_j|} e^{-|\lambda_j|(\tau_o - \tau)} q_{j+n}(M^*) - \frac{1}{|\lambda_j|} q_{j+n}(M^*)\Big)\, \overline{\mu}^* \tag{17}$$

The second and third terms in the parenthesis of the equation may be included in the part of homogeneous solution, thus

$$I^{*}_{p,\nu,iso}(\mu) = \frac{\kappa}{\beta} I_{bb,\nu}(T_a) \sum_{j=1}^{n} \frac{1}{|\lambda_j|} (q_j(M^*) - q_{j+n}(M^*))\overline{\mu}^* \tag{18}$$

The particular solution of an isothermal medium was verified to be $I_{bb,\nu}(T_a)$ by Love under the condition,

$$\sum_{j=1}^{n} [a_j S(\mu_i,\mu_j) + a_j S(\mu_i,-\mu_j)] = 2 , \qquad i = 1,2, \ldots n$$

Since in case of anisotropic scattering the assumption is precisely held only when n approaches infinity. Therefore it is left to be determined whether the part of relation in (18) implies,

$$\lim_{n\to\infty} \sum_{j=1}^{n} \frac{1}{|\lambda_j|} (q_j(M^*) - q_{j+n}(M^*))\overline{\mu}^* = \begin{bmatrix} \beta/\kappa \\ \beta/\kappa \\ \vdots \\ \beta/\kappa \end{bmatrix} \tag{19}$$

Although the correctness of Equation (19) may not be rigorously proved, it can be proved convincingly by direct numerical computation (see Appendix V) and the following example of a limiting case:

In a pure absorbing and emitting medium,

$$|\lambda_j| = \frac{1}{|\mu_j|}$$

and

$$\sum_{j=1}^{n} (q_j(M^*) - q_{j+n}(M^*)) \frac{\vec{\mu}^*}{|\lambda_j|}$$

$$= \begin{bmatrix} \mu_1 & 0 & & 0 & 0 & 0 & & 0 \\ 0 & \mu_2 & & 0 & 0 & 0 & & 0 \\ & & \ddots & & & & & \\ 0 & 0 & & \mu_n & 0 & 0 & & 0 \\ 0 & 0 & & 0 & -\mu_1 & 0 & & 0 \\ 0 & 0 & & 0 & 0 & -\mu_2 & & 0 \\ & & & & & & \ddots & \\ 0 & 0 & & 0 & 0 & 0 & & -\mu_n \end{bmatrix} \begin{bmatrix} 1/\mu_1 \\ 1/\mu_2 \\ \vdots \\ 1/\mu_n \\ -1/\mu_1 \\ -1/\mu_2 \\ \vdots \\ -1/\mu_n \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} \tag{20}$$

Since $\beta/\kappa = 1$ in this case (for $\sigma = 0$), Equation (20) is a proof for a limiting case.

It is noteworthy that the part of the solution contributed by the scattering effect is not a function of a degree of approximation, n, in the limiting case of an isotropic scattering or a negligible scattering (a special case of an isotropic scattering). The closeness of the numerical results between the left and right-hand sides of Equation (19) may give us some idea about the accuracy of an approximation, provided the numerical value of the angular distribution coefficient, scattering function, and the ratio of mass scattering to extinction coefficient chosen from Chu, Clark, Churchill (7) and Love (4) are sufficiently accurate.

(d) Complete Solution and Boundary Conditions

The complete solution for intensity $I^*_\nu(\tau,\mu)$ may be written as follows:

$$I^*_\nu(\tau,\mu) = I^*_{H,\nu}(\tau,\mu) + I^*_{p,\nu}(\tau,\mu) = \Big(\sum_{j=1}^{n} e^{-|\lambda_j|\tau} q_j(M^*) - \sum_{j=1}^{n} e^{-|\lambda_j|(\tau_o - \tau)} q_{j+n}(M^*) \Big) C^*$$

$$+ \frac{\kappa}{\beta} \Big(\int_o^{\tau} \sum_{j=1}^{n} e^{-|\lambda_j|(\tau - t)} q_j(M^*) I_{bb,\nu}(T(t))dt$$

$$- \int_{\tau}^{\tau_o} \sum_{j=1}^{n} e^{-|\lambda_j|(t - \tau)} q_{j+n}(M^*) I_{bb,\nu}(T(t))dt \Big) \overline{\mu}^* \qquad (21a)$$

or by quadrature,

$$I_\nu^*(\tau,\mu) = \Big(\sum_{j=1}^{n} e^{-|\lambda_j|\tau} q_j(M^*)$$

$$- \sum_{j=1}^{n} e^{-|\lambda_j|(\tau_o - \tau)} q_{j+n}(M^*) \Big) C^*$$

$$+ \frac{\pi}{\beta} \Big[\tau \sum_{j=1}^{n} \sum_{i=1}^{m} a_i' e^{-|\lambda_j|(\tau - x_i'\tau)} q_j(M^*) I_{bb,\nu}(T(t_i))$$

$$- (\tau_o - \tau) \sum_{j=1}^{n} \sum_{i=1}^{m} a_i' e^{-|\lambda_j|(\tau_o - \tau)x_i'} q_{j+n}(M^*) I_{bb,\nu}(T(t_i)) \Big] \bar{\mu}^* \qquad (21b)$$

where t_i is referred to Equation (16).

In the limiting case of pure absorbing and emitting medium, Equation (21a) becomes,

$$I_\nu^*(\tau,\mu) = \begin{bmatrix} e^{\frac{-\tau}{\mu_1}} & 0 & 0 & 0 & 0 & 0 \\ 0 & e^{\frac{-\tau}{\mu_2}} & 0 & 0 & 0 & 0 \\ & & \ddots & & & \\ 0 & 0 & e^{\frac{-\tau}{\mu_n}} & 0 & 0 & 0 \\ 0 & 0 & 0 & -e^{-\frac{\tau_o-\tau}{\mu_1}} & 0 & 0 \\ 0 & 0 & 0 & 0 & -e^{-\frac{\tau_o-\tau}{\mu_2}} & 0 \\ & & & & & \ddots \\ 0 & 0 & 0 & 0 & 0 & -e^{-\frac{\tau_o-\tau}{\mu_n}} \end{bmatrix} \begin{bmatrix} C_1 \\ C_2 \\ \vdots \\ C_n \\ C_1' \\ C_2' \\ \vdots \\ C_n' \end{bmatrix}$$

$$+ \int_0^\tau I_{bb,\nu}(T(t)) \begin{bmatrix} e^{-\frac{\tau-t}{\mu_1}} & 0 & 0 & 0 & 0 & 0 \\ 0 & e^{-\frac{\tau-t}{\mu_2}} & 0 & 0 & 0 & 0 \\ & & \ddots & & & \\ 0 & 0 & e^{-\frac{\tau-t}{\mu_n}} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1/\mu_1 \\ 1/\mu_2 \\ \vdots \\ 1/\mu_n \\ -1/\mu_1 \\ \vdots \\ -1/\mu_n \end{bmatrix} dt$$

$$
- \int_{\tau}^{\tau_o} I_{bb,\nu}(T(t)) \begin{bmatrix} 0 & 0 & & 0 & 0 & 0 & 0 \\ 0 & 0 & & 0 & 0 & 0 & 0 \\ & & \ddots & & & & \\ 0 & 0 & & 0 & 0 & 0 & 0 \\ 0 & 0 & & 0 & e^{-\frac{t-\tau}{\mu_1}} & 0 & 0 \\ 0 & 0 & & 0 & 0 & e^{-\frac{t-\tau}{\mu_2}} & 0 \\ & & & & & \ddots & \\ 0 & 0 & & 0 & 0 & 0 & e^{-\frac{t-\tau}{\mu_n}} \end{bmatrix} \begin{bmatrix} 1/\mu_1 \\ 1/\mu_2 \\ \vdots \\ 1/\mu_n \\ -1/\mu_1 \\ -1/\mu_2 \\ \vdots \\ -1/\mu_n \end{bmatrix} dt \tag{22}
$$

Equation (22) may be rewritten as follows,

$$
I_\nu(\tau,+\mu_i) = C_i\, e^{-\frac{\tau}{\mu_i}} + \int_0^{\tau} e^{-\frac{\tau-t}{\mu_i}}\, I_{bb,\nu}(T(t))\, \frac{dt}{\mu_i} \tag{23a}
$$

$$
I_\nu(\tau,-\mu_i) = -C_i'\, e^{-\frac{\tau_o-\tau}{\mu_i}} + \int_{\tau}^{\tau_o} e^{-\frac{t-\tau}{\mu_i}}\, I_{bb,\nu}(T(t))\, \frac{dt}{\mu_i} \tag{23b}
$$

where $i = 1,2, \ldots n$

It is easy to see that

$$
C_i = I_\nu(0,+\mu_i) \;; \quad C_i' = -I_\nu(\tau_o,-\mu_i)
$$

Therefore,

$$I_\nu(\tau,+\mu_1) = I_\nu(0,+\mu_1)\, e^{\frac{\tau}{\mu_1}} + \int_0^\tau e^{\frac{\tau-t}{\mu_1}} I_{bb,\nu}(T(t))dt \qquad (24a)$$

$$I_\nu(\tau,-\mu_1) = I_\nu(\tau_o,-\mu_1)\, e^{-\frac{\tau_o-\tau}{\mu_1}} + \int_\tau^{\tau_o} e^{-\frac{t-\tau}{\mu_1}} I_{bb,\nu}(T(t))dt \qquad (24b)$$

The above equations will be exactly the Chandrasekhar (9) formula for parallel plates, axial symmetry case by recalling the fact that $I_\nu(\tau,-\mu_1)$ defined in the present case is equivalent to $I_\nu(\tau,+\mu_1)$ in his case.

Since a total heat flux at a bounding surface, $Q(0)$ or $Q(\tau_o)$, is of most interest in the present investigation, the net monochromatic heat flux on a wall, $Q_\nu(0)$ or $Q_\nu(\tau_o)$, should be obtained. To do this the following steps are followed,

$$I_\nu^*(0,\mu) = \left(\sum_{j=1}^{n} q_j(M^*) - \sum_{j=1}^{n} e^{-|\lambda_j|\tau_o} q_{j+n}(M^*)\right) C^* + I_{p,\nu}^*(0,\mu) \qquad (25a)$$

$$I_\nu^*(\tau_o,\mu) = \left(\sum_{j=1}^{n} e^{-|\lambda_j|\tau_o} q_j(M^*) - \sum_{j=1}^{n} q_{j+n}(M^*) \right) C^* + I_{p,\nu}^*(\tau_o,\mu) \qquad (25b)$$

Eliminate C^* between Equation (25a) and (25b)

$$D^* I_\nu^*(0,\mu) - G^* I_\nu^*(\tau_o,\mu) = D^* I_{p,\nu}^*(0,\mu) - G^* I_{p,\nu}^*(\tau_o,\mu) \qquad (26)$$

where D^* is the inverse of the matrix,

$$\left(\sum_{j=1}^{n} q_j(M^*) - \sum_{j=1}^{n} e^{-|\lambda_j|\tau_o} q_{j+n}(M^*) \right)$$

and G^* is the inverse of the matrix,

$$\left(\sum_{j=1}^{n} e^{-|\lambda_j|\tau_o} q_j(M^*) - \sum_{j=1}^{n} q_{j+n}(M^*) \right)$$

For the diffusely reflecting and emitting non-gray walls having constant temperature $T(0)$ and $T(\tau_o)$ respectively, the boundary condition may be written as follows referring to Love (4),

$$I_\nu^*(0,\mu) =$$

$$\begin{bmatrix} \frac{R_{\nu,1}}{\pi} \\ \frac{R_{\nu,1}}{\pi} \\ \vdots \\ \frac{R_{\nu,1}}{\pi} \\ I_\nu(0,-\mu_1) \\ I_\nu(0,-\mu_2) \\ \vdots \\ I_\nu(0,-\mu_n) \end{bmatrix} \text{ or } \begin{bmatrix} (1-\rho_{\nu,1})I_{bb,\nu}(T(0)) + 2\rho_{\nu,1} \sum_{j=1}^{n} a_j\mu_j I_\nu(0,-\mu_j) \\ (1-\rho_{\nu,1})I_{bb,\nu}(T(0)) + 2\rho_{\nu,1} \sum_{j=1}^{n} a_j\mu_j I_\nu(0,-\mu_j) \\ \vdots \\ (1-\rho_{\nu,1})I_{bb,\nu}(T(0)) + 2\rho_{\nu,1} \sum_{j=1}^{n} a_j\mu_j I_\nu(0,-\mu_j) \\ I_\nu(0,-\mu_1) \\ I_\nu(0,-\mu_2) \\ \vdots \\ I_\nu(0,-\mu_n) \end{bmatrix} \quad (27a)$$

$$I_\nu^*(\tau_o,\mu) =$$

$$\begin{bmatrix} I_\nu(\tau_o,\mu_1) \\ I_\nu(\tau_o,\mu_2) \\ \vdots \\ I_\nu(\tau_o,\mu_n) \\ \frac{R_{\nu,2}}{\pi} \\ \frac{R_{\nu,2}}{\pi} \\ \vdots \\ \frac{R_{\nu,2}}{\pi} \end{bmatrix} \text{ or } \begin{bmatrix} I_\nu(\tau_o,\mu_1) \\ I_\nu(\tau_o,\mu_2) \\ \vdots \\ I_\nu(\tau_o,\mu_n) \\ (1-\rho_{\nu,2})I_{bb,\nu}(T(\tau_o)) + 2\rho_{\nu,2}\sum_{j=1}^{n} a_j\mu_j I_\nu(\tau_o,\mu_j) \\ (1-\rho_{\nu,2})I_{bb,\nu}(T(\tau_o)) + 2\rho_{\nu,2}\sum_{j=1}^{n} a_j\mu_j I_\nu(\tau_o,\mu_j) \\ \vdots \\ (1-\rho_{\nu,2})I_{bb,\nu}(T(\tau_o)) + 2\rho_{\nu,2}\sum_{j=1}^{n} a_j\mu_j I_\nu(\tau_o,\mu_j) \end{bmatrix} \tag{27b}$$

where $R_{\nu,1}$, $R_{\nu,2}$ are monochromatic radiosities at wall 1 and 2. $\rho_{\nu,1}$, $\rho_{\nu,2}$ are monochromatic reflectivities at wall 1 and 2.

After some necessary grouping and inversion, then

$$I_\nu^*(0-\tau_o,\mu) = L^*(D^*I_{p,\nu}^*(0,\mu) - G^*I_{p,\nu}^*(\tau_o,\mu)) \tag{28}$$

where

$$I_\nu^*(0-\tau_o,\mu) = \begin{bmatrix} I_\nu(0,-\mu_1) \\ I_\nu(0,-\mu_2) \\ \vdots \\ I_\nu(0,-\mu_n) \\ I_\nu(\tau_o,\mu_1) \\ I_\nu(\tau_o,\mu_2) \\ \vdots \\ I_\nu(\tau_o,\mu_n) \end{bmatrix}$$

L^* is a known 2n square matrix which includes $\rho_{\nu,1}$, $\rho_{\nu,2}$; $T(0)$, $T(\tau_o)$; and elements of D^*, G^*.

Since every matrix on the right-hand side of Equation (28) is a known quantity, $I_\nu^*(0-\tau_o,\mu)$ is thus obtained and the same for $I_\nu^*(0,\mu)$ and $I_\nu^*(\tau_o,\mu)$. If the monochromatic intensities anywhere in the medium, $I_\nu^*(\tau,\mu)$, are of interest, the result may be obtained by solving C^* in either Equation (25a) or (25b) with recalling that $I_\nu^*(0,\mu)$ or $I_\nu^*(\tau_o,\mu)$ is obtained in the previous approach, and substituting C^* back to Equation (21a) or (21b).

Also

$$Q_\nu(0) = [a_1\mu_1, \ldots a_n\mu_n, -a_1\mu_1, \ldots, -a_n\mu_n] I_\nu^*(0,\mu) \qquad (29a)$$

$$Q_\nu(\tau_o) = [a_1\mu_1, \ldots, a_n\mu_n, -a_1\mu_1, \ldots, -a_n\mu_n] I_\nu^*(\tau_o,\mu) \qquad (29b)$$

It should be noted that $Q_\nu(0)$, $Q_\nu(\tau_o)$ in the above equations are obtained for a constant particle size parameter, α or $\frac{\pi d}{\lambda}$. Therefore to get $Q(0)$ or $Q(\tau_0)$ for a given diameter of particles in the medium, $Q_\nu(0)$ or $Q_\nu(\tau_0)$ should be subjected to change due to the variation of α according to ν. The integration technique will be shown in the part of numerical results.

(e) The Eigenvalues

The matrix, M^*, may be seen to have a possibility of having complex eigenvalues. Fortunately, its diagonal elements are dominant over the others, thus the real eigenvalues are always expected. The iterative root-removal method is likely effective for obtaining eigenvalues in a large-size unsymmetric matrix as mentioned in Modern Computing Method (10). However, after applying the method in the present problem, the difficulty of an oscillating eigenvector appears. Even one eigenvalue could not be obtained. The problem of oscillation may be demonstrated by a simple matrix,

$$P^* = \begin{bmatrix} 4 & 1 \\ -1 & -4 \end{bmatrix} \tag{30}$$

When the method is applied, the following happens

$$\begin{bmatrix} 1 & 1 \\ -1 & -4 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 5 \\ -5 \end{bmatrix} \xrightarrow{\text{normalized}} \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

where $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ is the initial iterative eigenvector, then

$$\begin{bmatrix} 4 & 1 \\ -1 & -4 \end{bmatrix} \begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \end{bmatrix} \xrightarrow{\text{normalized}} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

The oscillation may be observed.

Actually, the eigenvalue of P^* are $\sqrt{15}$ and $-\sqrt{15}$. The corresponding normalized eigenvectors,

$$\begin{bmatrix} 1 \\ -4 + \sqrt{15} \end{bmatrix} \text{ and } \begin{bmatrix} -4 + \sqrt{15} \\ 1 \end{bmatrix}$$

may be found.

Whatever value is given to the initial iterative eigenvector (except the true values), it will most likely oscillate.

The oscillation characteristic of M^* is somewhat similar to P^*. However, a better method other than the iterative root removal one was not found for the present problem. Therefore, the possibility of finding an appropriate transformation prior to using the method was considered.

In the following relation,

$$(P^*)^2 = P^* \cdot P^* = \begin{bmatrix} 4 & 1 \\ -1 & -4 \end{bmatrix} \begin{bmatrix} 4 & 1 \\ -1 & -4 \end{bmatrix} = \begin{bmatrix} 15 & 0 \\ 0 & 15 \end{bmatrix}$$

It is interesting to note that the multiplicity eigenvalue of

$(P^*)^2$, 15, is the square of either one of the eigenvalues of P^*, $\sqrt{15}$ or $-\sqrt{15}$. This characteristic may be extended to M^*, for the determinant

$$|\lambda_M^2 U^* - M^{*2}| = |\lambda_M^2 U^{*2} - M^{*2}| = |(\lambda_M U^* - M^*)(\lambda_M U^* + M^*)|$$

$$= |\lambda_M U^* - M^*| \; |\lambda_M U^* + M^*|$$

$$= -f(\lambda_M) \; f(-\lambda_M)$$

Hence $|\lambda_M^2 U^* - M^{*2}| = 0$, if $f(\lambda_M)$ or $f(-\lambda_M) = 0$. The last relations denote that if λ_M (or $-\lambda_M$) is the eigenvalue of M^*, then α_M $(=\lambda_M^2)$ will be the eigenvalue of M^{*2}. If α_M is found, λ_M will also be obtained with some justification of its appropriate sign. If α_M is a negative, λ_M will be a complex number. If each positive α_M has a multiplicity, the pairs of a positive and negative but numerically equal of λ_M's may appear. This is the case of this investigation which had been indicated earlier in Equation (8).

The above transformation may also be applied to a matrix similar to M^* but without a multiplicity in α_M. The type of matrix will be seen in different geometric configurations.

Since the diagonal elements of M^{*2} are positive and dominant, then the iterative root-removal method becomes applicable and the oscillation disappears.

CHAPTER IV

THE NUMERICAL RESULTS

(a) General Discussion of the Results and a Comparison with Love's Isothermal Case

The computation for the radiant heat transfer between parallel walls separated by a non-isothermal medium were programmed by using a third order quadrature approximation. The program was written in two parts:

(1) the scattering functions and the eigenvalues of the matrix M^*

(2) the idempotent, the particular solution, and the net monochromatic flux at bounding walls.

The language used was Fortran for both parts. The first part was run on the IBM 1410 while the second part, for which larger storage and computations were required, was run on an IBM 7090. The computer programs are listed in Appendix VIII.

The variables and the data points of each variable involved in the computation are as follows:

$m = 1.25 - 1.25i$, $2.00 - 0.60i$

$\tau_0 = 0.2, 1.0$

$\rho_1, \rho_2 = 0.1, 0.1;\ 0.5, 0.5$

$T_1, T_2 = 2000, 4000;\ 2000, 6000;\ 1000, 4000;\ 1000, 6000;\ 500, 4000;\ 3000, 8000°R$

$\eta = 0,\ 2,\ 4$

$\alpha = 0,\ 0.6,\ 1.0,\ 2.0,\ 3.0,\ 4.0$

$\nu = .01,\ .18,\ .36,\ .90,\ 1.80,\ 3.60,\ 7.20,\ 14.40,\ 57.00\ hr^{-1}$

The results for $Q_\nu(0)/Q_{\nu,bb}$ and $Q_\nu(\tau_o)/Q_{\nu,bb}$ were tabulated in Appendix VII.

Since the computations are fairly cumbersome, merely the essential data have been calculated. However, the information may well present a general and basic characteristic of the problem. For example, the nine points of frequencies would cover the wavelengths through 0.18 to 1080 microns. The thermal radiation band is within the region. Although the data for the particle size parameter larger than 4 has not been computed, it may be reasonably assumed that they remain constant after that point. This point could be strongly supported by Love's work. In his case of isothermal medium the heat transfer parameters M, N, and Q are essentially constant for $\alpha > 4$. It is well understood that only two of the three parameters are independent. The independent parameters, if N and Q are chosen, may be related to the parameters, $Q_\nu(0)/Q_{\nu,bb}$ and $Q_\nu(\tau_o)/Q_{\nu,bb}$, used in this work as follows:

$$Q_\nu(0)/Q_{\nu,bb} = \left[\frac{Q(I_{\nu,bb}(T_a) - I_{\nu,bb}(T_1))}{\pi(I_{\nu,bb}(T_2) - I_{\nu,bb}(T_1))} + \frac{N}{\pi} \right] \quad (31)$$

$$Q_\nu(\tau_o)/Q_{\nu,bb} = \left[\frac{Q(I_{\nu,bb}(T_2) - I_{\nu,bb}(T_a))}{\pi(I_{\nu,bb}(T_2) - I_{\nu,bb}(T_1))} + \frac{N}{\pi} \right] \quad (32)$$

for $T_2 > T_1$

The direction of heat flow at a bounding wall is defined as a positive if the flow direction is from the right to left; and a negative if otherwise.

It may be easily seen that the terms in the left-hand side of Equation (31) and (32) are constant if N, Q are considered to be constant for $\alpha > 4$. In addition to this point some of the computed results as shown through Figure 7a,b to 12a,b indicate the same characteristic may be held for the non-isothermal case. That the accuracy of $Q_\nu(0)/Q_{\nu,bb}$ (or $Q_\nu(\tau_o)/Q_{\nu,bb}$) is decreasing for larger α's may be explained by the fact that the sum of

$$\frac{1}{2} \left[\sum_{j=1}^{n} a_j S(\mu_i,\mu_j) + \sum_{j=1}^{n} a_j S(\mu_i,-\mu_j) \right]$$

deviates much more from 1 at every μ_i for the α's. In the other words, $S(\mu_i,\mu_j)$ and $S(\mu_i,-\mu_j)$ may not adequately represent the scattering function for very large α's. The reason for this may be explained as follows. (1) The larger α, the more angular distribution coefficients are used for computing the scattering functions. The accuracy of the coefficients in Chu, Clark and Churchill need be further studied. (2) The Legendre polynomials for (μ_i, μ_j) directions in Love's work may require a more refined work in integrating the function with respect to the azimuthal angle. A comparatively higher inaccuracy existed for $\alpha > 4$ may be the other reason for not computing the results beyond that point.

In order to get a general picture of the numerical results, the case of the linear temperature distribution with $T_1 = 2000°R$ and $T_2 = 4000°R$ was chosen as an example. The curves, which may well show the effect on radiative transfer due to a change of the variables involved, were plotted. $Q_\nu(0)/Q_{\nu,bb}$ (or $Q_\nu(\tau_o)/Q_{\nu,bb}$) versus α using ν as a parameter was shown through Figures 7a,b to 12a,b. In each designated pair of figures, the net monochromatic heat flux at a wall in the parallel plates system was described. Besides the three variables, ν, α and $Q_\nu(0)/Q_{\nu,bb}$ (or $Q_\nu(\tau_o)/Q_{\nu,bb}$), an additional variable such as optical spacing (or reflectivity, refractive index, temperatures at the bounding walls ...) was involved to show the effect of the specific variable on heat transfer under the conditions described in the figures.

Turning first to Figure 7a and Figure 7b, it may be observed that the curves of $\tau_o = 0.2$ are relatively higher than $\tau_o = 1.0$ for the corresponding ν's. This is physically reasonable in that the increase of τ_o must increase the resistance of radiative heat flow. The curves of $\tau_o = 0.2$ are relatively flatter than $\tau_o = 1.0$. This is consistent with the fact that the scattering effect is smaller for a thinner optical spacing.

It may not be easy to see that the curves are moving up with decreasing of ν for wall 1 while with increasing of ν for wall 2. However, an evidence to support this may be shown with the aid of Love's work. If a constant temperature of 3000°R is substituted for the linear temperature distribution of the medium and the rest of the conditions are held the same, then the values of heat transfer parameters, N and Q namely, may be found in his work. According to Equations (31) and (32), the corresponding values of $Q_\nu(0)/Q_{\nu,bb}$ and $Q_\nu(\tau_0)/Q_{\nu,bb}$ may be computed. The curves of the linear and constant temperature distributions were compared for three different frequencies as shown in Figure 13a and Figure 13b. The trend of the variation of curves with respect to the frequencies at each wall is thus confirmed.

Focusing attention on Figure 13a, the curves for isothermal and linear temperature distributions are close together especially at the higher frequencies. Since ν_7 is near to the frequency of which $Q_{\nu,bb}$ is the maximum, as shown in Figure 18, and $Q_{\nu,bb}$ is comparatively negligible at ν_1, it is not surprising that the total net heat flux at the wall for the case may be closer than the monochromatic case. This trend may be roughly verified. For the simplicity of explanation, the cases in Figure 5a and Figure 5b may be approximated by the case of a pure absorbing and emitting medium between black walls. Then the following relations may be approximately held: In Figure 5a,

$$Q(0) = \sigma[T_a^4\ (e^{-1/4} + e^{-3/4}) + T_2^4\ e^{-1} - T_1^4\ ] \qquad (33)$$

In Figure 5b

$$Q'(0) = \sigma[(T_{I'}^4\ e^{-1/4} + T_{II'}^4\ e^{-3/4}) + T_2^4\ e^{-1} - T_1^4\ ] \qquad (34)$$

Under a numerical computation of the above equations with the assumption of $T_{I'} = 2000°R$ and $T_{II'} = 4000°R$, the result, $Q(0) \cong 314{,}600$ Btu/ft^2-hr and $Q'(0) \cong 302{,}500$ Btu/ft^2-hr, may be obtained. A more accurate comparison may be made by dividing the medium into many more regions.

In the same fashion, the net heat flux at wall 2 may be written: In Figure 5a

$$Q(\tau_o) = \sigma[T_2^4 - T_a^4\ (e^{-1/4} + e^{-3/4}) - T_1^4\ e^{-1}\ ] \qquad (35)$$

In Figure 5b

$$Q'(\tau_o) = \sigma[T_2^4 - (T_{I'}^4\ e^{-3/4} + T_{II'}^4\ e^{-1/4}) - T_1^4\ e^{-1}] \qquad (36)$$

$Q(\tau_o) \cong 257{,}900$ Btu/ft^2-hr and $Q'(\tau_o) \cong 208{,}200$ Btu/ft^2-hr may be computed. The significant difference between $Q(\tau_o)$ and $Q'(\tau_o)$ was displayed in Figure 13b.

The effect of reflectivity on radiative heat transfer may be observed from Figure 8a and Figure 8b. It is physically reasonable that heat transfer becomes much more difficult on the walls for a larger value of reflectivity. The relatively

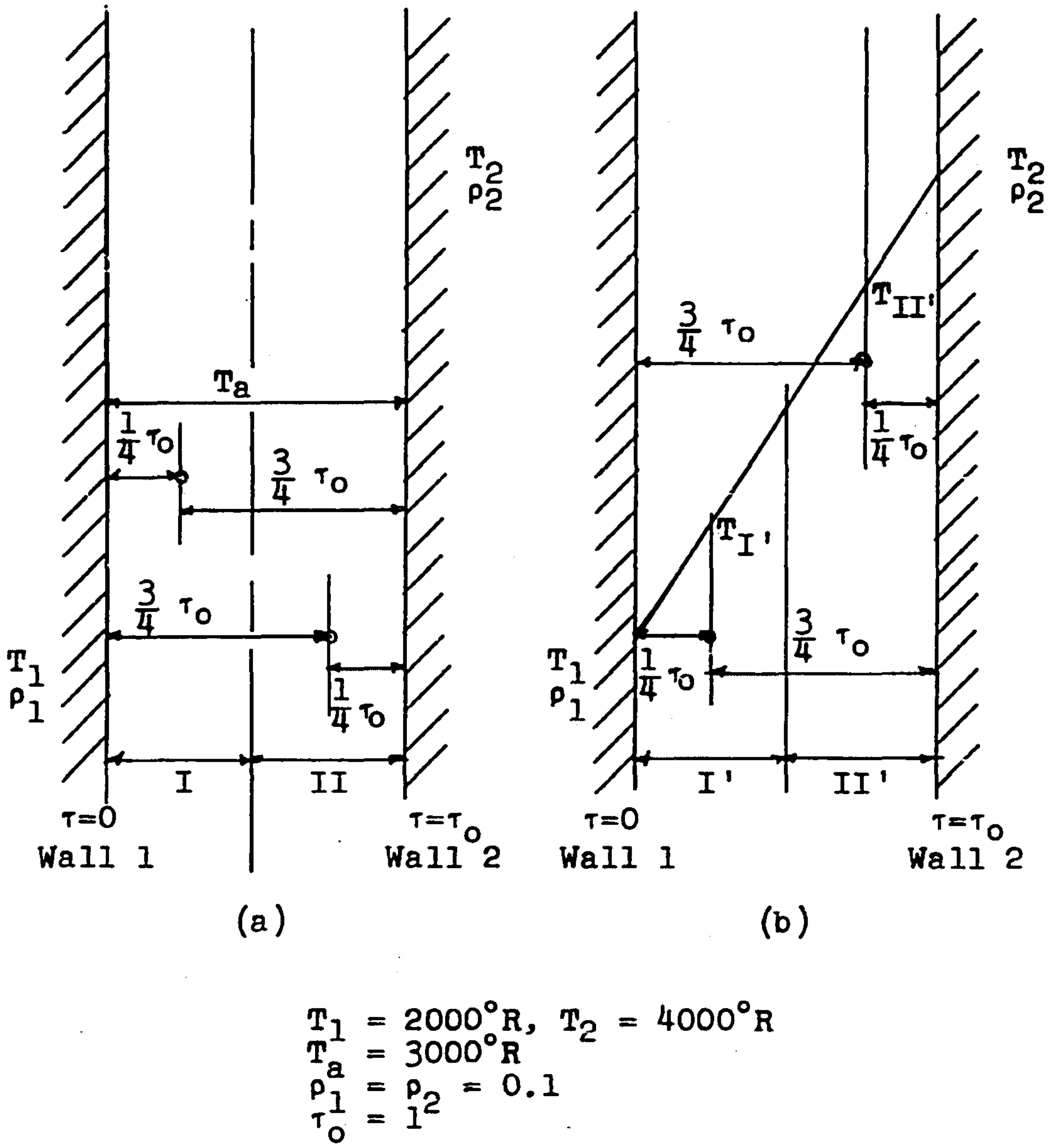


Figure 5. Sketch for an Approximate Explanation of Net Heat Flux at a Bounding Wall in the Linear and Isothermal (with T_a = Average of $T_1 + T_2$) Cases

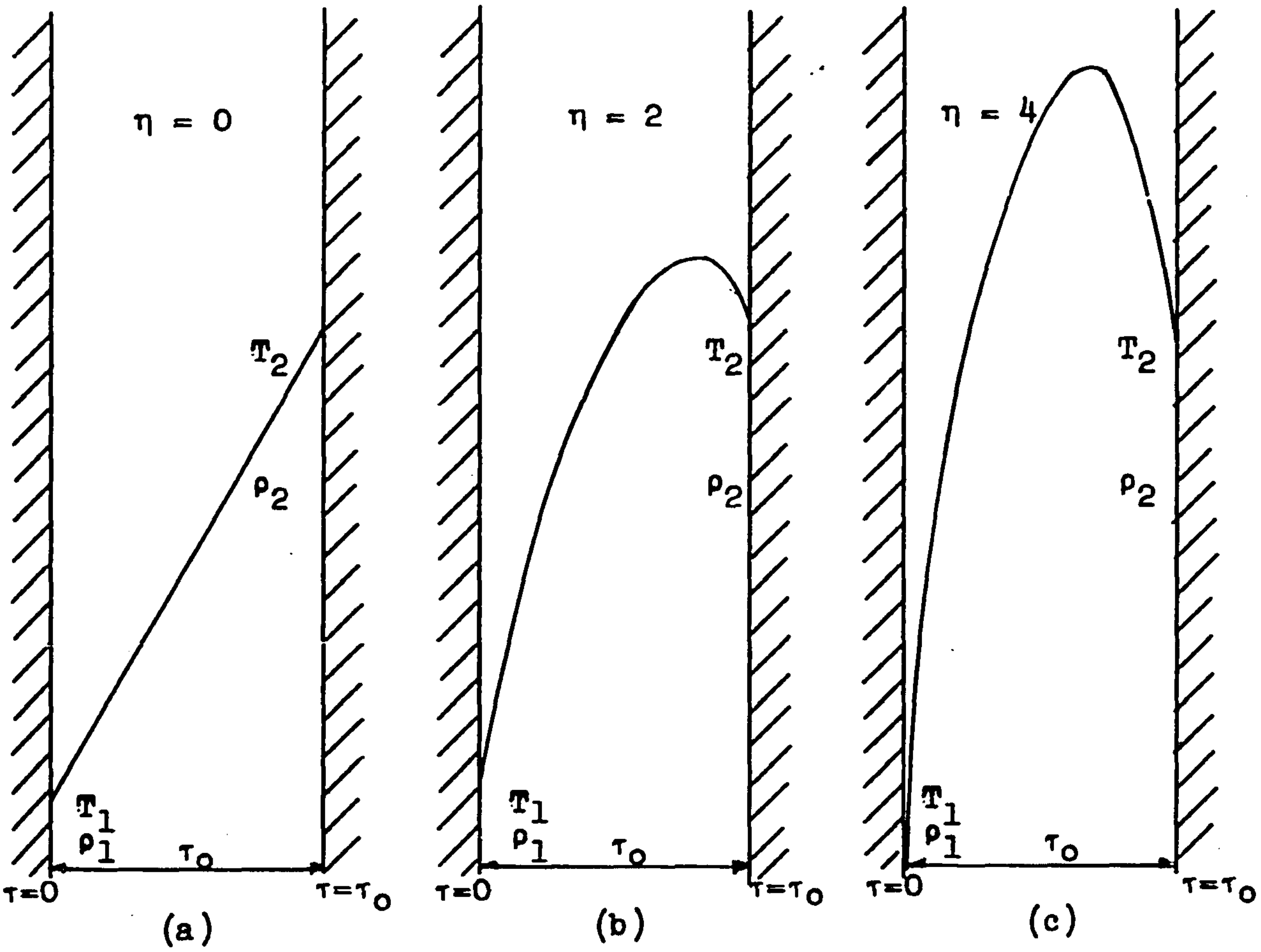
flattening trend for $\rho_1 = \rho_2 = 0.5$ as shown in the figures is the indication of a comparatively small effect of anisotropic scattering. This point may be explained by considering the larger diffuse reflections on both walls as a bigger isotropic stirring force. The non-directional property of the force tends to reduce the directional property of anisotropic scattering.

It was also displayed in Figure 9a and Figure 9b that τ_o is no longer the dominant factor of radiative transfer for large reflections on the walls.

The effect of the refractive indices of the particles on the radiant transfer was shown in Figure 10a and Figure 10b.

The effect of changing temperature of the boundaries while holding a linear temperature distribution in between may be shown in Figure 11a and Figure 11b. It is understood that $Q_{\nu,bb}$ varies with the combination of T_1 and T_2. Since $Q_\nu(0)/Q_{\nu,bb}$ or $Q_\nu(\tau_o)/Q_{\nu,bb}$ differs appreciably for changing the temperature, except comparing the case of $T_1 = 2000°R$, $T_2 = 4000°R$ with $T_1 = 2000°R$, $T_2 = 6000°R$, $Q_\nu(\tau)/Q_{\nu,bb}$ should not be the parameter for which the boundary temperatures need be defined. It would be the author's hope that such a parameter could be found in the further studies.

The three types of temperature distributions with the same boundary temperatures were shown in Figure 6. The local temperature of the medium are comparatively increased for the increasing of η. In other words, the incident radiation from



$T_1 = 2000°R$, $T_2 = 4000°R$
$\rho_1 = \rho_2 = 0.1$
$\tau_o = 1$

Figure 6. The Three Types of Temperature Distributions (η=0,2,4) for the Given Temperatures at Bounding Walls

the medium to the both walls is increased and consequently the net heat flux at wall 1 is increased while at wall 2 it is decreased with increasing of η. This trend can be seen from Figure 12a and Figure 12b. $Q_\nu(0)/Q_{\nu,bb}$ larger than 1 at certain places is physically reasonable for a medium having a local temperature higher than the temperatures of the boundaries. The direction of heat flow is changed when $Q_\nu(\tau_o)/Q_{\nu,bb}$ varies from a positive to a negative. The crossings of curves at point 1 in Figure 12a, point 2 and point 3 in Figure 12b were caused by the choice of the parameter. For if $Q_\nu(0)$ and $Q_\nu(\tau_o)$ versus α of the corresponding cases are plotted as shown in Figure 14a and Figure 14b, no intersections may be observed. The reason for the intersection of curves at point 4 in Figure 12b is because of the change of the direction of heat flow as shown in Figure 14c.

(b) Integration of Monochromatic Net Heat Flux

The total net heat flux at a wall may be expressed as follows: At wall 1

$$Q(0) = \int_0^\infty Q_\nu(0)\, d\nu \tag{37}$$

At wall 2

$$Q(\tau_o) = \int_0^\infty Q_\nu(\tau_o)\, d\nu \tag{38}$$

Radiant heat energy is comparatively negligible for

$\nu < .01 \times 10^{17}$ hr^{-1} and $\nu > 57.00 \times 10^{17}$ hr^{-1}. The following relations hold approximately.

$$Q(0) \cong \sum_{j=1}^{n} Q_{\bar{\nu}_j}(0) \; \Delta\nu_j \tag{39}$$

$$Q(\tau_o) \cong \sum_{j=1}^{n} Q_{\bar{\nu}_j}(\tau_o) \; \Delta\nu_j \tag{40}$$

where $\bar{\nu}_j = \frac{1}{2} (\log_{10} \nu_j + \log_{10} \nu_{j+1})$

$$\Delta\nu_j = \nu_{j+1} - \nu_j$$

In the present computation, n = 8 was chosen and ν_1, ν_2, ... ν_9 are the orderly numbers listed in the figures. Then

$$\Delta\nu_1 = .170 \times 10^{17} \text{ hr}^{-1}$$
$$\Delta\nu_2 = .180 \times 10^{17} \text{ hr}^{-1}$$
$$\Delta\nu_3 = .540 \times 10^{17} \text{ hr}^{-1}$$
$$\Delta\nu_4 = .900 \times 10^{17} \text{ hr}^{-1}$$
$$\Delta\nu_5 = .180 \times 10^{18} \text{ hr}^{-1}$$
$$\Delta\nu_6 = .360 \times 10^{18} \text{ hr}^{-1}$$
$$\Delta\nu_7 = .720 \times 10^{18} \text{ hr}^{-1}$$
$$\Delta\nu_8 = .426 \times 10^{19} \text{ hr}^{-1}$$

To check the accuracy of the approximate relations, the net heat flux at a wall for black surfaces of 2000°R and 4000°R without a medium as shown in Figure 18 was integrated. Q_{bb} having the value of 421,022 Btu/ft^2-hr which is 5,822

Btu/ft^2-hr larger than the true value, 415,200 Btu/ft^2-hr was obtained. The error is only about 1.4%; the approximate approach should be accurate enough for application.

To calculate the total heat flux at a wall for a fixed particle size of a medium, the following example may be shown:

(1) Statement of Problem. Two infinite parallel walls are spaced 0.1 ft apart. A uniform cloud of iron particles (density = 481 lb/ft^3) occupies the intervening space. The apparent density of the cloud is 0.008 $(lb_m)(ft)^{-3}$. The particles are assumed to be spheres with a diameter of 2 microns and a refractive index of 1.25 - 1.25i for all frequencies. There are variable local heat sources (or sinks) distributed between the medium such that a linear temperature distribution between the boundaries is considered. In addition to the conditions T_1 = 2000°R, T_2 = 4000°R, and $\rho_1 = \rho_2 = 0.1$ are assumed.

(2) Desired Information. Find the net heat flux at wall 1.

(3) Solution.

1. Compute α_j for the corresponding ν_j.
2. Read K^e from Love's work for the corresponding α_j.
3. Compute $(\tau_o)_j$ corresponding to K^e_j.
4. Read $Q_{\nu_j}(0)/Q_{\nu_j,bb}$ from Figure 1a corresponding to the values of α_j and $(\tau_o)_j$. Since only τ_o = 1.0 and τ_o = 0.2 were computed in this work, both the extrapolations and

interpolations for τ_o may be approximately made with the aid of Love's work as partially shown in Figure 15, Figure 16, and Figure 17. The results of the operations are tabulated below.

j	α_j	K_j^e	$(\tau_o)_j$	$Q_{\nu_j}(0)/Q_{\nu_j,bb}$
1	0.005	0.10	.037	.446
2	0.104	0.24	.091	.454
3	0.209	0.46	.174	.448
4	0.525	1.60	.608	.408
5	1.050	2.84	1.079	.485
6	2.110	2.88	1.094	.566
7	4.230	2.56	.972	.736
8	8.470	2.45	.931	.800
9	33.000	2.45	.931	.833

Multiplying $Q_{\nu_j}(0)/Q_{\nu_j,bb}$ by $Q_{\nu_j,bb}$ which was tabulated in Appendix VI, and plotting $Q_{\nu_j}(0)$ versus $\log_{10} \nu_j$ as shown in Figure 19, then $Q_{\bar{\nu}_j}(0)$ may be read from the figure. Finally

j	$Q_{\bar{\nu}_j}(0)\ \Delta\nu_j$
1	$.00010 \times 10^4$
2	$.00450 \times 10^4$
3	$.04050 \times 10^4$
4	$.54000 \times 10^4$
5	1.80000×10^4

j	$Q_{\bar{\nu}_j}(0)\ \Delta\nu_j$
6	12.96000×10^4
7	6.84000×10^4
8	$.00213 \times 10^4$

$Q(0) = 22.1872 \times 10^4 = .221872 \times 10^6$ Btu/ft^2-hr. The ratio of $Q(0)$ to Q_{bb} would be 52.7%. In other words, the heat transfer is reduced about 47.3% at wall 1 in comparison with the case of black walls without the medium.

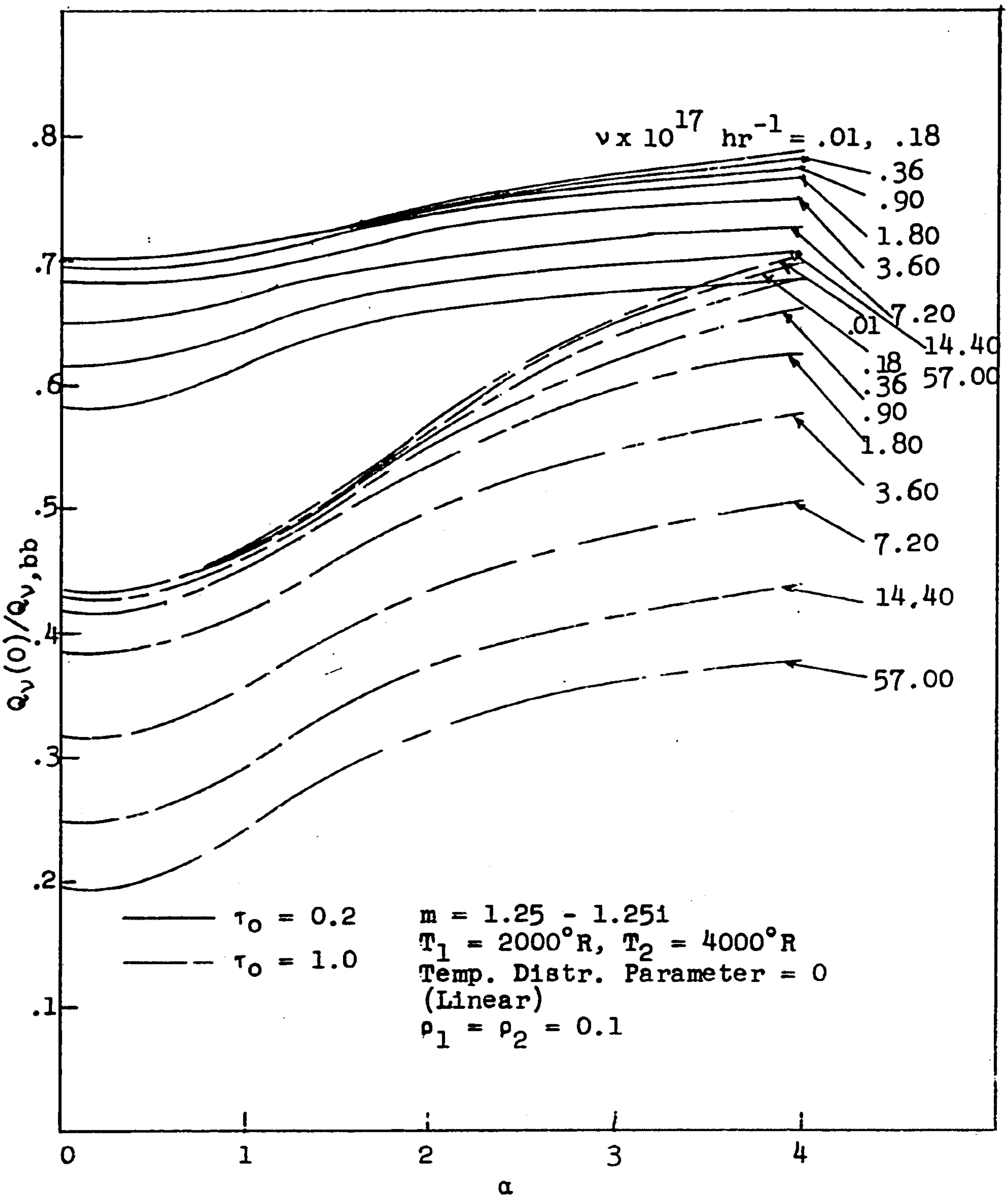


Figure 7a. The Effect of Radiative Transfer at Wall 1 for the Change of τ_o

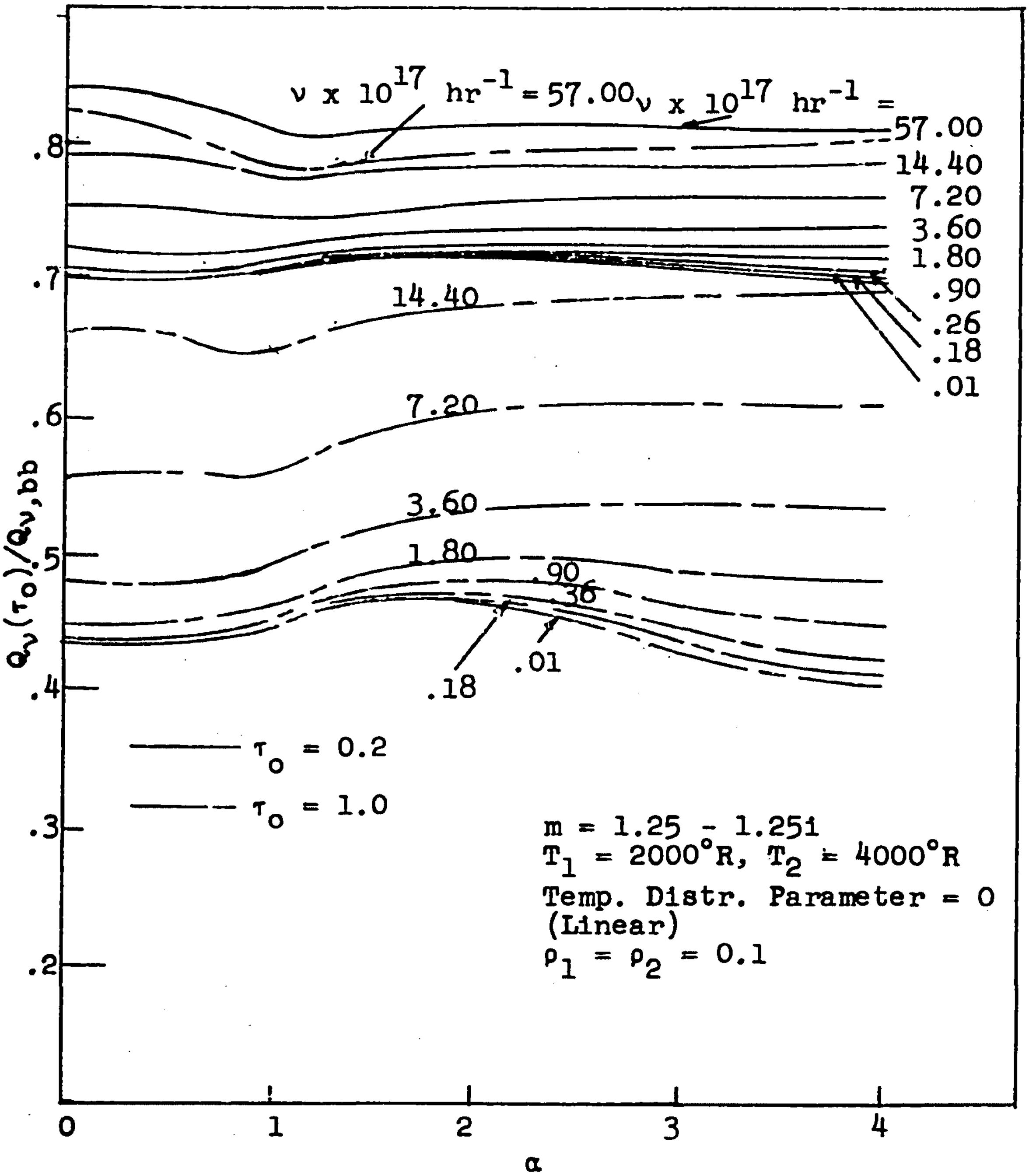


Figure 7b. The Effect of Radiative Transfer at Wall 2 for the Change of τ_o

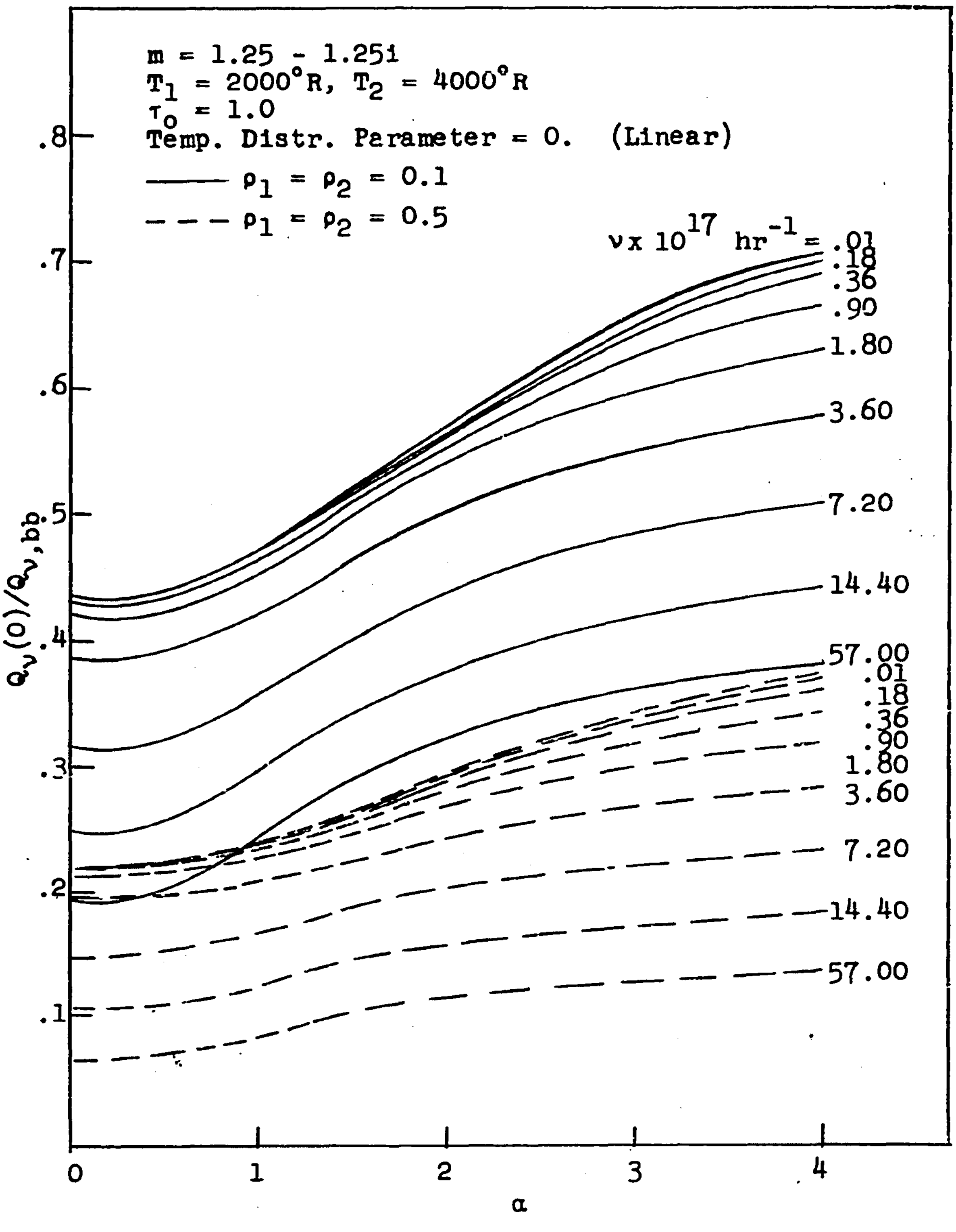


Figure 8a. The Effect of Radiative Transfer at Wall 1 for the Change of Surface Reflectance

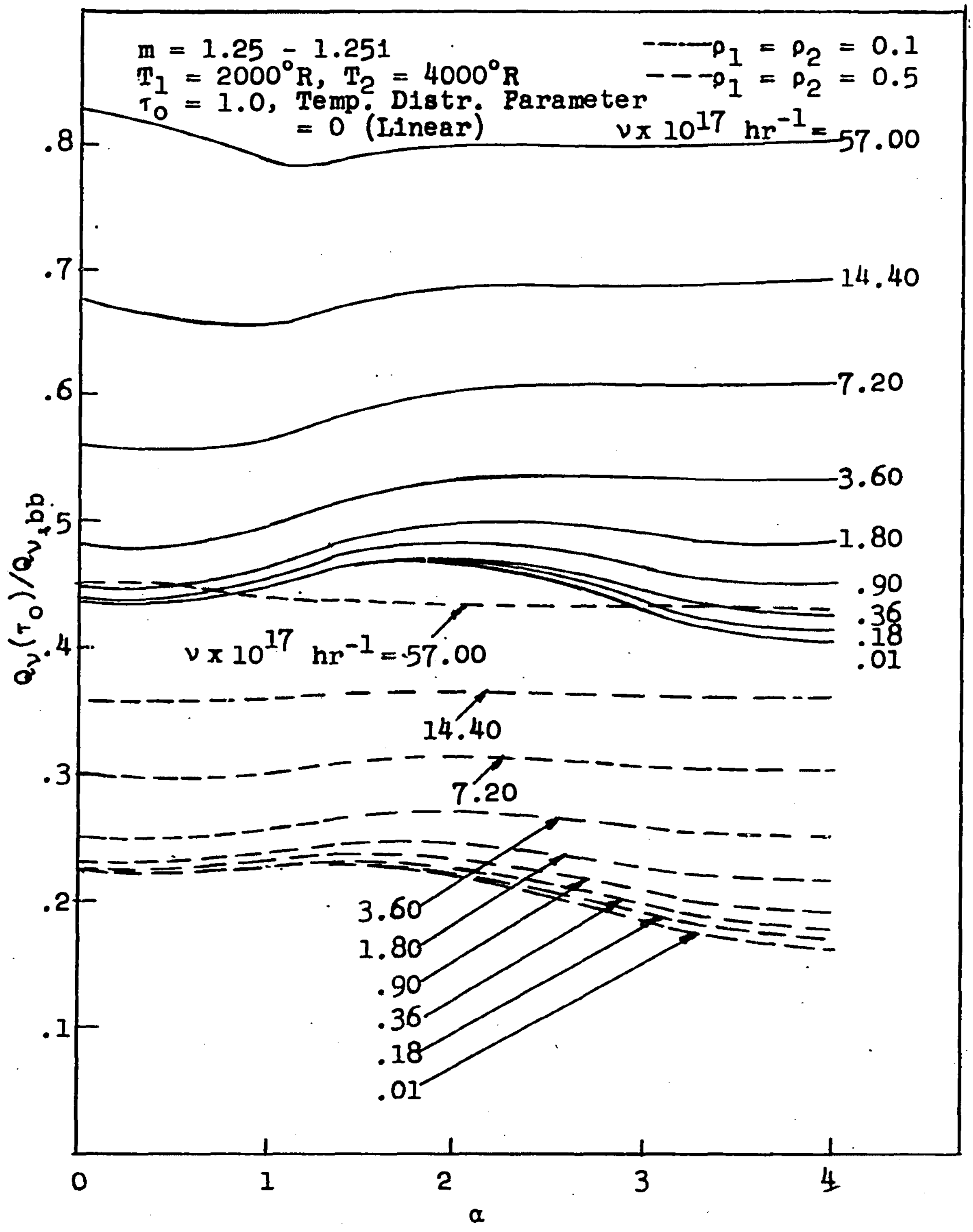


Figure 8b. The Effect of Radiative Transfer at Wall 2 for the Change of Surface Reflectance

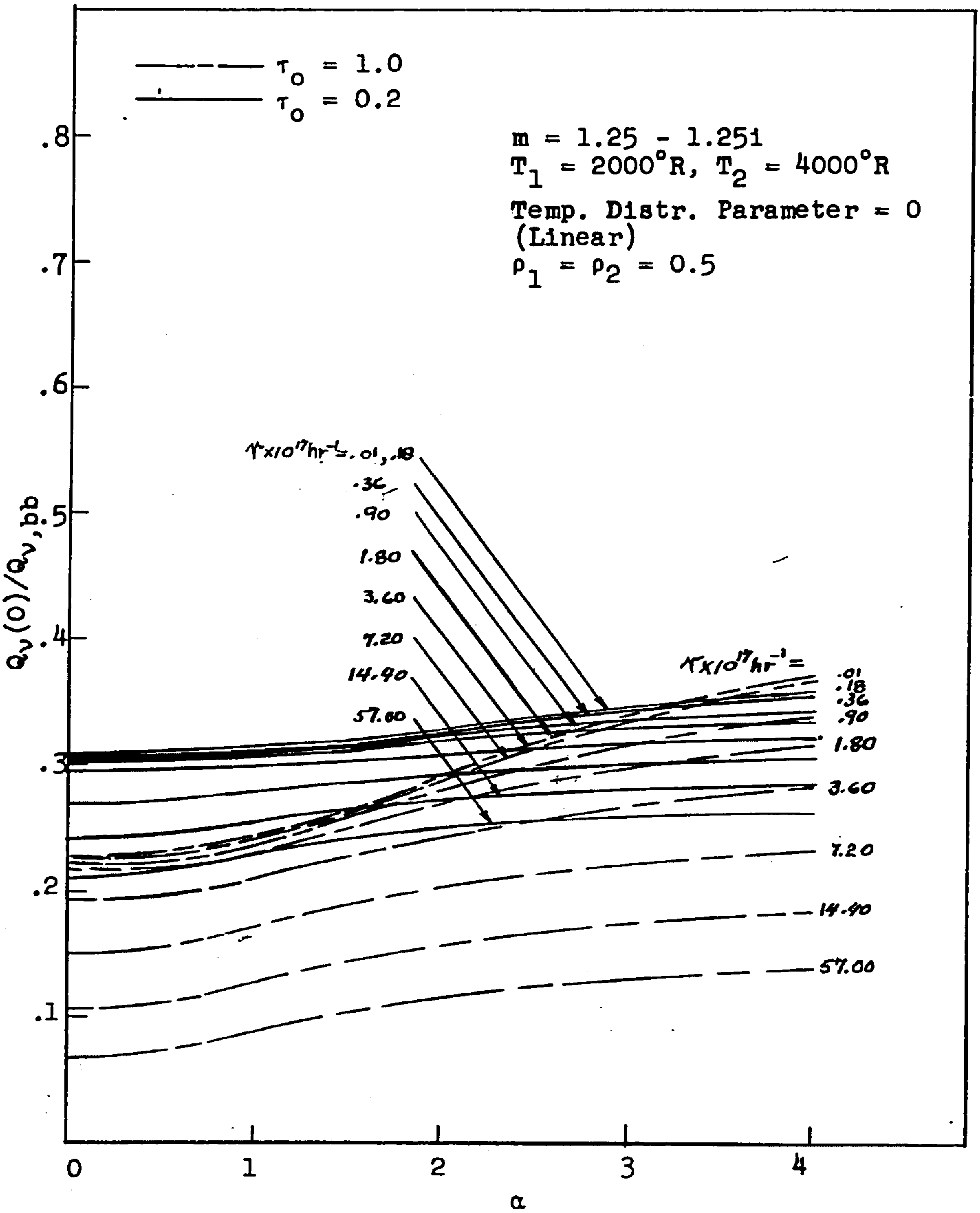


Figure 9a. The Effect of Radiative Transfer at Wall 1 for the Change of τ_o

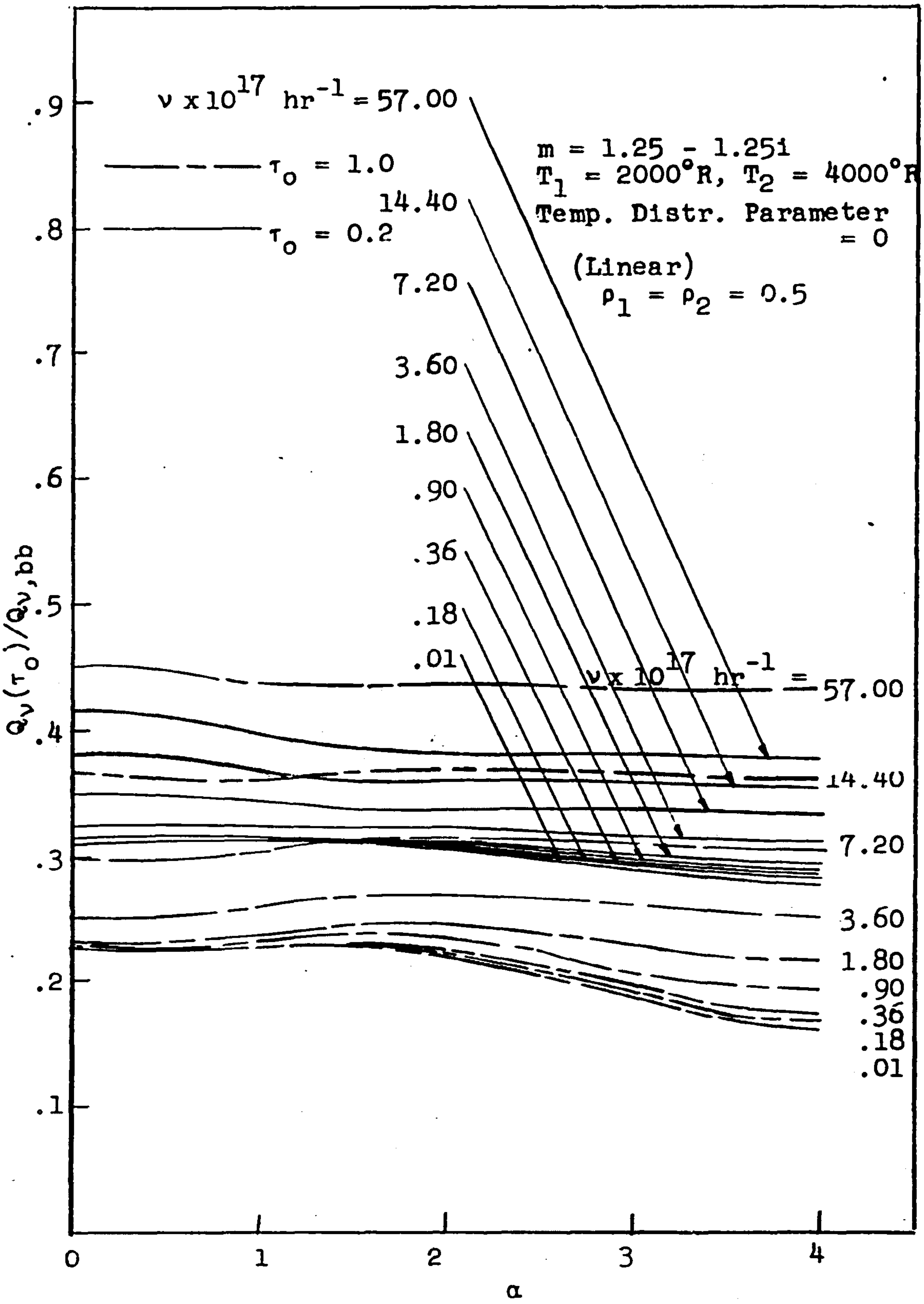


Figure 9b. The Effect of Radiative Transfer at Wall 2 for the Change of τ_o

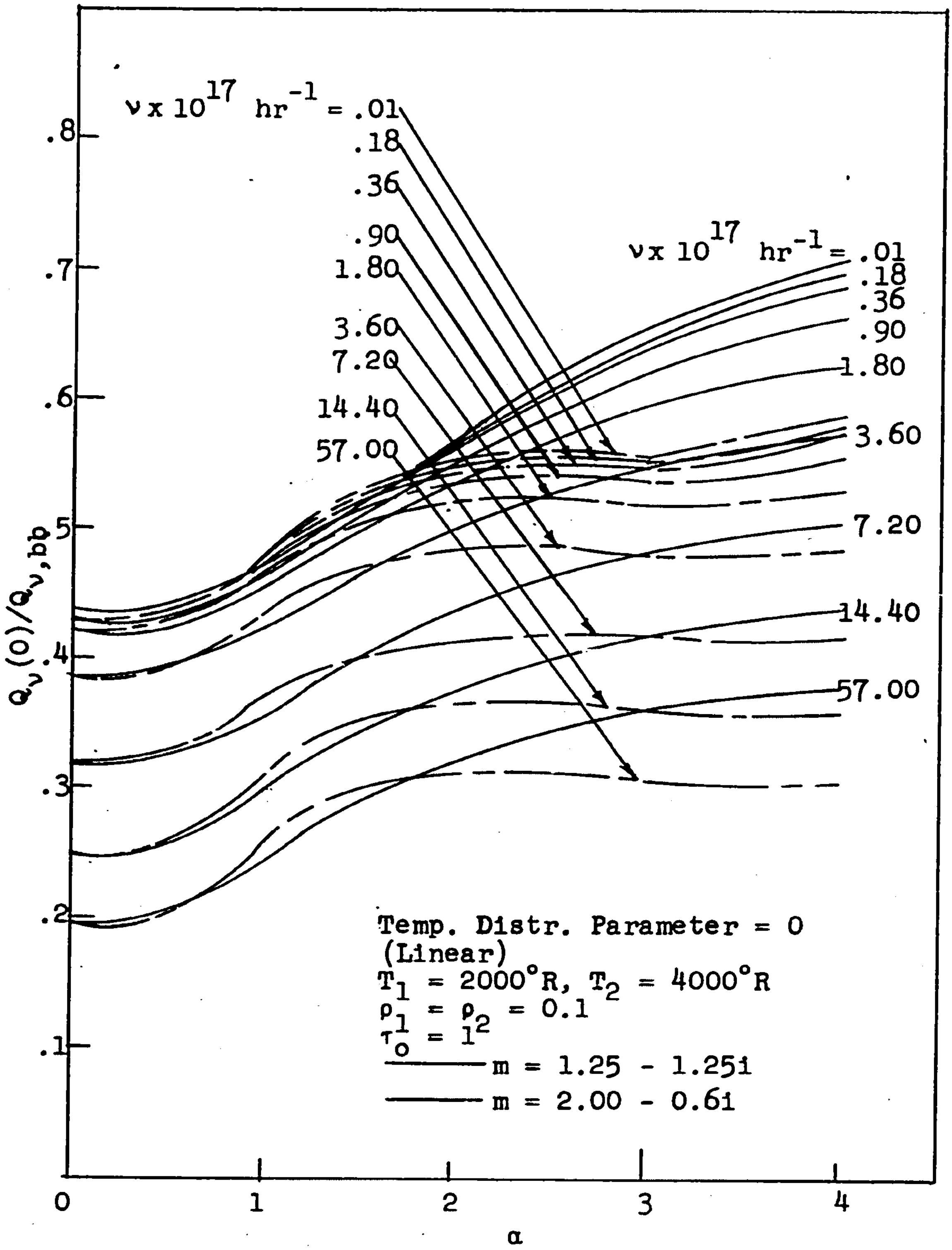


Figure 10a. The Effect of Radiative Transfer at Wall 1 for the Change of Refractive Index

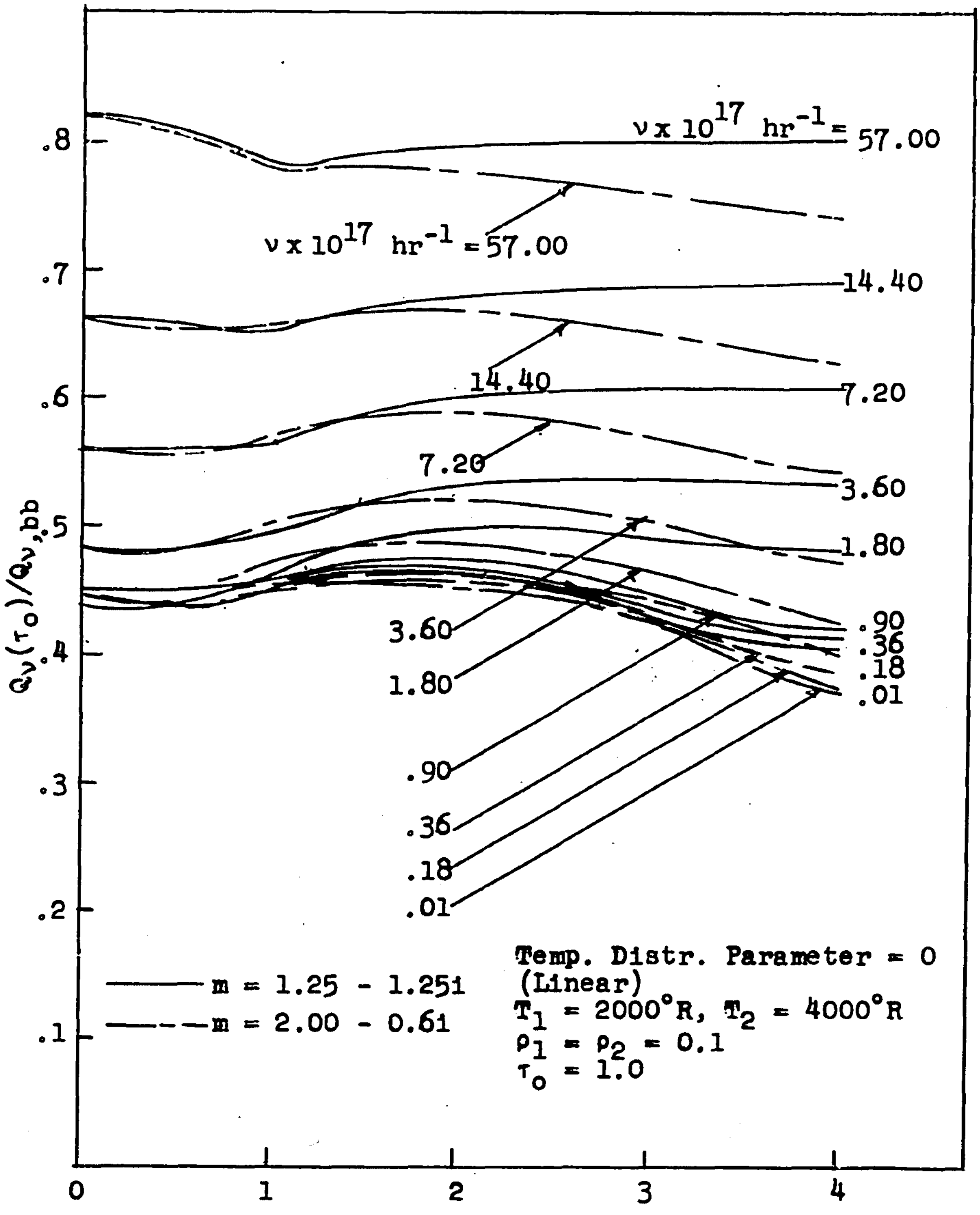


Figure 10b. The Effect of Radiative Transfer at Wall 2 for the Change of Refractive Index

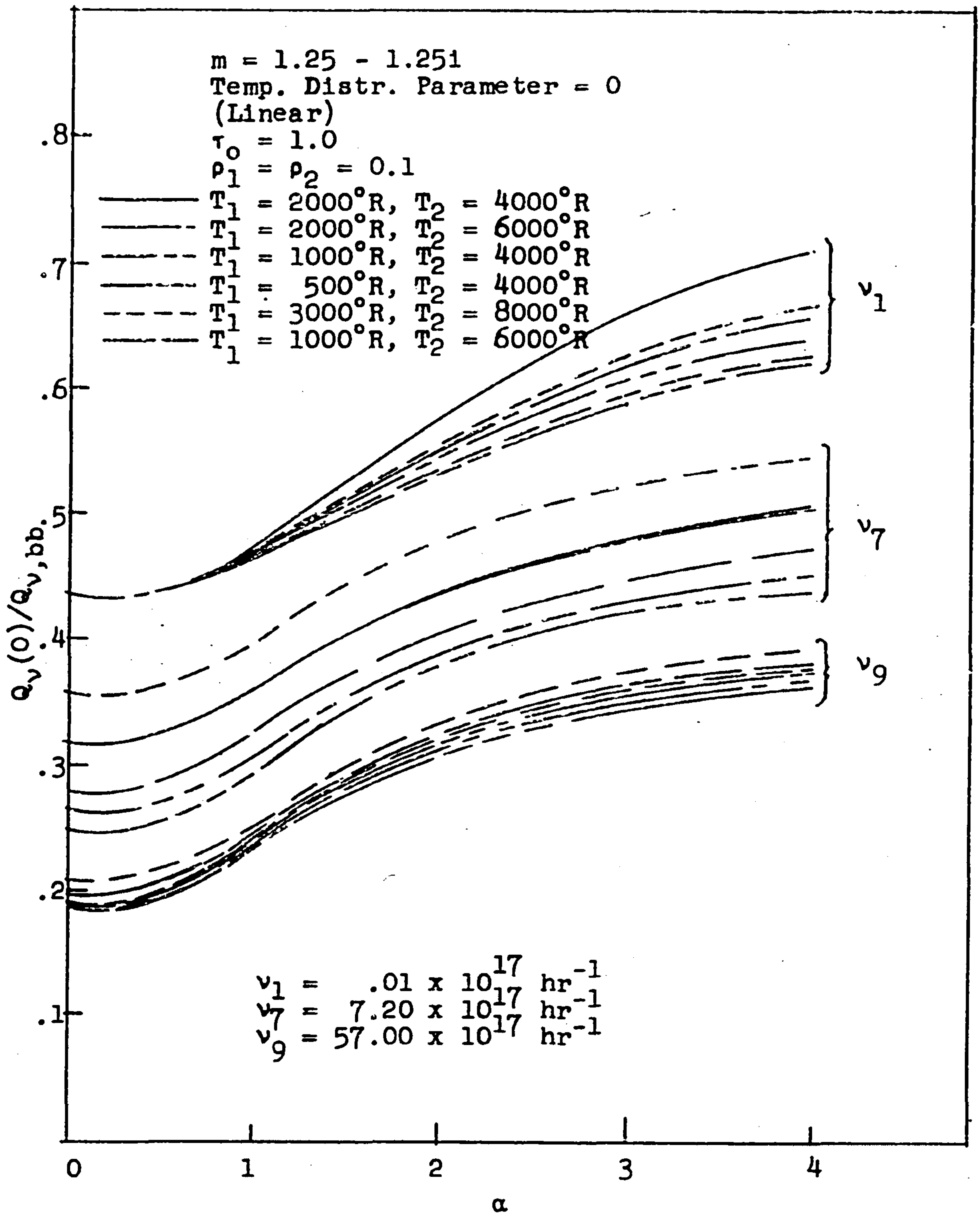


Figure 11a. The Effect of Radiative Transfer at Wall 1 for the Change of Boundary Temperatures

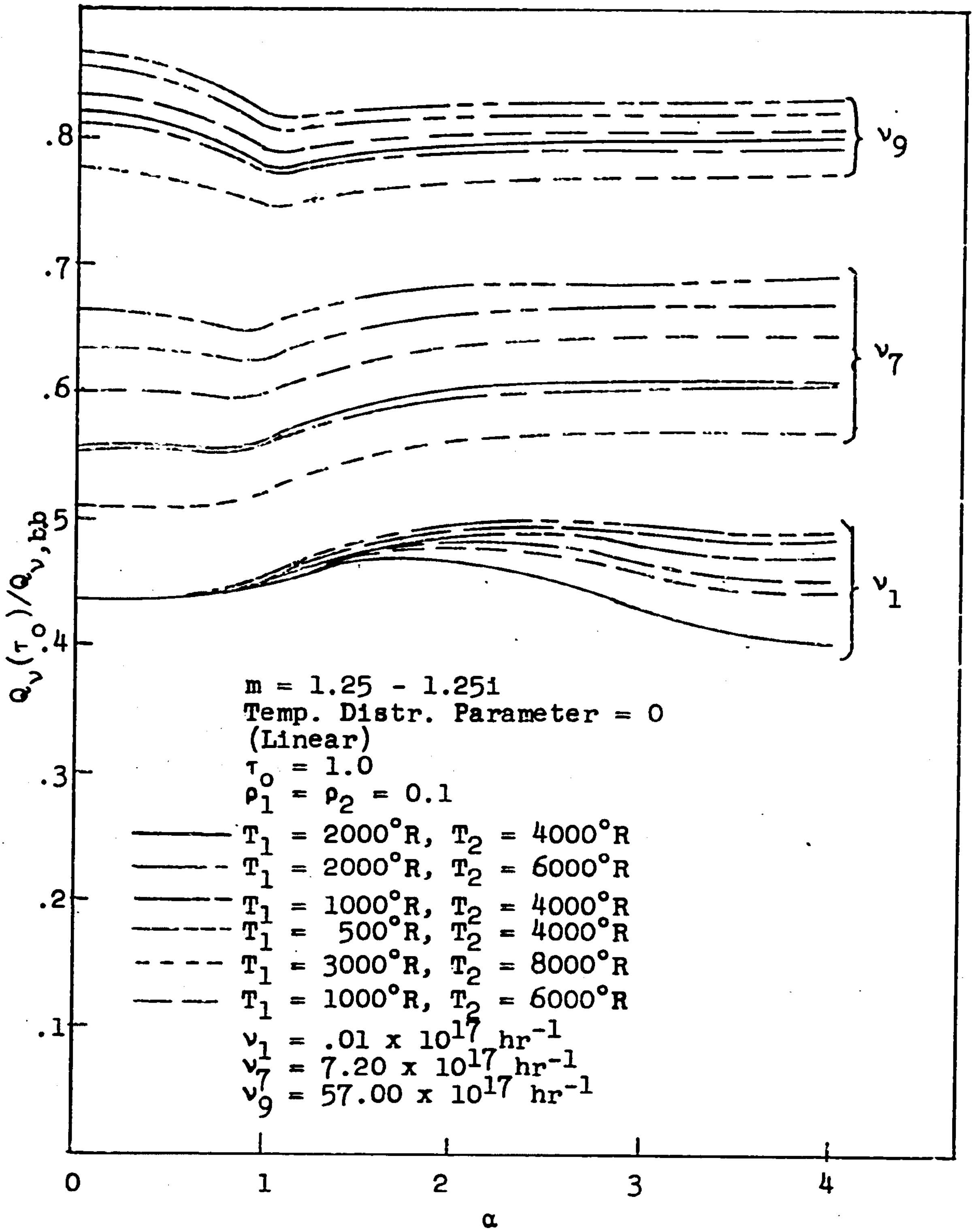


Figure 11b. The Effect of Radiative Transfer at Wall 2 for the Change of Boundary Temperatures

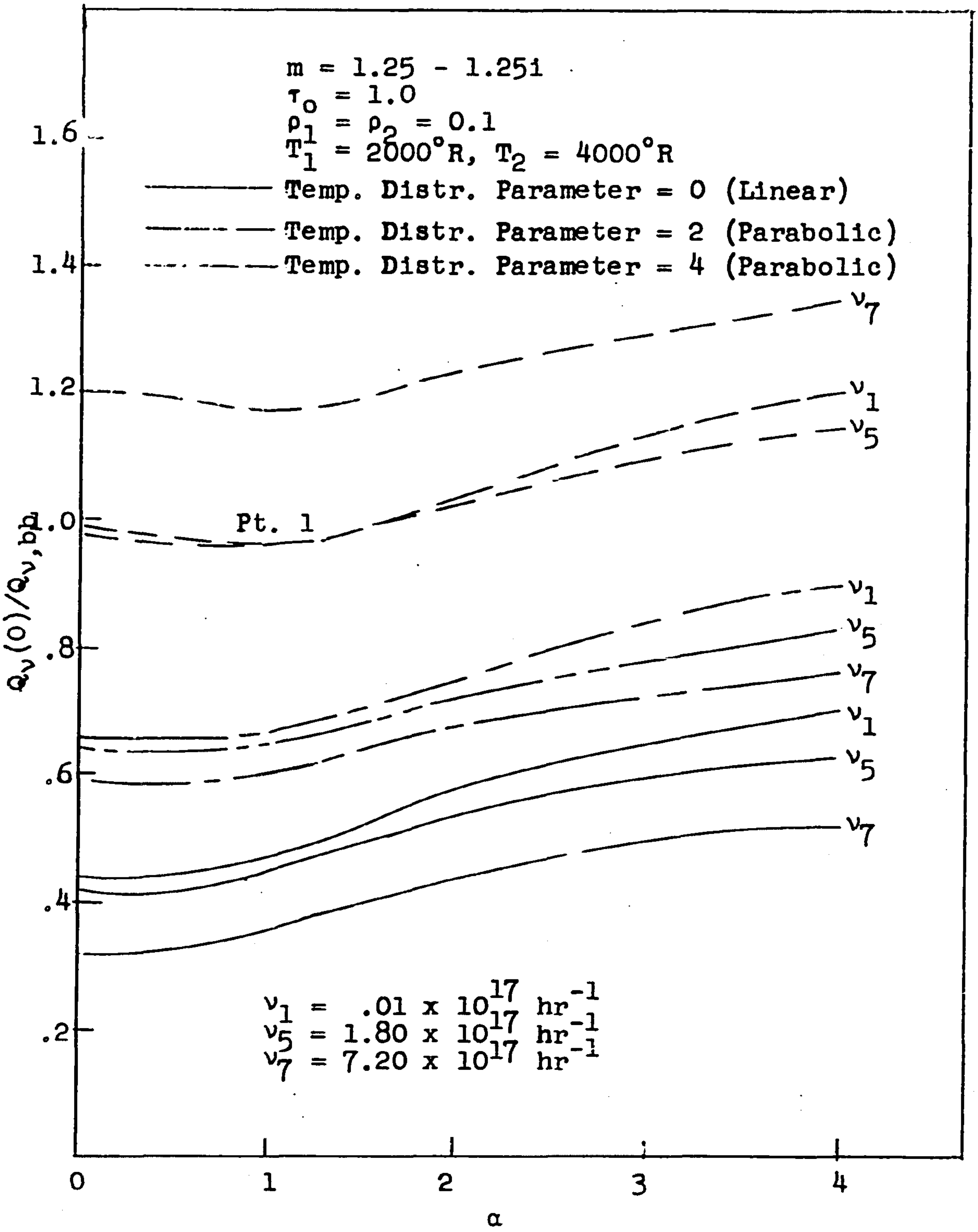


Figure 12a. The Effect of Radiative Transfer at Wall 1 for the Change of Temperature Distributions

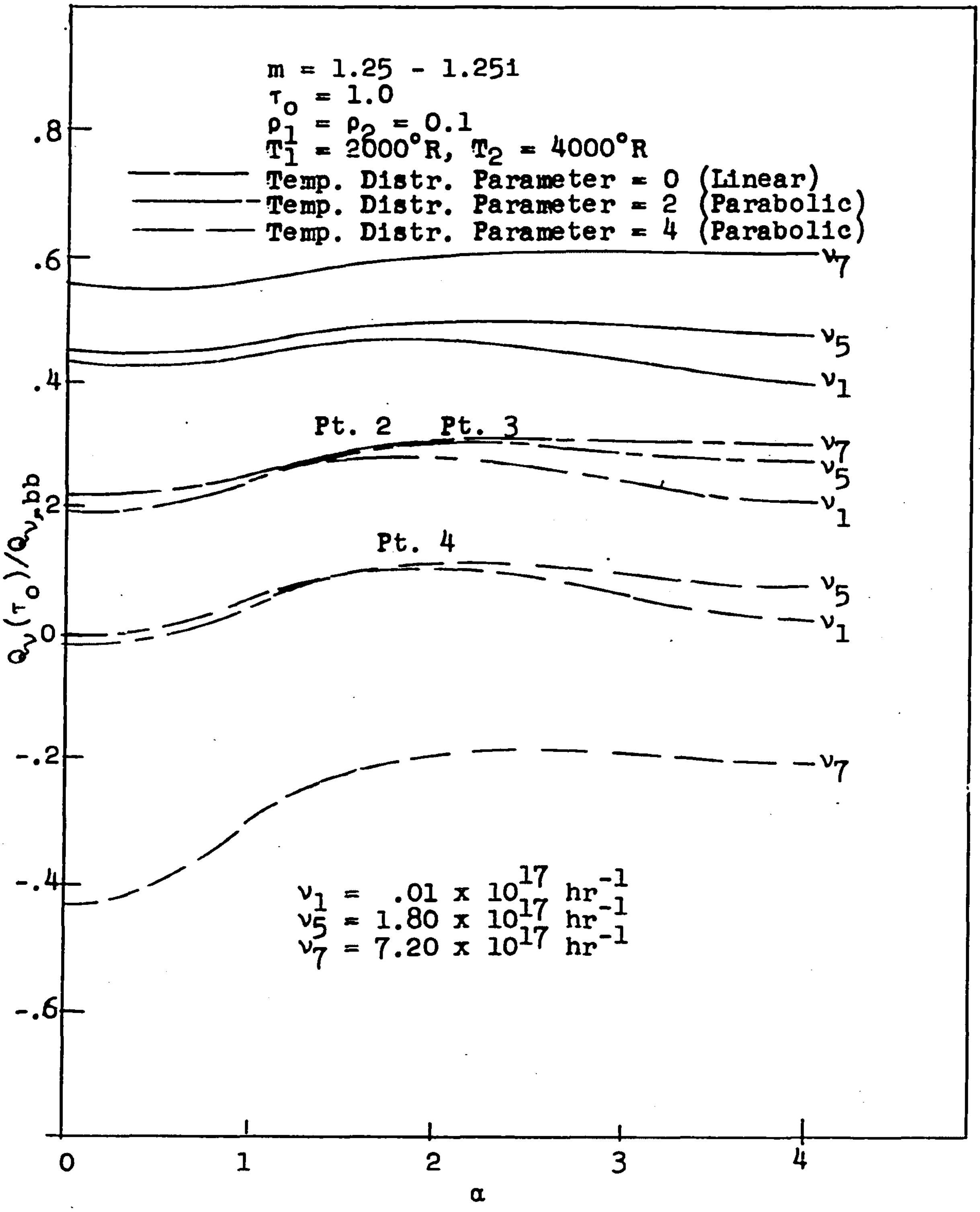


Figure 12b. The Effect of Radiative Transfer at Wall 2 for the Change of Temperature Distributions

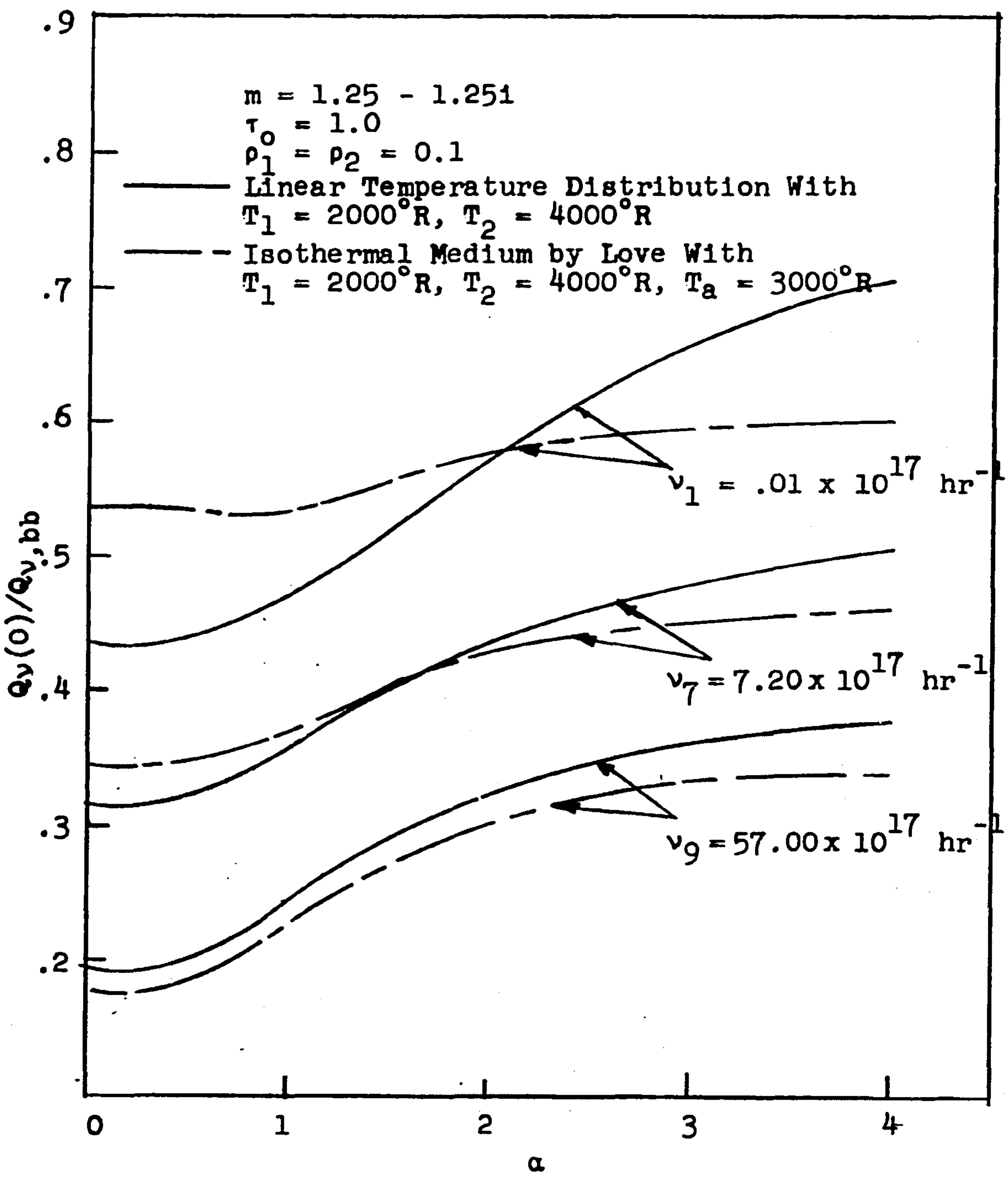


Figure 13a. A Comparison of Radiative Transfer at Wall 1 for the Linear and Isothermal Temperature Difference

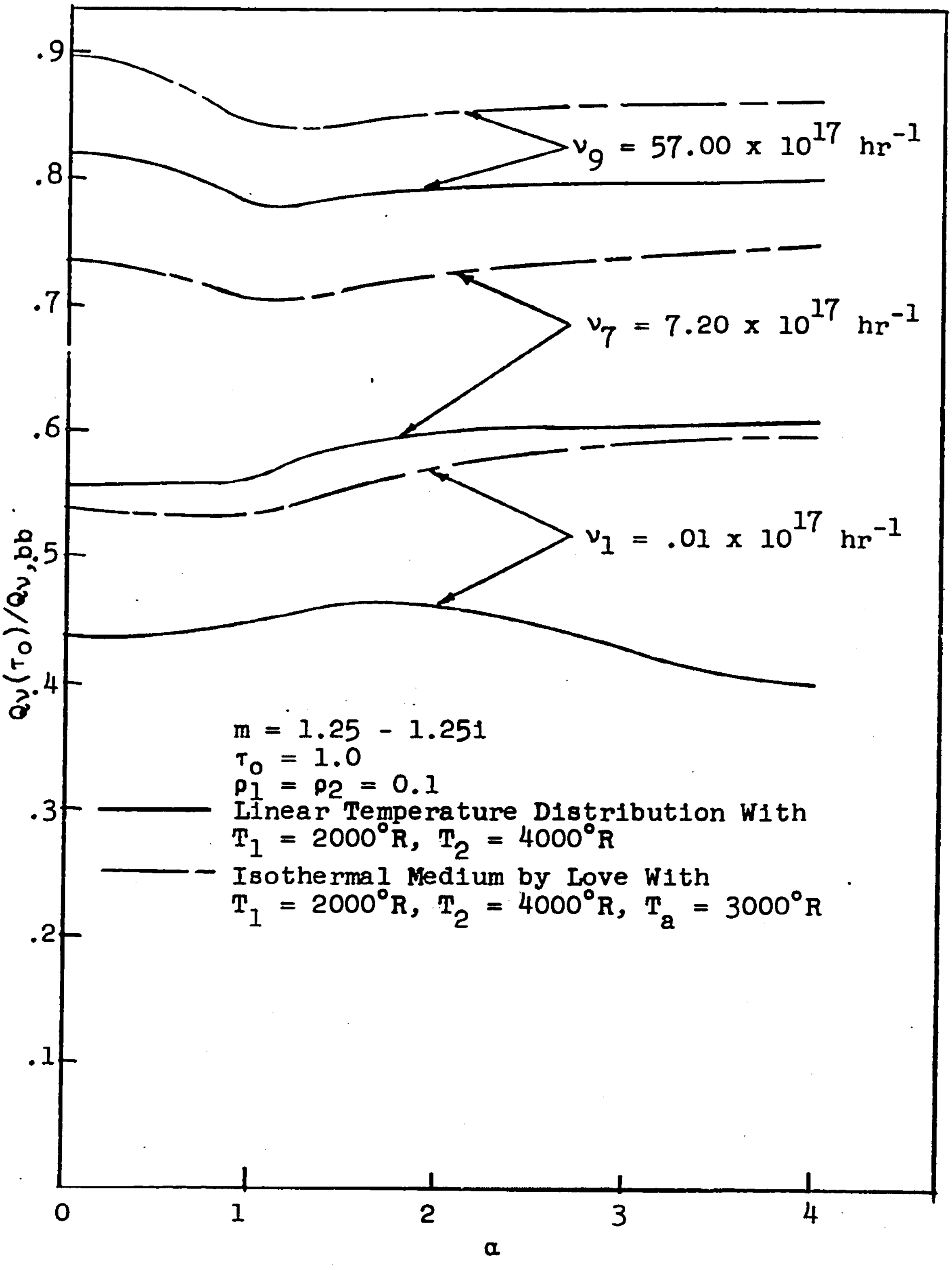


Figure 13b. A Comparison of Radiative Transfer at Wall 2 for the Linear and Isothermal Temperature Distribution

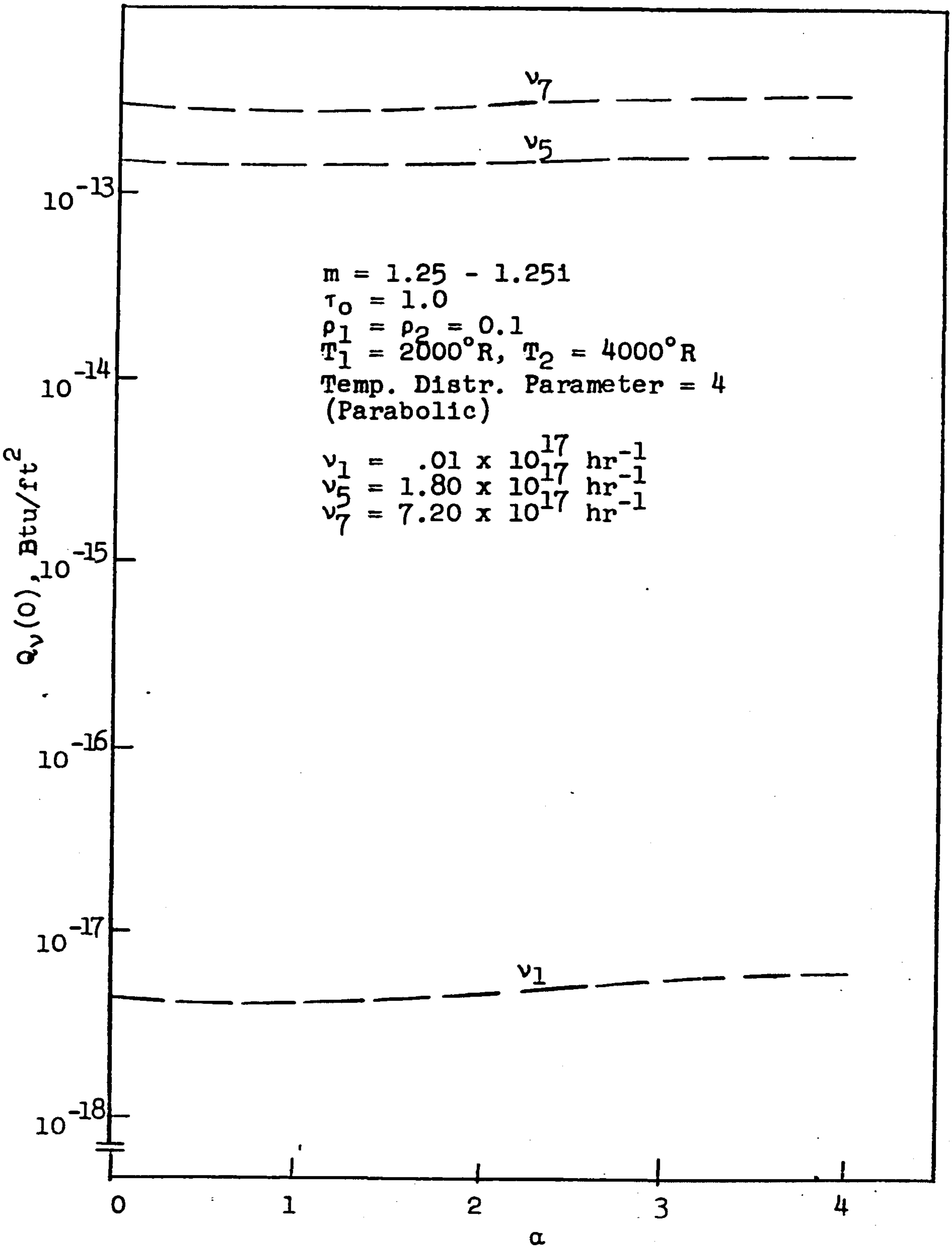


Figure 14a. Radiative Transfer at Wall 1 for a Parabolic Temperature Distribution

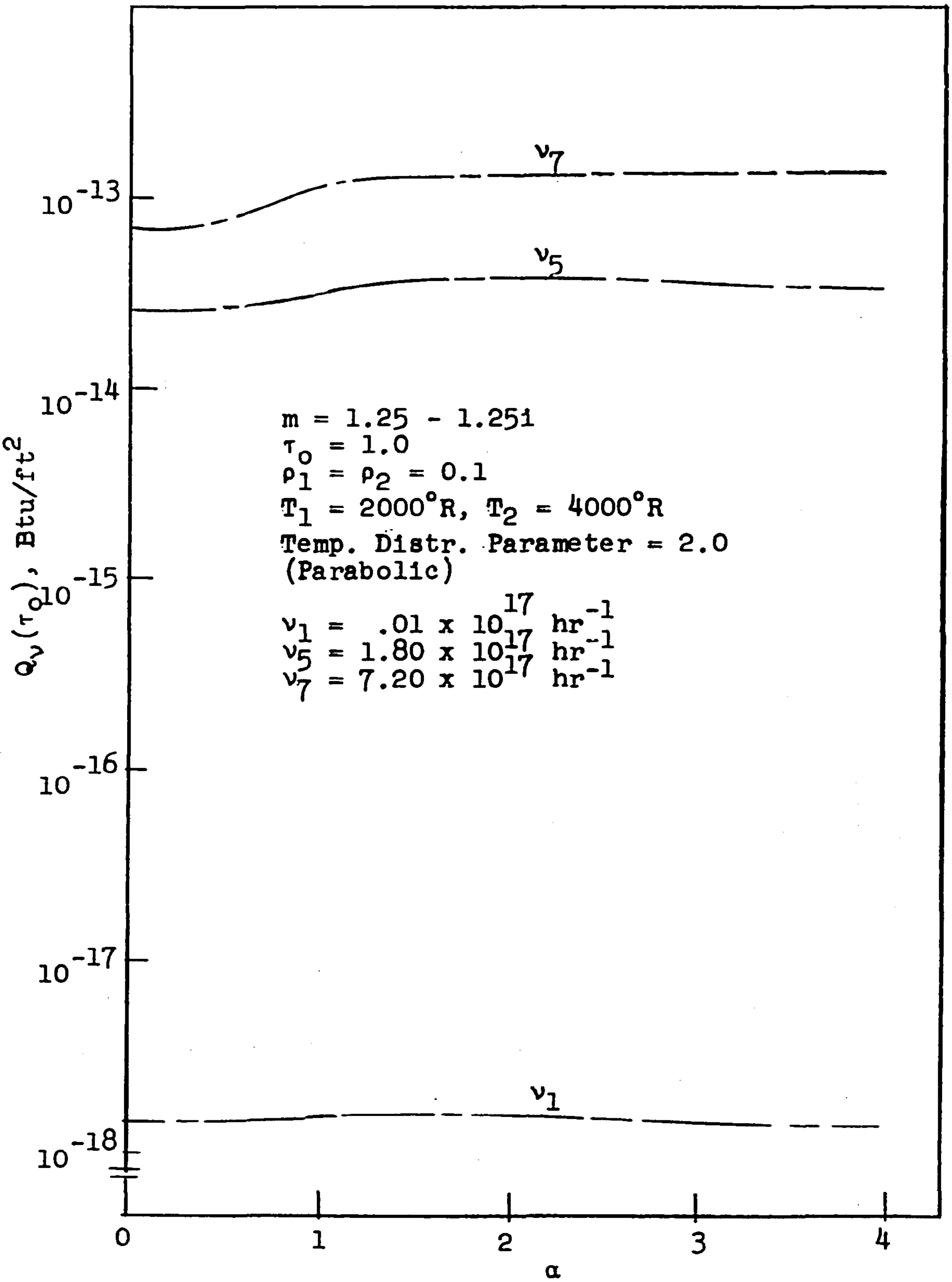


Figure 14b. Radiative Transfer at Wall 2 for a Parabolic Temperature Distribution

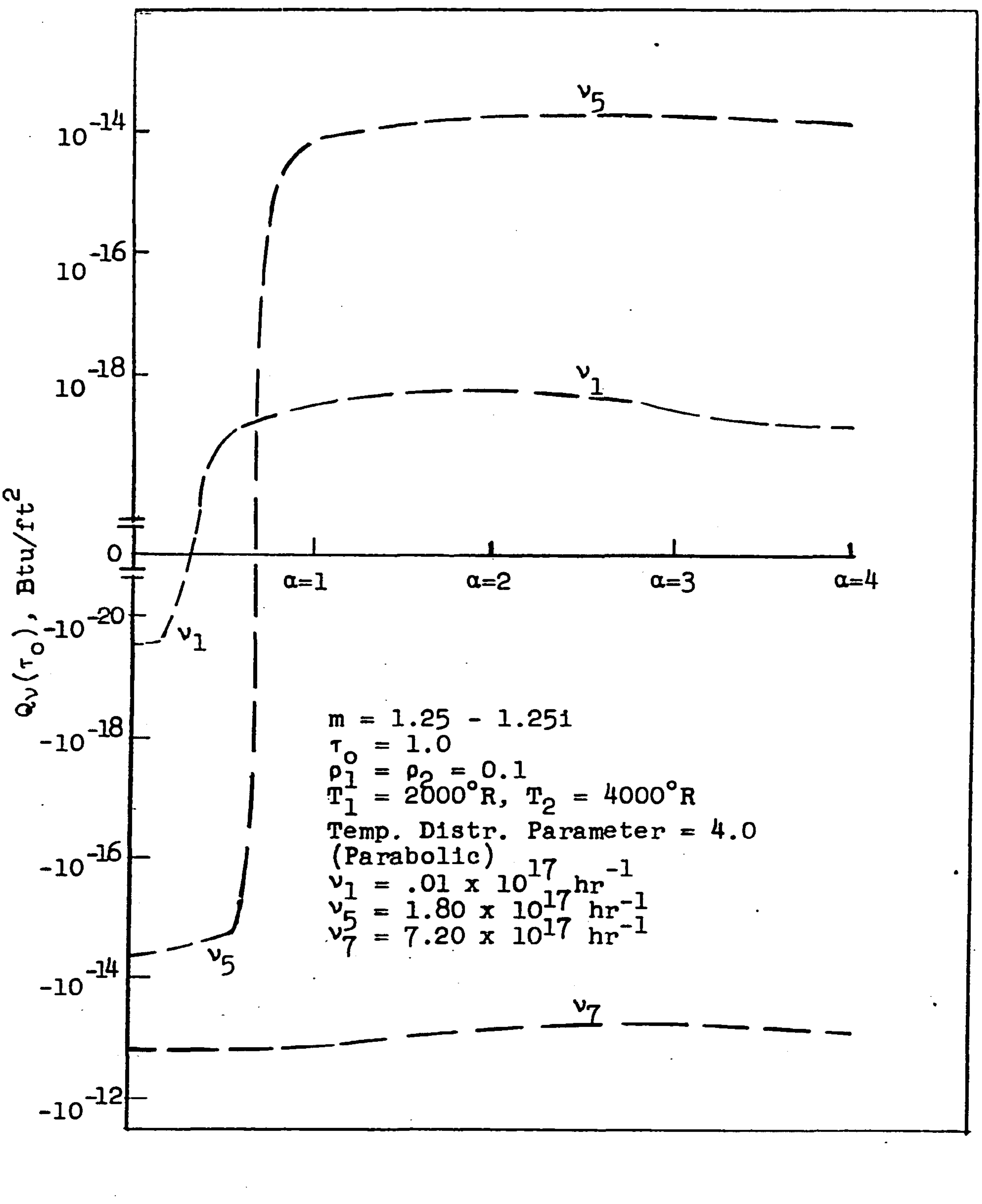


Figure 14c. The Change of the Direction of Heat Flow at Wall 2 for a Parabolic Temperature Distribution

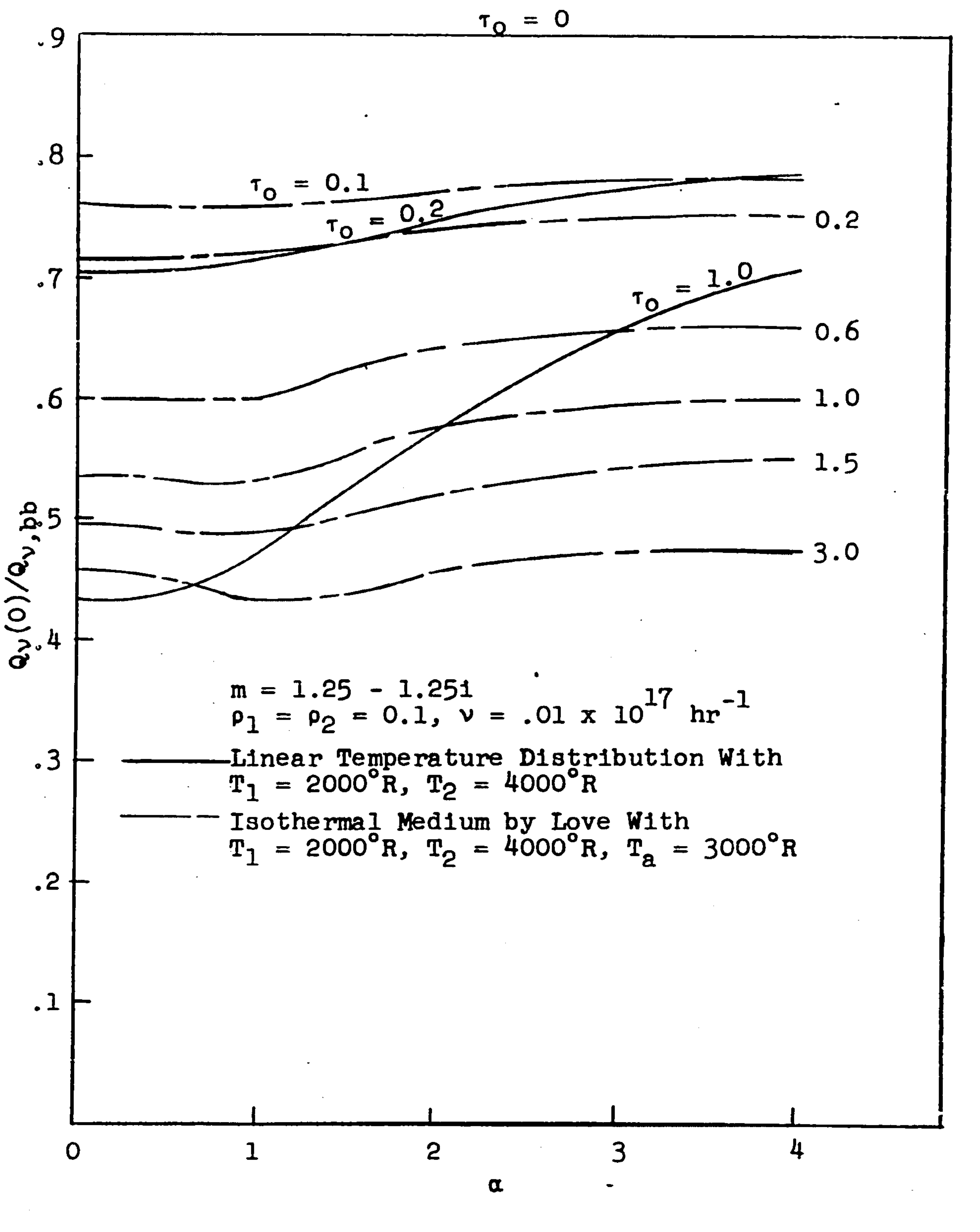


Figure 15. A Comparison of Radiative Transfer at Wall 1 Between the Linear and Isothermal Cases as a Reference for Interpolations and Extrapolations

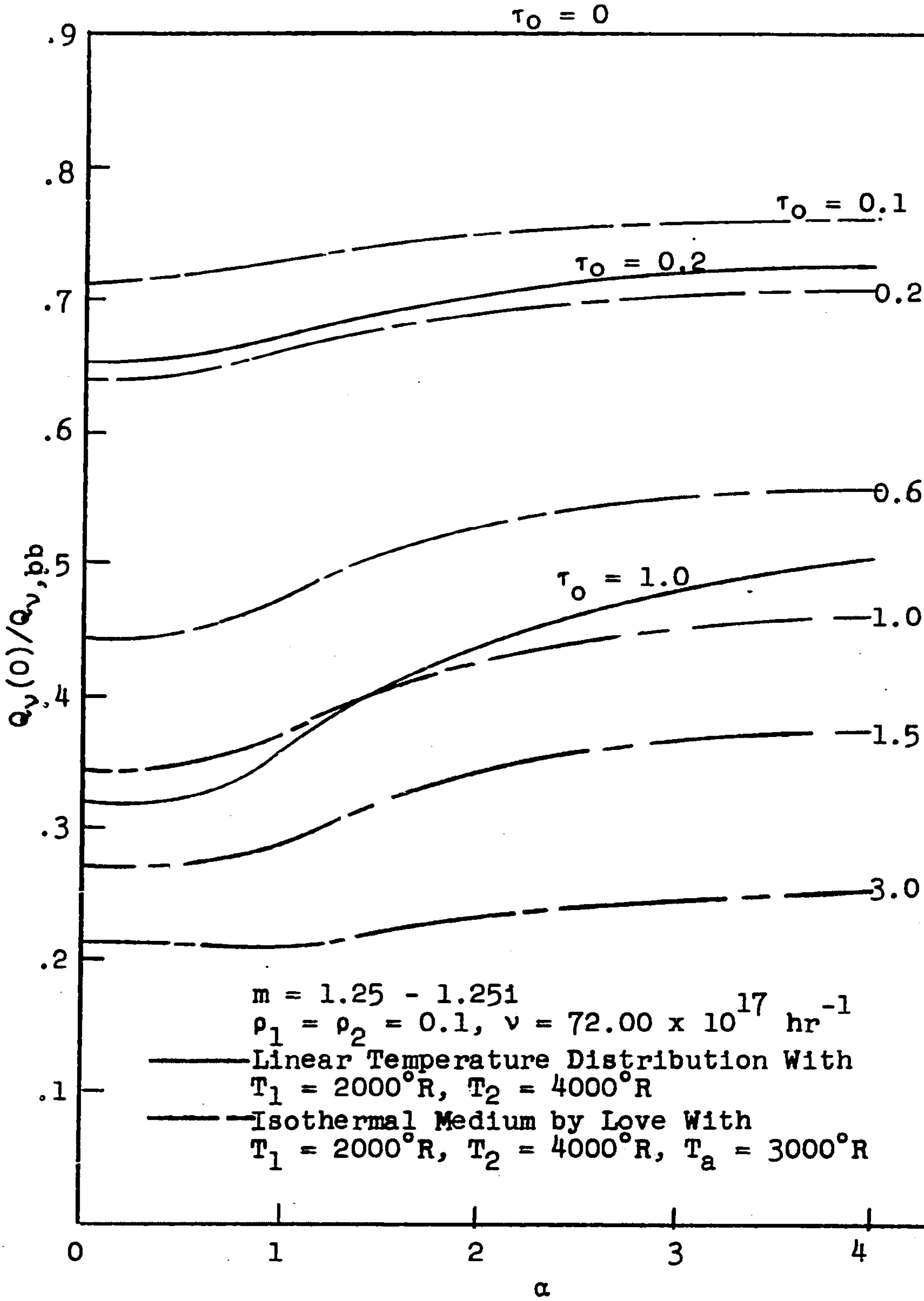


Figure 16. A Comparison of Radiative Transfer at Wall 1 Between the Linear and Isothermal Cases as a Reference for Interpolations and Extrapolations

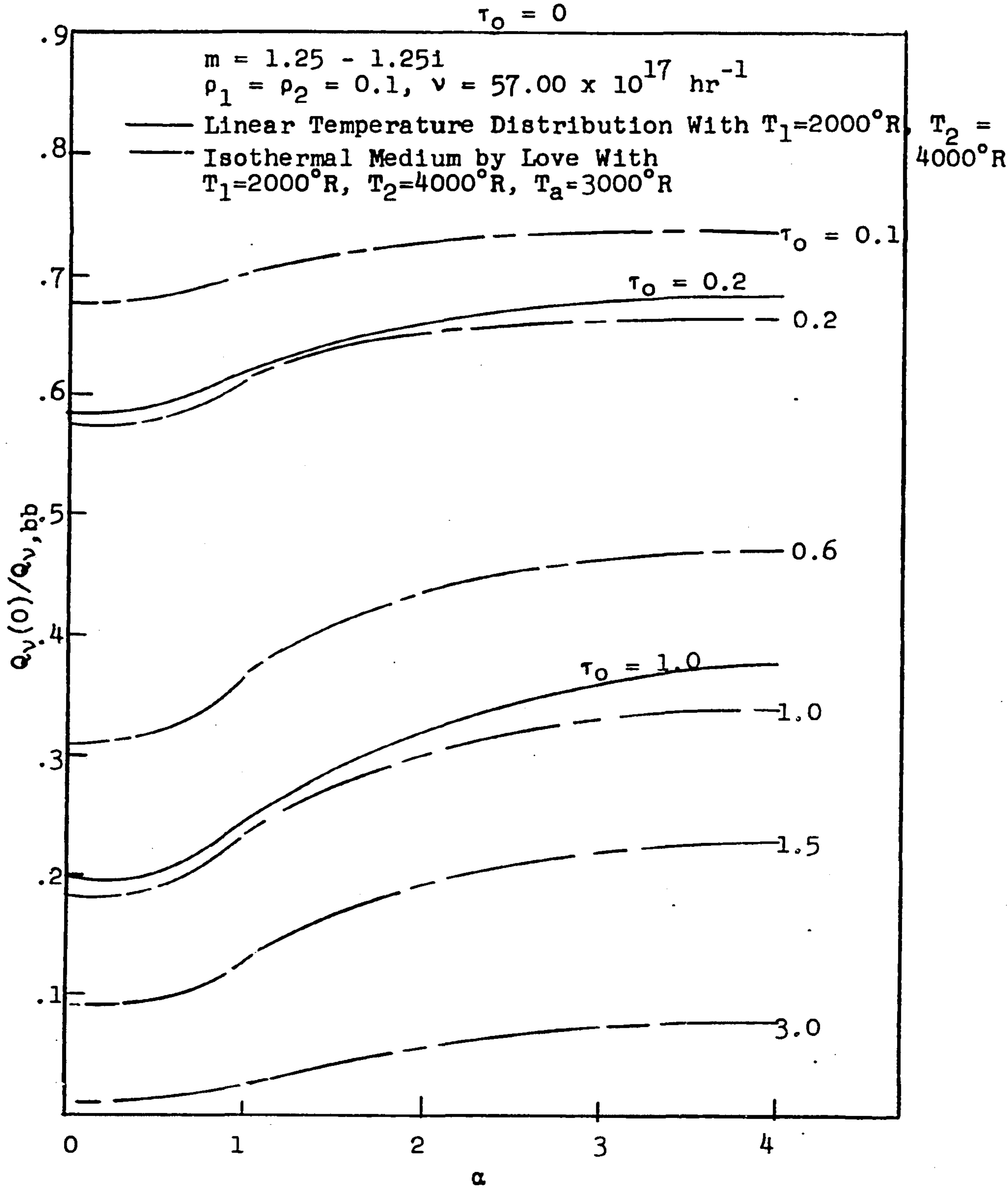


Figure 17. A Comparison of Radiative Transfer at Wall 1 Between the Linear and Isothermal Cases as a Reference for Interpolations and Extrapolations

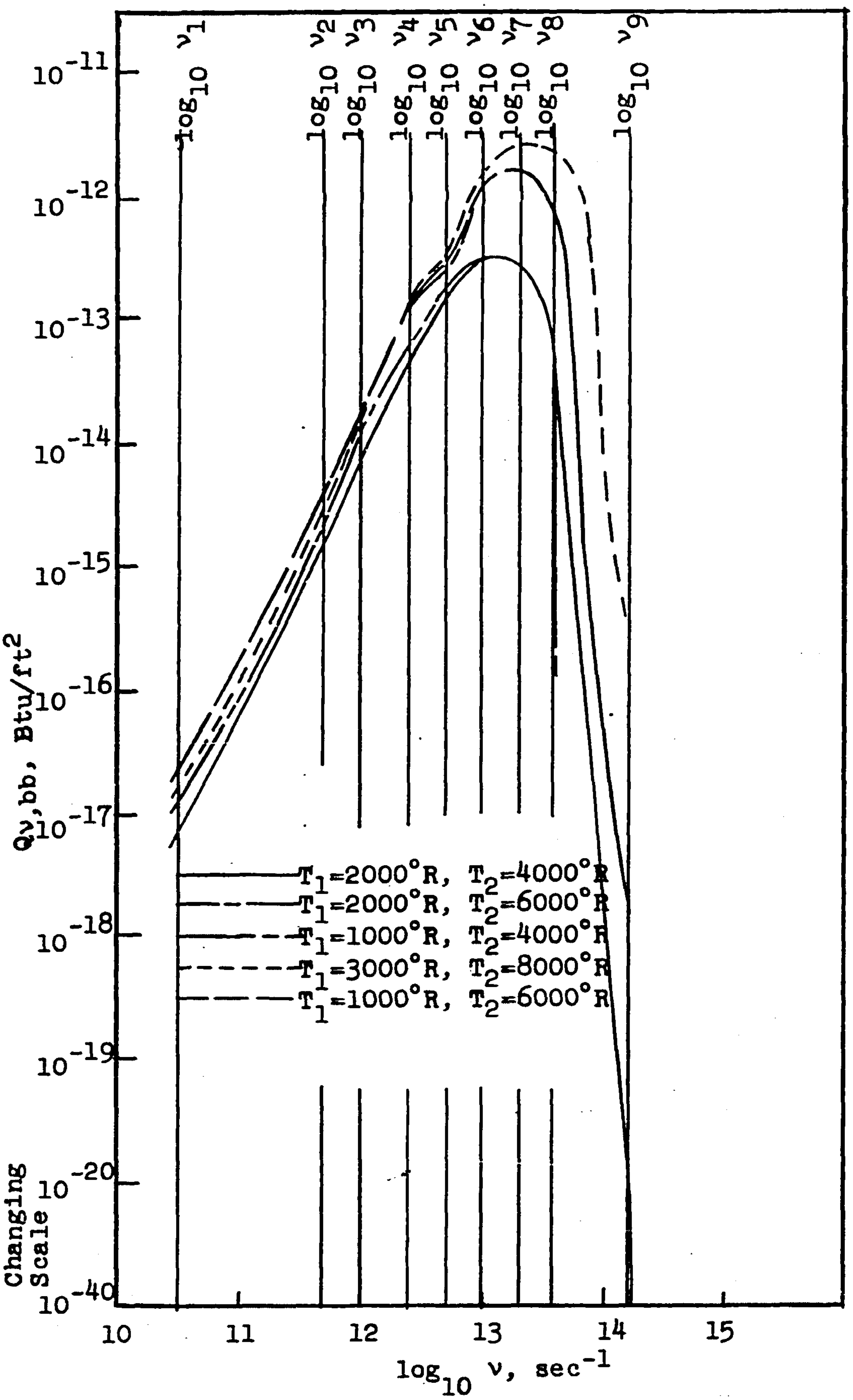


Figure 18. Radiative Transfer at A Wall for Black Surfaces
$\tau_o = 0$

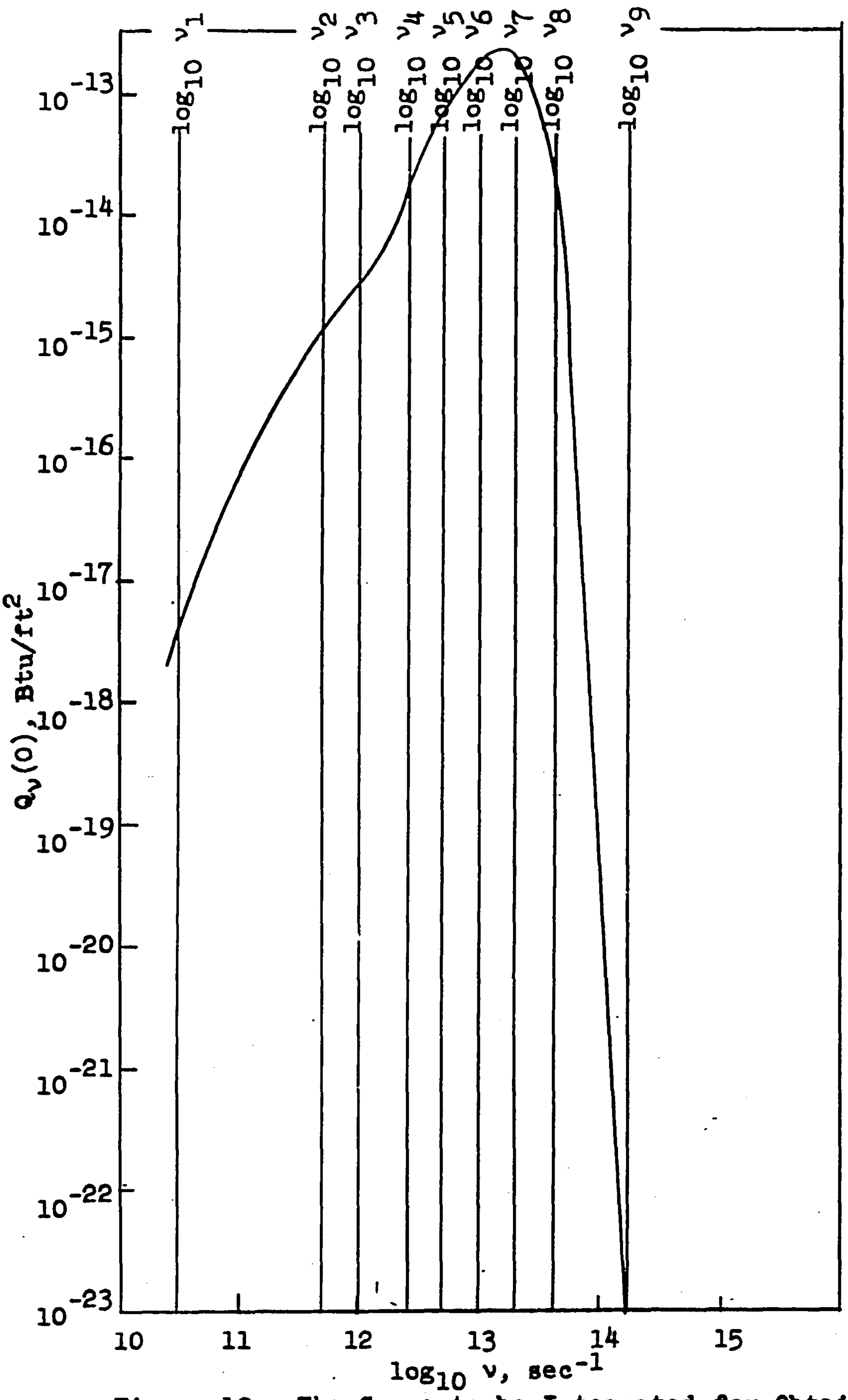


Figure 19. The Curve to be Integrated for Obtaining the Total Net Heat Flux at Wall 1 as Shown in the Example

CHAPTER V

DISCUSSION OF A DISTRIBUTION OF LOCAL HEAT SOURCE (OR SINK) IN THE SYSTEM

In referring to Usiskin and Sparrow's work, the local emissive power of a pure absorbing and emitting medium with a source distribution (either uniform or otherwise) between black walls of temperatures T_1 and T_2 may be rewritten as follows,

$$e_{med}(\tau) = e^{e}_{med}(\tau) + e^{'}_{med}(\tau) \tag{41}$$

where $e^{e}_{med}(\tau)$ is the local emissive power of a medium for radiative equilibrium case. The temperatures on the walls are T_1' and T_2'. $e^{'}_{med}(\tau)$ is the local emissive power of a medium for heat source case. The temperature on both walls is T_o. And

$$\sigma T_1^4 = \sigma T_1'^4 + \sigma T_o^4$$

$$\sigma T_2^4 = \sigma T_2'^4 + \sigma T_o^4$$

If $T_o = 0$ is chosen, then $T_1 = T_1'$ and $T_2 = T_2'$ are obtained. In other words, Equation (41) states that the emissive power of a medium with a source (or sink, if negative) distribution is the sum of emissive power of the medium in radiative equilibrium at the identical boundary temperatures and emissive power of the medium of the same source distribution at zero boundary temperatures. If the emissive powers previously mentioned follow the conventional representation (13), then the temperature distribution for a radiative equilibrium case may be plotted as shown in Figure 20. And according to Equation (41) the following relation is obtained.

$$e'_{med}(\tau/\tau_o) = \sigma(T^{\ell}(\tau/\tau_o))^4 - \sigma(T^{e}(\tau/\tau_o))^4 \qquad (42)$$

where $T^{\ell}(\tau/\tau_o)$ is the local temperature of the linear distribution and $T^{e}(\tau/\tau_o)$ is the local temperature of the equilibrium distribution. The parameter, Φ, defined by Usiskin and Sparrow is related to $e'_{med}(\tau/\tau_o)$ in the following.

$$\Phi(\tau/\tau_o) = \frac{e'_{med}(\tau/\tau_o)}{S_o(\tau/\tau_o)/\rho\varkappa_t} \qquad (43)$$

where $S_o(\tau/\tau_o)$ is a local heat source per unit volume. $\varkappa_t$ is the total mass absorption coefficient.

In applying their analysis, the following is obtained.

$$\int_0^{\tau/\tau_o} \Phi\left(\frac{t}{\tau_o}\right)\left[\int_{\tau-t}^{\infty}\left(\frac{e^{-\xi}}{\xi}\right)d\xi\right]d\left(\frac{t}{\tau_o}\right)$$

$$+\int_{\tau/\tau_o}^{1} \Phi\left(\frac{t}{\tau_o}\right)\left[\int_{t-\tau}^{\infty}\left(\frac{e^{-\xi}}{\xi}\right)d\xi\right]d\left(\frac{t}{\tau_o}\right)+\frac{1}{\tau_o}=\frac{2}{\tau_o}\Phi\left(\frac{\tau}{\tau_o}\right) \qquad (44)$$

From Equations (42), (43), and (44)

$$\int_0^{\tau/\tau_o} \frac{\left[(T^{\ell}(t/\tau_o))^4 - (T^e(t/\tau_o))^4\right]}{S_o(t/\tau_o)} \left[\int_{\tau-t}^{\infty} (e^{-\xi}/\xi)d\xi\right] d(t/\tau_o)$$

$$+ \int_{\tau/\tau_o}^{1} \frac{\left[(T^{\ell}(t/\tau_o))^4 - (T^e(t/\tau_o))^4\right]}{S_o(t/\tau_o)} \left[\int_{t-\tau}^{\infty} (e^{-\xi}/\xi)d\xi\right] d(t/\tau_o) + \frac{1}{\tau_o}$$

$$= \frac{(2/\tau_o)\left[(T^{\ell}(\tau/\tau_o))^4 - (T^e(\tau/\tau_o))^4\right]}{S_o(\tau/\tau_o)} \qquad (45)$$

The above integral equation may be solved for $S_o(\tau/\tau_o)$ using τ_o as a parameter in the similar fashion as solving for the emissive power of a medium by Usiskin and Sparrow.

In case of an isothermal temperature distribution, $(T^{\ell}(\tau/\tau_o))^4$ may be replaced by T_a^4 in Equation (45).

The emissive powers are not necessarily expressed in terms of σT^4. So long as a specific relation between them is given, $S_o(\tau/\tau_o)$ could be solved. Equations (41), (43) and (44) also hold for the monochromatic case. In case of $e^{\ell}_{\nu,med}(\tau/\tau_o)$ and $e^{e}_{\nu,med}(\tau/\tau_o)$ are given functions of the temperature and frequency, the monochromatic heat source could be determined.

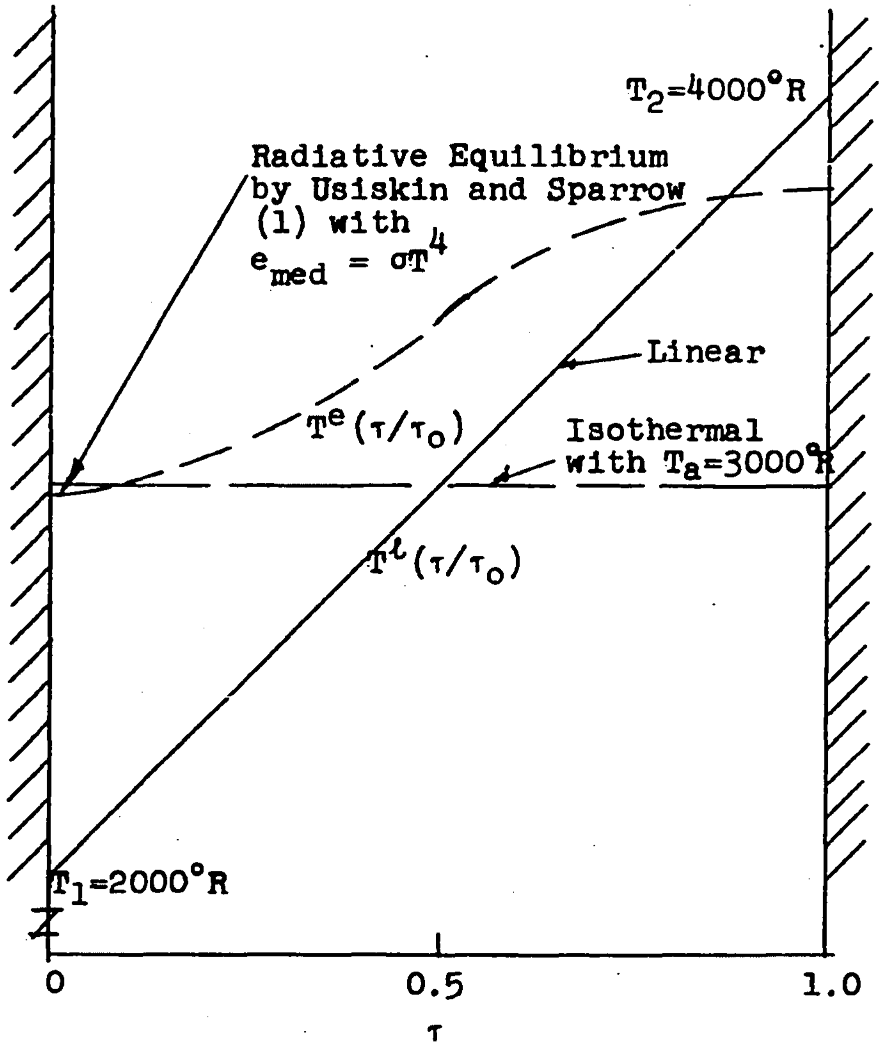


Figure 20. The Temperature Distributions of Radiative Equilibrium and Non-Equilibrium Cases with $\tau_0 = 1$ Between Black Walls

For a smaller reflectivity on the walls, the method could be approximately applied; however, a different approach should be considered for a larger reflection.

In the problem of anisotropic scattering, a local heat source should also be a function of a direction. It may be too involved to be accurately solved.

Generally speaking, the distribution of heat source in an optical spacing can be determined exactly or approximately for a given temperature distribution, if the emission power of a medium could be expressed as a specific function of the temperature.

CHAPTER VI

THE CONCENTRIC SPHERICAL BOUNDARIES

This model can be applied to the case of concentric spherical boundaries. The general approach and formulations for the case are discussed below.

The equation of radiative transfer in an absorbing, emitting, and scattering medium between the concentric spherical boundaries may be written in referring to Chandrasekhar's work as follows.

$$\mu \frac{\partial I_\nu(r,\mu)}{\partial r} + \frac{1-\mu^2}{r}\frac{\partial I_\nu(r,\mu)}{\partial \mu}$$

$$= -\rho\beta I_\nu(r,\mu) + \frac{\rho\sigma}{2}\int_{-1}^{1} I_\nu(r,\mu')S(\mu,\mu')d\mu'$$

$$+ \frac{\kappa}{\beta} I_{\nu,bb}(\tau) \tag{46}$$

where r is the radius of sphere between the inner wall of radius r_I and the outer wall of radius r_{II}; μ' is used for making distinction from μ.

Replacing the integral by a summation and considering

μ at a specific direction μ_i, Equation (46) becomes

$$\mu_i \frac{dI_\nu(r,\mu_i)}{dr} + \frac{1 - \mu_i^2}{r} \left[\frac{\partial I_\nu(r,\mu)}{\partial \mu} \right]_{\mu=\mu_i}$$

$$= -\rho\beta I_\nu(r,\mu_i) + \frac{\rho\sigma}{2} \sum a_j S(\mu_i,\mu_j) I_\nu(r,\mu_j) + \frac{\kappa}{\beta} I_{\nu,bb}(r) \qquad (47)$$

If the optical depth is defined as

$$d\tau = \rho\beta \, dr \qquad (48)$$

and $\rho\beta$ is assumed independent of r, Equation (47) may be rewritten as

$$\mu_i \frac{dI_i}{d\tau} + \frac{1 - \mu_i^2}{\tau + \tau^o} \left(\frac{\partial I}{\partial \mu} \right)_{\mu=\mu_i}$$

$$= -\rho\beta I_i + \frac{\rho\sigma}{2} \sum_j a_j S(\mu_i,\mu_j) I_j + \frac{\kappa}{\beta} I_G \qquad (49)$$

where I_i, I_j, I and I_G are respectively the abbreviations for $I_\nu(\tau,\mu_i)$, $I_\nu(\tau,\mu_j)$, $I_\nu(\tau,\mu)$ and $I_{\nu,bb}(\tau)$; τ^o is equal $\rho\beta r_I$.

Following the same method used by Chandrasekher in the pure absorbing and emitting medium with spherical boundaries, Equation (47) is multiplied by $a_i P_\ell'(\mu_i)$, where P_ℓ' is the first derivative of Legendre function of order ℓ, and summing over all i,

$$\frac{d}{d\tau}\sum_{i=-n}^{+n} a_i\mu_i P_\ell'(\mu_i)I_i + \frac{\ell(\ell+1)}{\tau+\tau^o}\sum_{i=-n}^{+n} a_i P_\ell(\mu_i)I_i$$

$$= -\sum_{i=-n}^{+n} a_i P_\ell'(\mu_i)I_i + \frac{\sigma}{2\beta}\sum_{i=-n}^{+n} a_i P_\ell'(\mu_i)\sum_{j=-n}^{+n} a_j S(\mu_i,\mu_j)I_j$$

$$+ \frac{\kappa}{\beta}\sum_{i=-n}^{+n} a_i P_\ell'(\mu_i)I_G \qquad (50)$$

Although either single or double Gaussian quadrature may be applied to Equation (49), only single Gaussian quadrature can be used for Equation (50). This is due to the restriction for which the equation is obtained.

Rewriting Equation (50) in the matrix form:

$$\frac{d}{d\tau} M^* I_\nu^*(\tau,\mu) + \left(\frac{1}{\tau+\tau^o}X^* + Y^* - \Phi^*\right) I_\nu^*(\tau,\mu)$$

$$= K^* I_{\nu,bb}^*(\tau) \qquad (51)$$

The elements of M^*, X^*, Y^*, Φ^*, or K^* ($m_{\ell,i}$, $x_{\ell,i}$, $y_{\ell,i}$, $\varphi_{\ell,i}$, or $k_{\ell,i}$ namely) may be expressed as follows if $m_{\ell,n+i} = m_{\ell,-i}$, $x_{\ell,n+i} = x_{\ell,-i}$, ... are defined.

$$m_{\ell,i} = a_i\mu_i P_\ell'(\mu_i)$$

$$m_{\ell,n+1} = -a_i\mu_i P_\ell'(-\mu_i)$$

$$x_{\ell,i} = \ell(\ell + 1)a_i P_\ell(\mu_i)$$

$$x_{\ell,n+1} = \ell(\ell + 1)a_i P_\ell(-\mu_i)$$

$$y_{\ell,i} = a_i P_\ell'(\mu_i)$$

$$y_{\ell,n+i} = a_i P_\ell'(-\mu_i)$$

$$k_{\ell,i} = \frac{\kappa}{\beta}\, a_i P_\ell'(\mu_i)$$

$$k_{\ell,n+i} = \frac{\kappa}{\beta}\, a_i P_\ell'(-\mu_i)$$

$$\varphi_{\ell,i} = \frac{\sigma}{2\beta}\left[\sum_{j=1}^{n} a_j P_\ell'(\mu_j) S(\mu_j,\mu_i) + \sum_{j=1}^{n} a_j P_\ell'(-\mu_j) S(-\mu_j,\mu_i)\right]$$

$$\varphi_{\ell,n+1} = \frac{\sigma}{2\beta}\left[\sum_{j=1}^{n} a_j P_\ell'(\mu_j) S(\mu_j,-\mu_i) + \sum_{j=1}^{n} a_j P_\ell'(-\mu_j) S(-\mu_j,-\mu_i)\right]$$

$$\ell = 1, \ldots, 2n \; ; \quad i = 1, \ldots, n$$

The existence of the inverse of M^* may be recognized by the fact that its column matrices are independent. Thus Equation (51) becomes

$$\frac{d}{d\tau} I_\nu^*(\tau,\mu) + (M^*)^{-1} \left(\frac{1}{\tau + \tau^o} X^* + Y^* - \Phi^* \right) I_\nu^*(\tau,\mu)$$

$$= (M^*)^{-1} K^* I_{\nu,bb}^*(\tau) \qquad (52)$$

For a value of $1/\rho\beta r$ close to zero, the contribution of the term, $\frac{1}{\tau + \tau^o} X^*$, may be comparatively negligible, Equation (52) becomes

$$\frac{d}{d\tau} I_\nu^*(\tau,\mu) + (M^*)^{-1}(Y^* - \Phi^*) I_\nu^*(\tau,\mu) = (M^*)^{-1} K^* I_{\nu,bb}^*(\tau) \qquad (53)$$

Equation (53) is similar to Equation (2) of a parallel plate case, therefore, the method developed in Chapter III can be applied. However, if $1/\rho\beta r$ is not close to zero the optical spacing between the boundaries may be partitioned into p divisions. In each partition an arithmetic mean radius, $\overline{r_1}$, is chosen to approximate the radius in a partition as shown in Figure 21.

Applying Equation (52) to each partition: (1) In the optical spacing between 0 and τ_1

$$\frac{d}{d\tau} I_\nu^*(\tau,\mu) + (M^*)^{-1} \left(\frac{1}{\overline{\tau_1} + \tau_o} X^* + Y^* - \Phi^* \right) I_\nu^*(\tau,\mu)$$

$$= (M^*)^{-1} K^* I_{\nu,bb}^*(\tau) \qquad (54.1)$$

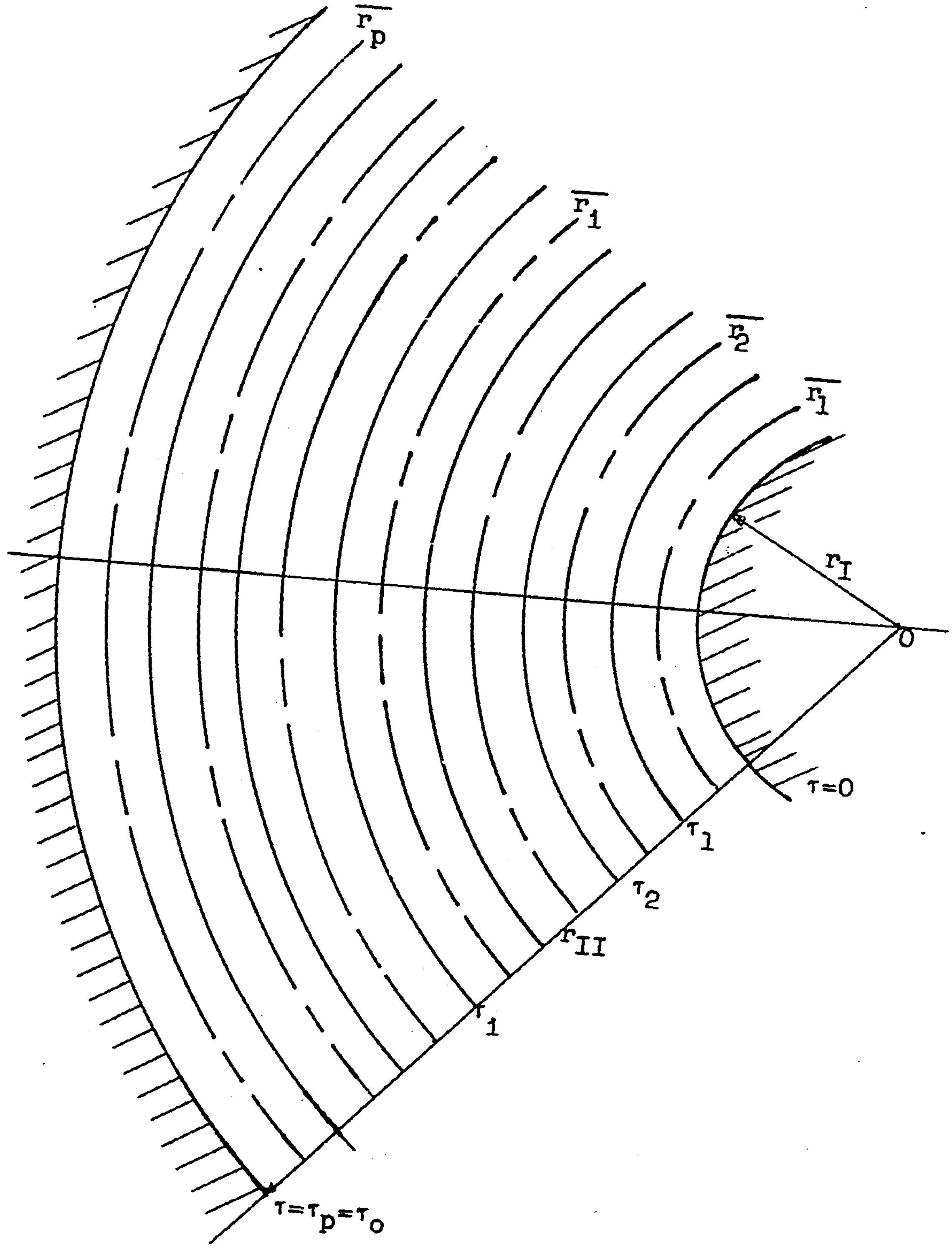


Figure 21. The Partition of an Optical Spacing Between the Spherical Boundaries

where $\overline{\tau_1} = \rho\beta\overline{r_1} - \tau^o$

(2) In the optical spacing between τ_1 and τ_2

$$\frac{d}{d\tau} I_\nu^*(\tau,\mu) + (M^*)^{-1} \left(\frac{1}{\overline{\tau_2} + \tau_o} X^* + Y^* - \Phi^* \right) I_\nu^*(\tau,\mu) = (M^*)^{-1} K^* I_{\nu,bb}^*(\tau) \qquad (54.2)$$

where $\overline{\tau_2} = \rho\beta\overline{r_2} - \tau^o$

(3) In general, for the optical spacing between τ_{i-1} and τ_i.

$$\frac{d}{d\tau} I_\nu^*(\tau,\mu) + (M^*)^{-1} \left(\frac{1}{\overline{\tau_i} + \tau^o} X^* + Y^* - \Phi^* \right) I_\nu^*(\tau,\mu) = (M^*)^{-1} K^* I_{\nu,bb}^*(\tau) \qquad (54.i)$$

where $\overline{\tau_i} = \rho\beta\overline{r_i} - \tau^o$

$i = 1, 2, \ldots p$

Since $\overline{\tau_1}, \overline{\tau_2}, \ldots, \overline{\tau_i}, \ldots, \overline{\tau_p}$ and τ^o are constants, the equation through (54.1) to (54.p) may be solved by using the method for parallel plates. The boundary conditions at τ_i and τ_{i-1} can be related to the boundary conditions at τ_{i+1} and τ_{i-2} respectively. τ_{i+1}, τ_{i-2}, in turn, can be related to the boundary condition at τ_{i+2}, τ_{i-3}. Repeating the process, then the boundary condition at τ_i, τ_{i-1}, can be expressed in terms of boundary condition at $\tau = \tau_o$, $\tau = 0$. Thus the problem may be solved.

The third and fourth order of approximation of

Gaussian quadrature for $P_{\ell}(\mu_i,\mu_j)$, of which the integration was carried out for every 5° interval of azimuthal angle, is listed in Appendix IX.

CHAPTER VII

CONCLUSIONS

The following conclusions may be drawn from this study.

(a) The problem of radiative heat transfer of an absorbing, emitting, anisotropic scattering, and non-isothermal medium was solved approximately by this model. The degree of accuracy may be further increased by increasing the degree of approximation. Other methods which are based on total flux cannot account properly for the frequency-dependent anisotropic scattering.

(b) The development of a particular solution for a non-isothermal medium utilized Frame's method. The application of the discrete heat flux model may be extended and a different geometrical configuration may be solved in a similar fashion. It is suggested that similar physical problems outside this field may also be solved by applying the method with the appropriate modifications.

(c) The modified method for finding eigenvalues of a matrix of this type may be considered as an additional method to handle the problem of large size unsymmetrical square matrices.

(d) The conclusion related to the numerical results may be listed as follows

(1) The net heat flux at wall 1 for a linear temperature distribution may be approximated by the isothermal case in which the temperature of the medium is taken as the average temperature of the walls. However, the approximation cannot be applied to wall 2, where the lower temperature is at wall 1.

(2) The general characteristics of the results for the non-isothermal cases are similar to the isothermal case.

(3) The method of integrating monochromatic heat flux to obtain total heat flux utilized a numerical scheme; however, the accuracy appears to be satisfactory.

(4) The large diffuse reflections on the walls reduce the directional effect of anisotropic scattering.

CHAPTER VIII

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APPENDIX I

The definition of idempotents (referred to Perlis):

Idempotent $E_1^*, \ldots, E_m^*$ are uniquely determined by a given n x n matrix, H^*, whose distinctive eigenvalues are $\alpha_1, \ldots \alpha_m$. They have the following properties:

(1) $H^* = \alpha_1 E_1^* + \ldots + \alpha_m E_m^*$

(2) $E_i^* E_j^* = \begin{cases} O^* & \text{if } i \neq j \\ E_i^* & \text{if } i = j \end{cases}$

(3) $E_1^* + \ldots + E_m^* = U^*$ (a unit matrix)

(4) Each E_i has rank equal to the multiplicity of the eigenvalue α_i

(5) If $W(x)$ is any polynomial, then

$W(H^*) = W(\alpha_1)E_1^* + \ldots + W(\alpha_m)E_m^*$

(6) Any given matrix Z^* commutes with V^* if and only if Z^* commutes with every E_i^*.

APPENDIX II

The proof of Equation (10):

By the definition of idempotents,

$$M^* = \lambda_1 q_1(M^*) + \dots + \lambda_i q_i(M^*) + \dots + \lambda_{2n} q_{2n}(M^*)$$

Multiplying the equation by $q_j(M^*)$ on the right of both sides,

$$M^* q_j(M^*) = \lambda_1 q_1(M^*) q_j(M^*) + \dots + \lambda_i q_i(M^*) q_j(M^*)$$
$$+ \lambda_{2n} q_{2n}(M^*) q_j(M^*)$$
$$= \lambda_j q_j(M^*)$$

For $q_i(M^*) q_j(M^*) = \begin{cases} 0^* & i \neq j \\ q_j(M^*) & i = j \end{cases}$

APPENDIX III

To prove that $e^{\lambda_j \tau} q_j(M^*)C^*$ is a homogeneous solution for $I_\nu^*(\tau,\mu)$, proceed as follows: Let $I_\nu^*(\tau,\mu) = e^{\lambda_j \tau} q_j(M^*)C^*$ substituting this relation into the left-hand side of Equation (2),

$$\frac{dI_\nu^*(\tau,\mu)}{d\tau} - M^* I_\nu(\tau,\mu) = e^{\lambda_j \tau}(\lambda_j U^* - M^*)q_j(M^*)C^*$$

$$= 0^*$$

$$\text{For } \lambda_j q_j(M^*) - M^* q_j(M^*) = 0^*$$

(refer to Appendix II)

Q. E. D.

APPENDIX IV

The proof of Equation (14);

Let $$I_\nu^*(\tau,\mu) = \frac{\kappa}{\beta}\int_0^\tau \sum_{j=1}^n e^{-|\lambda_j|(\tau - t)} q_j(M^*) I_{bb,\nu}(T))dt\ \overline{\mu}^*$$

$$- \frac{\kappa}{\beta}\int_\tau^{\tau_o} \sum_{j=1}^n e^{-|\lambda_j|(t - \tau)} q_{j+n}(M^*) I_{bb,\nu}(T(t))dt\ \overline{\mu}^*$$

Substituting from the above relation into each term at the left-hand side of Equation (2) and referring to Hilderbrand (11),

$$\frac{dI_\nu^*(\tau,\mu)}{d\tau} = -\frac{\kappa}{\beta}\Big[\int_0^\tau \sum_{j=1}^n |\lambda_j| e^{-|\lambda_j|(\tau - t)} q_j(M^*) I_{bb,\nu}(T(t))dt\ \overline{\mu}^*$$

$$+ \sum_{j=1}^n q_j(M^*) I_{bb,\nu}(T(\tau))\overline{\mu}^*\Big]$$

$$- \frac{\kappa}{\beta}\Big[\int_\tau^{\tau_o} \sum_{j=1}^n |\lambda_j| e^{-|\lambda_j|(t - \tau)} q_{j+n}(M^*) I_{bb,\nu}(T(t))dt\ \overline{\mu}^*$$

$$- \sum_{j=1}^n q_{j+n}(M^*) I_{bb,\nu}(T(\tau))\ \overline{\mu}^*\Big]$$

$$-M^*I_\nu^*(\tau,\mu) = -\frac{\kappa}{\beta}\int_0^\tau \sum_{j=1}^{n} M^* e^{-|\lambda_j|(\tau-t)} q_j(M^*)I_{bb,\nu}(T(t))dt\,\overline{\mu^*}$$

$$+\frac{\kappa}{\beta}\int_\tau^{\tau_0} \sum_{j=1}^{n} M^* e^{-|\lambda_j|(t-\tau)} q_{j+n}(M^*)I_{bb,\nu}(T(t))dt\,\overline{\mu^*}$$

Adding the above equations,

$$\frac{dI_\nu^*(\tau,\mu)}{d\tau} - M^*I_\nu^*(\tau,\mu) =$$

$$-\frac{\kappa}{\beta}\int_0^\tau \sum_{j=1}^{n} e^{-|\lambda_j|(\tau-t)} (M^* + |\lambda_j|U^*)q_j(M^*)I_{bb,\nu}(T(t))\overline{\mu^*}$$

$$+\frac{\kappa}{\beta}\int_\tau^{\tau_0} \sum_{j=1}^{n} e^{-|\lambda_j|(t-\tau)} (M^* - |\lambda_j|U^*)q_{j+n}(M^*)I_{bb,\nu}(T(t))dt\,\overline{\mu^*}$$

$$+\frac{\kappa}{\beta}\sum_{j=1}^{2n} q_j(M^*)I_{bb,\nu}(T(t))\overline{\mu^*} \qquad (1p)$$

Since $\lambda_j = \begin{cases} -|\lambda_j|, & j = 1,2, \ldots n \\ |\lambda_j|, & j = n, n+1, \ldots 2n \end{cases}$

and refer to Appendix II, then

$$(M^* + |\lambda_j|U^*)q_j(M^*) = (M^* - \lambda_j U^*)q_j(M^*) = 0^*$$

and

$$(M^* - |\lambda_j|U^*)q_{j+n}(M^*) = (M^* - \lambda_{j+n}U^*)q_{j+n}(M^*) = 0^*$$

$$j = 1, 2, \ldots n$$

By definition,

$$\sum_{j=1}^{2n} q_j(M^*) = U^*$$

Therefore Equation (1p) becomes

$$\frac{dI_\nu^*(\tau,\mu)}{d\tau} - M^* I_\nu^*(\tau,\mu) = \frac{\kappa}{\beta} I_{bb,\nu}(T(t))\overline{\mu^*} \qquad (2p)$$

Compare Equation (2p) with Equation (2); the validity of Equation (14) is thus proved.

APPENDIX V

The examples of the numerical computation of Equation (19)

(1) Refraction index = 1.25 - 1.25i

$\alpha = 1, \quad \sigma/\beta = 0.315$

By third approximation,

$$\sum_{j=1}^{3} \frac{1}{|\lambda_j|} (q_j(M^*) - q_{j+n}(M^*))\overline{\mu}^* = \begin{bmatrix} 1.47265 \\ 1.46923 \\ 1.48975 \\ 1.47266 \\ 1.46924 \\ 1.48975 \end{bmatrix}$$

The true value of β/κ should be

$$\frac{\beta}{\kappa} = \frac{1}{(1 - \sigma/\beta)} = \frac{1}{(1 - 0.315)} = 1.45985$$

(2) Isotropic scattering with $\sigma/\beta = 0.145$

By third approximation

$$\sum_{j=1}^{3} \frac{1}{|\lambda_j|} (q_j(M^*) - q_{j+n}(M^*))\overline{\mu}^* = \begin{bmatrix} 1.17036 \\ 1.16957 \\ 1.17039 \\ 1.17036 \\ 1.16957 \\ 1.17039 \end{bmatrix}$$

The true value of β/κ should be 1.16959.

APPENDIX VI

	$T_1 = 2000°R$, $T_2 = 4000°R$	$T_1 = 2000°R$, $T_2 = 6000°R$	$T_1 = 1000°R$, $T_2 = 4000°R$
$Q_{\nu_1,bb}$	$.728523 \times 10^{-17}$	$.145703 \times 10^{-16}$	$.109277 \times 10^{-16}$
$Q_{\nu_2,bb}$	$.235580 \times 10^{-14}$	$.471467 \times 10^{-14}$	$.352687 \times 10^{-14}$
$Q_{\nu_3,bb}$	$.936855 \times 10^{-14}$	$.187856 \times 10^{-13}$	$.139456 \times 10^{-13}$
$Q_{\nu_4,bb}$	$.562372 \times 10^{-13}$	$.114300 \times 10^{-12}$	$.807024 \times 10^{-13}$
$Q_{\nu_5,bb}$	$.195720 \times 10^{-12}$	$.417075 \times 10^{-12}$	$.255321 \times 10^{-12}$
$Q_{\nu_6,bb}$	$.476806 \times 10^{-12}$	$.121157 \times 10^{-11}$	$.531089 \times 10^{-12}$
$Q_{\nu_7,bb}$	$.434260 \times 10^{-12}$	$.193540 \times 10^{-11}$	$.440038 \times 10^{-12}$
$Q_{\nu_8,bb}$	$.462255 \times 10^{-13}$	$.825728 \times 10^{-12}$	$.462337 \times 10^{-13}$
$Q_{\nu_9,bb}$	$.228274 \times 10^{-22}$	$.203562 \times 10^{-17}$	$.228274 \times 10^{-22}$

	$T_1 = 1000°R$, $T_2 = 6000°R$	$T_1 = 3000°R$, $T_2 = 8000°R$	$T_1 = 500°R$, $T_2 = 4000°R$
$Q_{\nu_1,bb}$	$.182128 \times 10^{-16}$	$.182134 \times 10^{-16}$	$.127487 \times 10^{-16}$
$Q_{\nu_2,bb}$	$.588573 \times 10^{-14}$	$.589716 \times 10^{-14}$	$.409901 \times 10^{-14}$
$Q_{\nu_3,bb}$	$.233627 \times 10^{-13}$	$.235428 \times 10^{-13}$	$.160360 \times 10^{-13}$
$Q_{\nu_4,bb}$	$.138765 \times 10^{-12}$	$.145165 \times 10^{-12}$	$.881525 \times 10^{-13}$
$Q_{\nu_5,bb}$	$.476676 \times 10^{-12}$	$.553772 \times 10^{-12}$	$.262107 \times 10^{-12}$
$Q_{\nu_6,bb}$	$.126585 \times 10^{-11}$	$.185493 \times 10^{-11}$	$.531811 \times 10^{-12}$
$Q_{\nu_7,bb}$	$.194118 \times 10^{-11}$	$.415127 \times 10^{-11}$	$.440039 \times 10^{-12}$
$Q_{\nu_8,bb}$	$.825735 \times 10^{-12}$	$.351771 \times 10^{-11}$	$.462337 \times 10^{-12}$
$Q_{\nu_9,bb}$	$.203562 \times 10^{-17}$	$.607881 \times 10^{-15}$	$.228274 \times 10^{-22}$

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.444	.470	.571	.657	.708
.18	.435	.443	.469	.567	.649	.698
.36	.435	.443	.468	.564	.642	.688
.90	.431	.439	.464	.553	.622	.663
1.80	.421	.428	.453	.536	.595	.629
3.60	.387	.395	.421	.500	.550	.577
7.20	.318	.329	.358	.437	.482	.506
14.40	.251	.263	.297	.376	.419	.440
57.00	.195	.209	.244	.321	.362	.380

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.437	.448	.466	.430	.405
.18	.436	.437	.448	.469	.437	.415
.36	.436	.438	.450	.473	.445	.425
.90	.439	.441	.454	.483	.464	.450
1.80	.449	.451	.464	.500	.491	.483
3.60	.482	.483	.495	.535	.536	.534
7.20	.559	.558	.564	.603	.607	.610
14.40	.664	.657	.654	.684	.689	.693
57.00	.822	.805	.783	.795	.796	.802

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.228	.242	.292	.343	.374
.18	.222	.228	.242	.289	.338	.367
.36	.222	.227	.241	.287	.332	.360
.90	.220	.225	.238	.280	.319	.342
1.80	.214	.218	.231	.268	.300	.319
3.60	.193	.198	.211	.244	.269	.283
7.20	.150	.156	.170	.201	.222	.232
14.40	.108	.113	.128	.158	.176	.185
57.00	.068	.074	.088	.116	.131	.138

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.224	.228	.221	.186	.162
.18	.223	.224	.228	.223	.191	.169
.36	.223	.224	.229	.225	.196	.176
.90	.225	.226	.232	.232	.209	.193
1.80	.231	.233	.239	.244	.228	.217
3.60	.251	.253	.259	.268	.259	.252
7.20	.298	.299	.303	.313	.308	.305
14.40	.360	.359	.359	.366	.363	.361
57.00	.451	.446	.437	.436	.432	.432

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.706	.714	.747	.772	.788
.18	.703	.705	.714	.746	.770	.785
.36	.703	.705	.713	.744	.768	.782
.90	.702	.704	.712	.741	.762	.775
1.80	.697	.700	.708	.736	.754	.766
3.60	.683	.686	.696	.725	.741	.751
7.20	.652	.658	.673	.704	.720	.729
14.40	.618	.627	.647	.682	.699	.708
57.00	.583	.595	.620	.660	.678	.686

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.703	.707	.716	.709	.703
.18	.703	.703	.707	.717	.711	.706
.36	.704	.704	.707	.718	.713	.709
.90	.705	.705	.709	.721	.718	.716
1.80	.709	.709	.713	.726	.726	.725
3.60	.723	.722	.724	.738	.739	.740
7.20	.756	.751	.749	.759	.761	.763
14.40	.794	.787	.778	.783	.784	.786
57.00	.841	.829	.812	.811	.810	.812

TEMP1=2000.R, TEMP2=4000.R
TEMP.-DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.315	.329	.346	.356
.18	.309	.311	.314	.328	.344	.354
.36	.309	.310	.314	.328	.342	.352
.90	.308	.309	.313	.325	.337	.345
1.80	.304	.306	.309	.320	.331	.337
3.60	.293	.295	.300	.310	.319	.324
7.20	.268	.272	.280	.292	.300	.304
14.40	.240	.246	.257	.273	.281	.285
57.00	.210	.218	.233	.252	.261	.264

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.308	.303	.290	.282
.18	.309	.309	.309	.304	.292	.284
.36	.309	.309	.309	.305	.294	.286
.90	.310	.310	.310	.307	.299	.293
1.80	.314	.314	.314	.312	.305	.301
3.60	.325	.324	.323	.322	.317	.314
7.20	.351	.348	.344	.340	.336	.334
14.40	.381	.376	.367	.361	.356	.354
57.00	.416	.408	.395	.384	.378	.377

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.446	.485	.557	.556	.591
.18	.435	.446	.484	.554	.552	.584
.36	.435	.445	.482	.550	.548	.577
.90	.431	.441	.477	.540	.536	.558
1.80	.421	.431	.466	.523	.517	.531
3.60	.387	.398	.435	.487	.480	.486
7.20	.318	.332	.374	.426	.418	.420
14.40	.251	.267	.313	.366	.359	.359
57.00	.195	.213	.261	.313	.306	.306

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.437	.456	.452	.431	.371
.18	.436	.438	.457	.456	.436	.378
.36	.436	.438	.458	.459	.440	.386
.90	.439	.442	.463	.470	.451	.404
1.80	.449	.452	.474	.486	.470	.430
3.60	.482	.483	.504	.521	.506	.474
7.20	.559	.557	.571	.587	.573	.546
14.40	.664	.655	.658	.668	.654	.629
57.00	.822	.800	.780	.778	.765	.743

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.230	.249	.288	.292	.321
.18	.222	.229	.249	.286	.289	.316
.36	.222	.229	.248	.283	.286	.311
.90	.220	.227	.244	.276	.278	.298
1.80	.214	.220	.237	.265	.265	.279
3.60	.193	.199	.217	.240	.240	.249
7.20	.150	.158	.176	.198	.197	.202
14.40	.108	.115	.134	.156	.155	.158
57.00	.068	.076	.095	.115	.114	.116

THE RATIO OF $Q_{\nu}(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.224	.230	.217	.206	.169
.18	.223	.224	.231	.219	.209	.174
.36	.223	.225	.232	.222	.212	.179
.90	.225	.227	.235	.229	.220	.192
1.80	.231	.233	.242	.240	.233	.210
3.60	.251	.253	.262	.264	.257	.240
7.20	.298	.299	.306	.308	.303	.289
14.40	.360	.358	.360	.361	.356	.345
57.00	.451	.444	.436	.431	.427	.418

TEMP1=2000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.706	.719	.742	.742	.749
.18	.703	.706	.718	.741	.741	.747
.36	.703	.706	.718	.740	.739	.745
.90	.702	.704	.716	.737	.736	.739
1.80	.697	.700	.712	.732	.730	.731
3.60	.683	.687	.702	.720	.718	.718
7.20	.652	.660	.679	.700	.698	.696
14.40	.618	.630	.655	.679	.676	.675
57.00	.583	.599	.630	.657	.655	.653

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.703	.710	.711	.705	.686
.18	.703	.703	.710	.713	.706	.689
.36	.704	.703	.711	.714	.707	.691
.90	.705	.705	.712	.717	.711	.696
1.80	.709	.709	.716	.722	.716	.704
3.60	.723	.722	.727	.733	.728	.717
7.20	.756	.750	.750	.754	.749	.739
14.40	.794	.784	.777	.777	.773	.763
57.00	.841	.825	.809	.805	.800	.791

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.316	.329	.331	.341
.18	.309	.311	.316	.328	.330	.339
.36	.309	.311	.316	.327	.329	.337
.90	.308	.310	.314	.324	.325	.332
1.80	.304	.306	.311	.320	.320	.325
3.60	.293	.296	.302	.310	.310	.314
7.20	.268	.273	.283	.292	.292	.295
14.40	.240	.248	.261	.273	.273	.275
57.00	.210	.221	.239	.253	.253	.255

THE RATIO OF $Q_{\nu}(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.309	.302	.298	.286
.18	.309	.309	.309	.303	.299	.288
.36	.309	.309	.309	.304	.300	.290
.90	.310	.310	.311	.306	.304	.294
1.80	.314	.313	.314	.311	.309	.301
3.60	.325	.324	.323	.321	.319	.313
7.20	.351	.347	.343	.339	.337	.332
14.40	.381	.374	.365	.359	.357	.353
57.00	.416	.406	.391	.382	.380	.376

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.443	.466	.553	.619	.657
.18	.435	.442	.466	.552	.615	.652
.36	.435	.442	.465	.550	.611	.647
.90	.431	.438	.461	.543	.600	.633
1.80	.420	.427	.452	.529	.581	.610
3.60	.385	.393	.419	.496	.543	.569
7.20	.317	.328	.358	.437	.481	.505
14.40	.253	.266	.299	.379	.422	.443
57.00	.197	.211	.246	.324	.364	.383

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.438	.451	.483	.468	.455
.18	.436	.438	.452	.485	.472	.460
.36	.436	.439	.453	.487	.475	.465
.90	.439	.442	.456	.493	.487	.480
1.80	.449	.451	.466	.506	.505	.501
3.60	.481	.483	.495	.538	.541	.541
7.20	.555	.554	.561	.600	.606	.608
14.40	.654	.648	.646	.678	.683	.687
57.00	.813	.796	.775	.789	.790	.796

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.227	.240	.280	.317	.338
.18	.222	.227	.240	.279	.314	.335
.36	.222	.227	.239	.277	.311	.331
.90	.220	.225	.237	.273	.303	.321
1.80	.213	.218	.230	.264	.290	.306
3.60	.192	.197	.209	.241	.264	.277
7.20	.150	.156	.169	.201	.221	.232
14.40	.110	.115	.130	.160	.178	.187
57.00	.070	.076	.090	.118	.133	.140

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.224	.230	.233	.212	.197
.18	.223	.225	.230	.234	.214	.201
.36	.223	.225	.231	.235	.217	.204
.90	.225	.227	.233	.240	.225	.214
1.80	.231	.233	.240	.248	.238	.230
3.60	.251	.253	.259	.270	.263	.257
7.20	.296	.297	.301	.312	.307	.304
14.40	.354	.354	.355	.362	.359	.357
57.00	.446	.441	.433	.432	.428	.428

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α =.0	.6	1.0	2.0	3.0	4.0
.01	.703	.705	.713	.741	.761	.774
.18	.703	.705	.713	.741	.760	.772
.36	.703	.705	.712	.740	.759	.771
.90	.702	.703	.711	.738	.756	.767
1.80	.697	.699	.707	.734	.751	.760
3.60	.682	.686	.696	.724	.739	.748
7.20	.652	.658	.673	.704	.720	.729
14.40	.620	.629	.648	.683	.700	.709
57.00	.585	.597	.621	.661	.679	.687

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α =.0	.6	1.0	2.0	3.0	4.0
.01	.703	.704	.708	.721	.719	.717
.18	.703	.704	.708	.722	.720	.719
.36	.704	.704	.708	.722	.721	.720
.90	.705	.705	.710	.724	.725	.724
1.80	.709	.709	.713	.728	.730	.731
3.60	.724	.722	.724	.739	.741	.742
7.20	.755	.751	.748	.759	.760	.762
14.40	.792	.784	.776	.782	.782	.784
57.00	.839	.827	.811	.810	.809	.811

TEMP1=2000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.310	.314	.325	.337	.344
.18	.309	.310	.313	.325	.336	.343
.36	.309	.310	.313	.324	.335	.341
.90	.308	.309	.312	.322	.332	.338
1.80	.304	.306	.309	.319	.327	.332
3.60	.293	.295	.299	.310	.317	.322
7.20	.268	.272	.280	.292	.300	.304
14.40	.242	.248	.259	.274	.282	.286
57.00	.212	.220	.235	.253	.262	.265

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.309	.307	.299	.294
.18	.309	.309	.310	.308	.300	.295
.36	.309	.309	.310	.308	.301	.297
.90	.311	.310	.311	.310	.304	.300
1.80	.314	.314	.314	.314	.309	.306
3.60	.326	.324	.323	.322	.319	.316
7.20	.350	.347	.343	.340	.336	.334
14.40	.379	.374	.366	.359	.354	.353
57.00	.414	.406	.393	.383	.377	.376

TEMP1=2000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.445	.480	.540	.535	.554
.18	.435	.444	.479	.538	.533	.551
.36	.435	.444	.478	.536	.531	.547
.90	.431	.440	.474	.529	.523	.536
1.80	.420	.429	.464	.516	.509	.517
3.60	.385	.396	.432	.483	.476	.480
7.20	.317	.331	.373	.425	.417	.419
14.40	.253	.270	.316	.369	.361	.362
57.00	.197	.215	.263	.315	.308	.309

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.439	.461	.470	.452	.408
.18	.436	.439	.461	.472	.454	.411
.36	.436	.440	.462	.474	.457	.415
.90	.439	.443	.466	.480	.464	.426
1.80	.449	.452	.475	.493	.477	.444
3.60	.481	.483	.504	.523	.509	.479
7.20	.555	.554	.568	.585	.571	.544
14.40	.654	.646	.650	.662	.648	.623
57.00	.813	.791	.773	.772	.758	.736

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60 i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.229	.246	.276	.277	.296
.18	.222	.229	.246	.275	.276	.293
.36	.222	.228	.245	.274	.274	.290
.90	.220	.226	.242	.269	.269	.283
1.80	.213	.219	.235	.260	.259	.270
3.60	.192	.198	.215	.238	.237	.244
7.20	.150	.157	.176	.198	.197	.202
14.40	.110	.117	.136	.158	.157	.160
57.00	.070	.078	.097	.117	.115	.118

THE RATIO OF $Q_\nu(T_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.225	.233	.229	.221	.194
.18	.223	.225	.234	.230	.222	.197
.36	.223	.225	.234	.231	.224	.199
.90	.225	.227	.237	.236	.229	.207
1.80	.231	.234	.243	.244	.238	.219
3.60	.251	.253	.262	.265	.259	.244
7.20	.296	.297	.304	.307	.302	.288
14.40	.354	.353	.356	.357	.352	.341
57.00	.446	.439	.431	.427	.423	.414

TEMP1=2000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.706	.717	.737	.736	.738
.18	.703	.706	.717	.736	.735	.737
.36	.703	.705	.717	.736	.734	.736
.90	.702	.704	.715	.734	.732	.733
1.80	.697	.700	.712	.730	.728	.727
3.60	.682	.687	.701	.719	.717	.716
7.20	.652	.660	.679	.700	.698	.696
14.40	.620	.631	.656	.680	.678	.676
57.00	.585	.600	.631	.658	.656	.654

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.704	.711	.717	.711	.697
.18	.703	.704	.711	.717	.711	.698
.36	.704	.704	.712	.718	.712	.699
.90	.705	.705	.713	.720	.714	.702
1.80	.709	.709	.717	.724	.719	.708
3.60	.724	.722	.727	.734	.729	.719
7.20	.755	.749	.749	.753	.749	.739
14.40	.792	.782	.775	.776	.771	.762
57.00	.839	.823	.808	.804	.799	.790

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.315	.324	.325	.332
.18	.309	.311	.315	.324	.325	.331
.36	.309	.311	.315	.323	.324	.330
.90	.308	.309	.314	.321	.322	.327
1.80	.304	.306	.310	.318	.318	.322
3.60	.293	.295	.301	.309	.309	.312
7.20	.268	.273	.283	.292	.292	.295
14.40	.242	.249	.263	.274	.274	.276
57.00	.212	.222	.240	.254	.254	.256

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.310	.306	.304	.295
.18	.309	.309	.310	.307	.304	.296
.36	.309	.309	.310	.307	.305	.297
.90	.311	.310	.311	.309	.307	.300
1.80	.314	.314	.314	.313	.311	.305
3.60	.326	.324	.323	.321	.320	.315
7.20	.350	.347	.342	.338	.337	.332
14.40	.379	.372	.364	.357	.356	.352
57.00	.414	.404	.390	.380	.379	.375

TEMP1=1000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.442	.465	.548	.606	.640
.18	.435	.441	.464	.545	.601	.634
.36	.433	.440	.462	.541	.595	.627
.90	.421	.428	.451	.528	.577	.605
1.80	.388	.396	.421	.498	.545	.570
3.60	.325	.335	.365	.444	.489	.512
7.20	.262	.275	.308	.388	.431	.453
14.40	.222	.236	.270	.349	.391	.411
57.00	.186	.201	.236	.313	.353	.371

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.438	.453	.489	.480	.472
.18	.436	.439	.454	.492	.486	.479
.36	.438	.441	.455	.495	.491	.486
.90	.447	.450	.465	.507	.508	.506
1.80	.476	.478	.491	.534	.539	.539
3.60	.542	.542	.550	.590	.596	.598
7.20	.635	.630	.630	.664	.669	.673
14.40	.725	.715	.705	.730	.733	.738
57.00	.857	.838	.811	.818	.818	.824

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.227	.239	.276	.308	.327
.18	.222	.227	.238	.274	.304	.322
.36	.221	.225	.237	.272	.300	.317
.90	.214	.218	.230	.263	.288	.302
1.80	.194	.199	.211	.243	.265	.278
3.60	.155	.161	.174	.206	.227	.237
7.20	.116	.121	.136	.167	.185	.194
14.40	.089	.095	.109	.138	.155	.163
57.00	.062	.068	.082	.109	.124	.130

THE RATIO OF $Q_\nu(T_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.225	.231	.236	.221	.209
.18	.223	.225	.232	.238	.224	.214
.36	.224	.226	.233	.240	.228	.219
.90	.230	.232	.239	.249	.240	.233
1.80	.248	.250	.256	.268	.261	.256
3.60	.288	.289	.294	.305	.301	.297
7.20	.343	.343	.345	.353	.350	.348
14.40	.396	.393	.391	.395	.392	.391
57.00	.472	.465	.454	.451	.446	.446

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.705	.712	.740	.758	.769
.18	.703	.705	.712	.739	.756	.767
.36	.702	.704	.711	.738	.755	.765
.90	.698	.700	.707	.734	.750	.759
1.80	.684	.687	.697	.725	.740	.749
3.60	.656	.662	.676	.707	.723	.731
7.20	.625	.633	.652	.687	.704	.712
14.40	.601	.612	.634	.672	.689	.697
57.00	.577	.590	.616	.656	.674	.682

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.704	.708	.723	.723	.722
.18	.704	.704	.709	.724	.724	.724
.36	.704	.705	.709	.725	.726	.726
.90	.709	.709	.713	.729	.731	.732
1.80	.722	.721	.723	.738	.740	.742
3.60	.750	.746	.744	.756	.758	.760
7.20	.785	.778	.771	.778	.778	.781
14.40	.815	.805	.793	.796	.795	.798
57.00	.850	.837	.819	.817	.815	.817

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.310	.313	.323	.333	.340
.18	.309	.310	.313	.323	.332	.338
.36	.308	.310	.312	.322	.331	.336
.90	.305	.306	.309	.318	.326	.331
1.80	.294	.296	.300	.310	.318	.322
3.60	.272	.275	.283	.295	.303	.306
7.20	.246	.252	.262	.277	.285	.289
14.40	.226	.233	.246	.263	.272	.275
57.00	.205	.214	.229	.248	.258	.261

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.310	.309	.302	.298
.18	.309	.309	.310	.309	.304	.300
.36	.310	.310	.311	.310	.305	.302
.90	.314	.313	.314	.314	.310	.307
1.80	.324	.323	.322	.322	.318	.316
3.60	.346	.344	.340	.337	.333	.331
7.20	.374	.369	.362	.356	.351	.350
14.40	.396	.390	.380	.371	.366	.364
57.00	.422	.414	.400	.388	.382	.381

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.444	.478	.534	.528	.542
.18	.435	.443	.477	.531	.525	.537
.36	.433	.442	.475	.528	.522	.532
.90	.421	.430	.464	.514	.507	.514
1.80	.388	.398	.435	.485	.478	.481
3.60	.325	.338	.380	.432	.424	.426
7.20	.262	.279	.324	.377	.370	.370
14.40	.222	.240	.287	.340	.333	.333
57.00	.186	.205	.253	.305	.298	.299

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.439	.462	.476	.459	.420
.18	.436	.440	.463	.478	.462	.425
.36	.438	.441	.465	.481	.466	.430
.90	.447	.451	.475	.494	.479	.447
1.80	.476	.479	.501	.520	.506	.477
3.60	.542	.541	.558	.575	.561	.534
7.20	.635	.629	.635	.648	.633	.608
14.40	.725	.712	.707	.713	.699	.675
57.00	.857	.831	.806	.801	.788	.766

TEMP1=1000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.228	.245	.272	.273	.287
.18	.222	.228	.244	.270	.271	.284
.36	.221	.227	.243	.268	.268	.280
.90	.214	.220	.236	.259	.258	.268
1.80	.194	.200	.217	.240	.238	.245
3.60	.155	.162	.181	.203	.202	.207
7.20	.116	.123	.142	.164	.163	.167
14.40	.089	.096	.116	.136	.135	.138
57.00	.062	.070	.088	.108	.107	.109

THE RATIO OF $Q_{\nu}(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.225	.234	.233	.225	.203
.18	.223	.226	.235	.234	.227	.206
.36	.224	.227	.236	.237	.230	.210
.90	.230	.233	.243	.245	.239	.221
1.80	.248	.250	.260	.263	.258	.242
3.60	.288	.290	.297	.301	.295	.282
7.20	.343	.343	.346	.348	.343	.331
14.40	.396	.392	.391	.390	.385	.375
57.00	.472	.463	.451	.445	.441	.433

TEMP1=1000.R.   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.705	.717	.735	.734	.735
.18	.703	.705	.716	.734	.733	.733
.36	.702	.705	.716	.733	.731	.732
.90	.698	.700	.712	.729	.727	.727
1.80	.684	.688	.702	.720	.718	.717
3.60	.656	.664	.682	.703	.700	.699
7.20	.625	.636	.660	.683	.681	.679
14.40	.601	.615	.643	.669	.666	.664
57.00	.577	.594	.626	.653	.651	.649

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.704	.712	.718	.713	.700
.18	.704	.704	.712	.719	.714	.702
.36	.704	.705	.713	.720	.715	.703
.90	.709	.709	.716	.724	.719	.708
1.80	.722	.720	.726	.733	.728	.718
3.60	.750	.745	.746	.750	.746	.736
7.20	.785	.776	.771	.772	.767	.758
14.40	.815	.802	.791	.790	.785	.776
57.00	.850	.833	.815	.810	.806	.797

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.315	.323	.324	.329
.18	.309	.310	.314	.322	.323	.327
.36	.308	.310	.314	.321	.322	.326
.90	.305	.306	.311	.318	.318	.321
1.80	.294	.297	.302	.310	.310	.313
3.60	.272	.276	.285	.295	.295	.297
7.20	.246	.253	.266	.277	.277	.279
14.40	.226	.235	.251	.264	.264	.266
57.00	.205	.216	.235	.249	.249	.251

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.310	.308	.306	.298
.18	.309	.309	.311	.309	.306	.299
.36	.310	.310	.311	.309	.307	.301
.90	.314	.313	.314	.313	.311	.305
1.80	.324	.323	.322	.321	.319	.314
3.60	.346	.343	.339	.336	.334	.330
7.20	.374	.368	.360	.354	.353	.348
14.40	.396	.388	.377	.369	.367	.363
57.00	.422	.411	.396	.386	.384	.380

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.442	.464	.543	.596	.627
.18	.435	.441	.463	.541	.593	.623
.36	.433	.440	.462	.539	.589	.618
.90	.423	.430	.452	.528	.576	.603
1.80	.395	.403	.428	.504	.550	.575
3.60	.341	.351	.380	.458	.503	.527
7.20	.281	.293	.325	.405	.449	.471
14.40	.235	.248	.282	.362	.404	.425
57.00	.192	.206	.241	.318	.359	.377

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.439	.454	.494	.490	.486
.18	.436	.439	.454	.495	.494	.490
.36	.437	.440	.456	.498	.497	.494
.90	.445	.448	.463	.507	.509	.508
1.80	.468	.470	.484	.528	.533	.533
3.60	.520	.521	.531	.573	.578	.581
7.20	.601	.598	.601	.637	.643	.647
14.40	.691	.683	.677	.706	.710	.715
57.00	.834	.816	.792	.803	.804	.809

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_\nu$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.227	.238	.273	.301	.317
.18	.222	.226	.238	.272	.299	.314
.36	.221	.226	.237	.270	.296	.311
.90	.215	.219	.231	.263	.287	.301
1.80	.198	.203	.215	.247	.269	.282
3.60	.165	.171	.184	.216	.237	.248
7.20	.127	.133	.148	.179	.198	.208
14.40	.098	.103	.118	.148	.165	.173
57.00	.066	.072	.086	.114	.129	.135

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.225	.232	.240	.228	.219
.18	.223	.225	.232	.241	.230	.221
.36	.224	.226	.233	.242	.232	.225
.90	.229	.231	.238	.249	.241	.234
1.80	.243	.245	.252	.263	.257	.252
3.60	.275	.277	.282	.294	.289	.285
7.20	.323	.323	.326	.336	.333	.330
14.40	.376	.374	.374	.380	.377	.375
57.00	.458	.452	.443	.441	.437	.436

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.705	.712	.738	.755	.765
.18	.703	.705	.712	.738	.754	.764
.36	.703	.704	.711	.737	.753	.763
.90	.699	.700	.708	.734	.749	.759
1.80	.687	.690	.699	.727	.742	.751
3.60	.664	.669	.682	.712	.728	.736
7.20	.635	.642	.660	.693	.710	.718
14.40	.609	.619	.640	.677	.694	.702
57.00	.581	.594	.619	.658	.677	.685

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.704	.709	.724	.725	.726
.18	.704	.704	.709	.725	.726	.727
.36	.704	.705	.709	.725	.727	.728
.90	.708	.708	.712	.728	.731	.732
1.80	.718	.718	.720	.736	.738	.740
3.60	.741	.739	.738	.750	.753	.754
7.20	.773	.767	.762	.770	.771	.773
14.40	.804	.796	.785	.789	.789	.792
57.00	.844	.831	.815	.813	.812	.814

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.309	.310	.313	.322	.331	.337
.18	.309	.310	.313	.322	.330	.335
.36	.309	.310	.312	.321	.329	.334
.90	.305	.307	.310	.319	.326	.331
1.80	.297	.298	.303	.312	.319	.324
3.60	.278	.281	.288	.299	.307	.311
7.20	.254	.259	.269	.283	.291	.295
14.40	.233	.240	.252	.268	.277	.280
57.00	.209	.217	.232	.251	.260	.263
	THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$					
.01	.309	.309	.310	.310	.305	.302
.18	.309	.309	.310	.310	.306	.303
.36	.310	.310	.311	.311	.307	.304
.90	.313	.313	.313	.314	.310	.307
1.80	.321	.321	.320	.320	.316	.314
3.60	.340	.338	.335	.333	.329	.327
7.20	.365	.361	.355	.350	.345	.344
14.40	.388	.383	.373	.366	.361	.359
57.00	.418	.410	.397	.385	.379	.378

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.444	.477	.529	.523	.532
.18	.435	.443	.476	.528	.521	.529
.36	.433	.442	.475	.525	.518	.526
.90	.423	.432	.465	.515	.507	.512
1.80	.395	.405	.441	.491	.483	.486
3.60	.341	.354	.394	.446	.438	.440
7.20	.281	.296	.341	.394	.386	.387
14.40	.235	.252	.299	.352	.345	.345
57.00	.192	.210	.258	.310	.304	.304

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.440	.464	.480	.465	.430
.18	.436	.440	.464	.482	.467	.433
.36	.437	.441	.466	.484	.469	.436
.90	.445	.449	.473	.493	.479	.448
1.80	.468	.471	.494	.514	.500	.471
3.60	.520	.521	.539	.558	.544	.516
7.20	.601	.597	.607	.622	.607	.581
14.40	.691	.681	.680	.689	.675	.651
57.00	.834	.810	.789	.785	.772	.751

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.228	.244	.269	.269	.280
.18	.222	.228	.244	.268	.268	.278
.36	.221	.227	.243	.266	.266	.276
.90	.215	.221	.237	.259	.258	.267
1.80	.198	.204	.221	.243	.242	.249
3.60	.165	.172	.191	.213	.212	.217
7.20	.127	.135	.154	.176	.175	.179
14.40	.098	.105	.124	.146	.144	.148
57.00	.066	.074	.093	.112	.111	.114

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.226	.235	.236	.229	.209
.18	.223	.226	.236	.237	.230	.212
.36	.224	.227	.237	.238	.232	.214
.90	.229	.232	.242	.245	.239	.222
1.80	.243	.246	.255	.259	.253	.238
3.60	.275	.277	.285	.289	.284	.270
7.20	.323	.323	.329	.331	.326	.314
14.40	.376	.374	.375	.375	.370	.359
57.00	.458	.450	.441	.436	.431	.423

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.703	.705	.716	.734	.732	.732
.18	.703	.705	.716	.733	.731	.731
.36	.703	.705	.716	.733	.731	.730
.90	.699	.701	.713	.730	.727	.726
1.80	.687	.691	.704	.722	.720	.718
3.60	.664	.671	.688	.708	.705	.704
7.20	.635	.645	.667	.690	.687	.685
14.40	.609	.622	.649	.674	.671	.669
57.00	.581	.597	.629	.656	.653	.652
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.703	.704	.712	.720	.714	.703
.18	.704	.704	.712	.720	.715	.704
.36	.704	.705	.713	.721	.716	.705
.90	.708	.708	.716	.724	.719	.709
1.80	.718	.717	.723	.731	.726	.716
3.60	.741	.738	.740	.745	.740	.731
7.20	.773	.766	.762	.765	.760	.750
14.40	.804	.793	.784	.783	.779	.769
57.00	.844	.828	.811	.807	.802	.793

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.314	.321	.322	.326
.18	.309	.310	.314	.321	.322	.325
.36	.309	.310	.314	.320	.321	.324
.90	.305	.307	.311	.318	.318	.321
1.80	.297	.299	.304	.311	.312	.314
3.60	.278	.282	.290	.299	.299	.301
7.20	.254	.261	.272	.283	.283	.285
14.40	.233	.241	.256	.268	.268	.270
57.00	.209	.219	.237	.251	.252	.253

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.311	.309	.307	.301
.18	.309	.310	.311	.309	.307	.301
.36	.310	.310	.311	.310	.308	.302
.90	.313	.313	.314	.313	.311	.306
1.80	.321	.320	.320	.319	.317	.312
3.60	.340	.337	.334	.331	.330	.325
7.20	.365	.360	.353	.348	.346	.342
14.40	.388	.381	.371	.364	.362	.358
57.00	.418	.407	.393	.383	.381	.378

TEMP1=3000.R. TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.443	.467	.557	.627	.667
.18	.435	.443	.467	.556	.624	.663
.36	.435	.442	.466	.554	.620	.659
.90	.433	.441	.464	.549	.611	.648
1.80	.428	.435	.459	.540	.597	.630
3.60	.409	.417	.441	.519	.570	.598
7.20	.359	.368	.395	.473	.519	.544
14.40	.285	.297	.329	.408	.452	.475
57.00	.206	.220	.255	.333	.374	.393

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.438	.451	.480	.460	.445
.18	.436	.438	.451	.481	.463	.449
.36	.436	.438	.451	.483	.466	.453
.90	.437	.440	.453	.487	.475	.465
1.80	.442	.444	.458	.496	.489	.482
3.60	.459	.461	.475	.516	.515	.513
7.20	.508	.509	.520	.561	.565	.567
14.40	.601	.597	.600	.636	.642	.645
57.00	.778	.764	.748	.766	.768	.773

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.222	.227	.240	.282	.322	.345
.18	.222	.227	.240	.281	.320	.343
.36	.222	.227	.240	.280	.318	.340
.90	.221	.226	.239	.277	.311	.332
1.80	.218	.223	.235	.271	.302	.319
3.60	.207	.211	.224	.257	.283	.297
7.20	.176	.181	.194	.226	.248	.259
14.40	.130	.136	.150	.181	.200	.210
57.00	.077	.083	.097	.125	.141	.148
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	.223	.224	.230	.230	.207	.190
.18	.223	.224	.230	.231	.209	.193
.36	.223	.225	.230	.232	.211	.196
.90	.224	.226	.231	.235	.217	.204
1.80	.226	.228	.235	.241	.227	.216
3.60	.237	.239	.245	.255	.245	.238
7.20	.267	.269	.275	.285	.280	.275
14.40	.323	.323	.326	.335	.332	.329
57.00	.426	.422	.416	.418	.414	.413

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.705	.713	.742	.764	.777
.18	.703	.705	.713	.742	.763	.775
.36	.703	.705	.713	.742	.762	.774
.90	.703	.704	.712	.740	.759	.771
1.80	.700	.702	.710	.737	.755	.766
3.60	.693	.695	.704	.731	.747	.757
7.20	.671	.675	.687	.716	.732	.741
14.40	.636	.644	.661	.694	.711	.719
57.00	.591	.602	.626	.665	.683	.691

THE RATIO OF $Q_{\nu}(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.703	.708	.720	.717	.714
.18	.703	.704	.708	.720	.718	.716
.36	.703	.704	.708	.721	.719	.717
.90	.704	.704	.709	.722	.721	.720
1.80	.706	.706	.711	.725	.725	.725
3.60	.714	.713	.717	.731	.733	.734
7.20	.735	.733	.733	.746	.748	.750
14.40	.772	.766	.761	.769	.771	.773
57.00	.829	.818	.804	.805	.804	.806

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.314	.326	.339	.347
.18	.309	.310	.314	.325	.338	.346
.36	.309	.310	.314	.325	.337	.345
.90	.309	.310	.313	.324	.335	.342
1.80	.307	.308	.311	.322	.331	.337
3.60	.301	.302	.306	.316	.324	.329
7.20	.283	.286	.292	.303	.311	.315
14.40	.256	.260	.270	.284	.292	.295
57.00	.217	.225	.239	.257	.266	.269

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.309	.306	.297	.291
.18	.309	.309	.309	.307	.298	.292
.36	.309	.309	.310	.307	.299	.294
.90	.310	.310	.310	.308	.301	.296
1.80	.311	.311	.312	.311	.305	.301
3.60	.318	.317	.317	.316	.312	.309
7.20	.335	.333	.331	.329	.325	.323
14.40	.364	.360	.354	.349	.345	.343
57.00	.407	.400	.388	.378	.373	.371

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.435	.445	.481	.543	.540	.562
.18	.435	.445	.480	.542	.538	.559
.36	.435	.445	.480	.540	.536	.556
.90	.433	.443	.478	.535	.531	.547
1.80	.428	.437	.472	.527	.521	.533
3.60	.409	.419	.454	.506	.499	.506
7.20	.359	.371	.410	.461	.453	.456
14.40	.285	.301	.345	.397	.390	.391
57.00	.206	.224	.271	.324	.317	.317

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.436	.438	.460	.466	.448	.400
.18	.436	.439	.460	.468	.450	.403
.36	.436	.439	.461	.469	.451	.406
.90	.437	.440	.463	.474	.457	.415
1.80	.442	.445	.468	.482	.466	.429
3.60	.459	.462	.484	.502	.487	.454
7.20	.508	.509	.528	.546	.532	.504
14.40	.601	.596	.606	.621	.606	.580
57.00	.778	.759	.747	.749	.735	.712

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.229	.247	.279	.280	.301
.18	.222	.229	.246	.278	.279	.299
.36	.222	.229	.246	.277	.278	.297
.90	.221	.228	.245	.273	.274	.290
1.80	.218	.224	.241	.267	.268	.281
3.60	.207	.213	.229	.253	.253	.262
7.20	.176	.182	.200	.223	.222	.228
14.40	.130	.138	.157	.179	.177	.182
57.00	.077	.085	.104	.124	.123	.126

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.225	.233	.226	.218	.189
.18	.223	.225	.233	.227	.219	.191
.36	.223	.225	.233	.228	.220	.193
.90	.224	.226	.235	.231	.224	.199
1.80	.226	.229	.238	.237	.230	.209
3.60	.237	.239	.249	.251	.244	.226
7.20	.267	.269	.278	.281	.275	.261
14.40	.323	.323	.328	.330	.325	.313
57.00	.426	.420	.415	.413	.408	.399

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.703	.706	.718	.738	.737	.740
.18	.703	.706	.717	.738	.736	.740
.36	.703	.706	.717	.737	.736	.739
.90	.703	.705	.716	.736	.734	.736
1.80	.700	.703	.715	.733	.731	.732
3.60	.693	.696	.709	.727	.724	.724
7.20	.671	.677	.693	.712	.710	.708
14.40	.636	.646	.668	.691	.688	.686
57.00	.591	.606	.636	.662	.659	.658
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	.703	.703	.711	.716	.710	.695
.18	.703	.704	.711	.716	.710	.696
.36	.703	.704	.711	.716	.711	.696
.90	.704	.704	.712	.718	.712	.699
1.80	.706	.706	.714	.720	.715	.703
3.60	.714	.713	.720	.727	.722	.711
7.20	.735	.732	.735	.741	.736	.726
14.40	.772	.765	.761	.764	.759	.750
57.00	.829	.815	.801	.798	.794	.785

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.311	.315	.325	.326	.333
.18	.309	.311	.315	.325	.326	.333
.36	.309	.311	.315	.324	.326	.332
.90	.309	.310	.314	.323	.324	.330
1.80	.307	.309	.313	.321	.322	.326
3.60	.301	.303	.308	.315	.316	.319
7.20	.283	.287	.294	.303	.303	.305
14.40	.256	.262	.273	.283	.284	.286
57.00	.217	.227	.244	.257	.257	.259

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.310	.305	.303	.293
.18	.309	.309	.310	.306	.303	.294
.36	.309	.309	.310	.306	.304	.295
.90	.310	.310	.311	.308	.305	.297
1.80	.311	.311	.312	.310	.308	.301
3.60	.318	.317	.317	.315	.313	.308
7.20	.335	.333	.330	.328	.326	.321
14.40	.364	.359	.352	.347	.346	.341
57.00	.407	.398	.385	.376	.375	.371

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.435	.442	.464	.541	.592	.621
.18	.434	.440	.462	.538	.587	.615
.36	.428	.435	.457	.532	.580	.607
.90	.401	.408	.433	.509	.554	.580
1.80	.353	.363	.391	.469	.514	.539
3.60	.296	.308	.339	.419	.464	.486
7.20	.248	.260	.294	.374	.417	.438
14.40	.215	.229	.263	.342	.384	.403
57.00	.184	.198	.234	.310	.350	.368
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.436	.439	.454	.496	.495	.492
.18	.437	.440	.456	.499	.500	.498
.36	.441	.444	.459	.503	.506	.505
.90	.462	.465	.479	.523	.528	.529
1.80	.506	.507	.518	.561	.566	.568
3.60	.575	.573	.579	.618	.623	.627
7.20	.663	.656	.654	.685	.689	.694
14.40	.745	.734	.722	.744	.747	.752
57.00	.868	.848	.819	.825	.825	.830

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.227	.238	.272	.298	.313
.18	.221	.226	.237	.269	.294	.309
.36	.218	.223	.234	.266	.290	.303
.90	.202	.206	.218	.250	.272	.285
1.80	.173	.178	.192	.224	.245	.256
3.60	.137	.143	.158	.189	.209	.219
7.20	.106	.112	.126	.157	.175	.183
14.40	.084	.090	.104	.133	.149	.156
57.00	.060	.066	.080	.107	.121	.127

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.225	.232	.241	.231	.223
.18	.223	.226	.233	.243	.234	.227
.36	.226	.228	.235	.246	.238	.232
.90	.239	.242	.248	.260	.254	.249
1.80	.266	.268	.274	.285	.281	.277
3.60	.308	.309	.313	.323	.320	.317
7.20	.359	.358	.359	.367	.363	.362
14.40	.407	.404	.401	.404	.401	.400
57.00	.478	.471	.459	.455	.450	.450

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.705	.712	.738	.754	.764
.18	.703	.704	.711	.737	.752	.762
.36	.701	.702	.710	.735	.750	.760
.90	.690	.692	.701	.728	.743	.752
1.80	.670	.674	.686	.715	.731	.740
3.60	.643	.650	.666	.698	.715	.723
7.20	.617	.626	.646	.681	.699	.707
14.40	.597	.608	.631	.669	.686	.695
57.00	.575	.588	.614	.655	.673	.681

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.703	.704	.709	.725	.727	.727
.18	.704	.704	.709	.726	.728	.729
.36	.706	.706	.711	.727	.730	.731
.90	.716	.715	.719	.734	.737	.739
1.80	.735	.733	.733	.746	.749	.751
3.60	.764	.759	.755	.764	.766	.768
7.20	.795	.787	.778	.784	.784	.786
14.40	.821	.810	.797	.799	.799	.801
57.00	.853	.839	.821	.818	.817	.819

TEMP1= 500.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.309	.310	.313	.322	.330	.335
.18	.309	.310	.312	.321	.329	.333
.36	.307	.308	.311	.320	.327	.332
.90	.299	.300	.304	.313	.321	.325
1.80	.283	.286	.292	.303	.310	.314
3.60	.261	.266	.274	.288	.295	.299
7.20	.239	.245	.257	.272	.281	.284
14.40	.223	.230	.243	.261	.269	.273
57.00	.204	.212	.228	.247	.257	.260
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	.309	.309	.310	.310	.306	.303
.18	.310	.310	.311	.311	.307	.305
.36	.311	.311	.312	.313	.309	.306
.90	.319	.319	.319	.319	.315	.313
1.80	.335	.333	.331	.329	.326	.324
3.60	.357	.354	.349	.345	.341	.339
7.20	.381	.376	.368	.361	.356	.355
14.40	.401	.394	.383	.374	.369	.367
57.00	.424	.416	.401	.389	.383	.382

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60 i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.435	.444	.476	.527	.520	.528
.18	.434	.442	.474	.524	.517	.523
.36	.428	.437	.470	.519	.511	.516
.90	.401	.411	.446	.495	.488	.491
1.80	.353	.366	.406	.457	.449	.451
3.60	.296	.311	.355	.408	.400	.401
7.20	.248	.264	.310	.364	.356	.357
14.40	.215	.233	.280	.333	.326	.326
57.00	.184	.203	.250	.302	.296	.296
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	.436	.440	.464	.482	.467	.434
.18	.437	.441	.466	.485	.470	.439
.36	.441	.445	.469	.490	.475	.445
.90	.462	.466	.489	.510	.495	.467
1.80	.506	.507	.526	.546	.532	.504
3.60	.575	.573	.586	.602	.588	.561
7.20	.663	.654	.657	.668	.654	.629
14.40	.745	.730	.722	.727	.713	.690
57.00	.868	.841	.814	.808	.795	.774

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.222	.228	.244	.268	.267	.277
.18	.221	.227	.242	.266	.265	.274
.36	.218	.224	.239	.262	.261	.269
.90	.202	.208	.224	.246	.245	.252
1.80	.173	.180	.198	.220	.219	.225
3.60	.137	.145	.164	.186	.185	.190
7.20	.106	.114	.133	.154	.153	.157
14.40	.084	.091	.110	.131	.130	.133
57.00	.060	.068	.086	.106	.105	.107

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.223	.226	.236	.237	.231	.212
.18	.223	.227	.237	.239	.233	.216
.36	.226	.229	.239	.242	.236	.220
.90	.239	.242	.252	.256	.250	.235
1.80	.266	.268	.277	.281	.275	.261
3.60	.308	.309	.316	.319	.313	.300
7.20	.359	.358	.360	.362	.356	.345
14.40	.407	.403	.401	.399	.394	.384
57.00	.478	.468	.456	.449	.445	.437

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.703	.705	.716	.733	.731	.731
.18	.703	.705	.716	.732	.730	.729
.36	.701	.703	.714	.731	.728	.727
.90	.690	.693	.706	.724	.721	.720
1.80	.670	.676	.692	.711	.709	.707
3.60	.643	.652	.673	.695	.692	.691
7.20	.617	.629	.654	.678	.676	.674
14.40	.597	.611	.640	.666	.663	.662
57.00	.575	.592	.625	.652	.650	.648
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.703	.704	.712	.720	.715	.704
.18	.704	.705	.713	.721	.716	.706
.36	.706	.706	.714	.723	.718	.708
.90	.716	.715	.722	.729	.725	.715
1.80	.735	.732	.735	.741	.737	.727
3.60	.764	.757	.756	.759	.754	.745
7.20	.795	.785	.777	.778	.773	.764
14.40	.821	.807	.795	.793	.789	.779
57.00	.853	.835	.817	.812	.807	.798

TEMP1= 500.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 0.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.310	.314	.321	.322	.325
.18	.309	.310	.314	.320	.321	.324
.36	.307	.309	.312	.319	.319	.322
.90	.299	.301	.306	.313	.313	.316
1.80	.283	.287	.294	.302	.302	.305
3.60	.261	.267	.277	.287	.288	.290
7.20	.239	.247	.261	.272	.273	.275
14.40	.223	.232	.248	.261	.261	.263
57.00	.204	.215	.234	.248	.248	.250

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.309	.309	.311	.310	.308	.302
.18	.310	.310	.311	.310	.308	.303
.36	.311	.311	.313	.312	.310	.305
.90	.319	.319	.319	.318	.316	.311
1.80	.335	.333	.331	.328	.326	.322
3.60	.357	.353	.348	.343	.342	.337
7.20	.381	.375	.366	.359	.358	.353
14.40	.401	.392	.380	.372	.370	.366
57.00	.424	.413	.397	.387	.386	.382

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.656	.656	.666	.756	.843	.898
.18	.656	.656	.665	.752	.835	.888
.36	.656	.655	.664	.749	.828	.879
.90	.654	.653	.661	.740	.810	.855
1.80	.648	.646	.654	.727	.787	.826
3.60	.628	.627	.637	.706	.758	.791
7.20	.591	.593	.607	.679	.729	.760
14.40	.577	.581	.599	.678	.730	.762
			THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$			
.01	.215	.225	.252	.281	.244	.214
.18	.215	.225	.253	.284	.251	.224
.36	.215	.225	.253	.288	.258	.234
.90	.215	.226	.255	.296	.276	.256
1.80	.214	.226	.257	.305	.295	.282
3.60	.212	.225	.258	.314	.313	.306
7.20	.196	.210	.247	.310	.316	.312
14.40	.114	.135	.182	.257	.266	.263

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.360	.369	.417	.472	.507
.18	.357	.360	.369	.414	.466	.500
.36	.357	.360	.368	.412	.461	.493
.90	.356	.358	.366	.406	.449	.477
1.80	.353	.355	.362	.398	.434	.457
3.60	.342	.344	.352	.385	.415	.434
7.20	.322	.325	.335	.369	.397	.414
14.40	.318	.322	.335	.373	.403	.421

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.091	.101	.096	.057	.029
.18	.088	.092	.101	.098	.062	.036
.36	.088	.092	.102	.100	.067	.043
.90	.088	.092	.103	.106	.079	.059
1.80	.088	.093	.105	.112	.092	.077
3.60	.088	.093	.107	.119	.106	.095
7.20	.080	.087	.102	.120	.111	.102
14.40	.035	.044	.065	.089	.082	.073

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.792	.786	.807	.829	.845
.18	.798	.792	.786	.806	.827	.843
.36	.798	.792	.785	.805	.825	.840
.90	.798	.791	.784	.802	.820	.833
1.80	.796	.790	.783	.799	.814	.826
3.60	.792	.785	.779	.794	.807	.817
7.20	.784	.778	.773	.788	.800	.810
14.40	.791	.785	.779	.793	.805	.815

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.617	.635	.656	.652	.646
.18	.608	.617	.635	.657	.654	.649
.36	.608	.617	.635	.658	.656	.651
.90	.608	.617	.636	.660	.661	.658
1.80	.609	.618	.637	.663	.666	.665
3.60	.611	.620	.639	.667	.672	.673
7.20	.612	.621	.640	.669	.675	.677
14.40	.593	.604	.626	.658	.665	.667

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.381	.375	.381	.396	.407
.18	.385	.381	.375	.381	.394	.405
.36	.385	.381	.375	.380	.393	.403
.90	.385	.380	.374	.378	.388	.397
1.80	.383	.379	.372	.375	.383	.390
3.60	.380	.376	.369	.371	.377	.382
7.20	.376	.372	.366	.367	.372	.377
14.40	.383	.379	.372	.372	.378	.383

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.239	.248	.251	.240	.231
.18	.234	.239	.248	.252	.242	.233
.36	.234	.239	.248	.252	.243	.235
.90	.234	.239	.249	.255	.248	.241
1.80	.235	.240	.250	.257	.253	.248
3.60	.237	.242	.252	.261	.258	.255
7.20	.238	.244	.254	.263	.262	.259
14.40	.225	.232	.244	.255	.254	.251

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

	α = .0	.6	1.0	2.0	3.0	4.0
$\nu \times 10^{17}$ hr^{-1}	THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$					
.01	.656	.656	.675	.738	.737	.776
.18	.656	.655	.674	.735	.733	.768
.36	.656	.655	.673	.732	.729	.761
.90	.654	.652	.669	.722	.719	.744
1.80	.648	.646	.662	.710	.704	.721
3.60	.628	.627	.645	.689	.682	.691
7.20	.591	.594	.617	.662	.654	.660
14.40	.577	.582	.611	.660	.651	.656
	THE RATIO OF $Q_{\nu}(\tau_0)/Q_{\nu,bb}$					
.01	.215	.228	.266	.271	.250	.187
.18	.215	.228	.267	.274	.254	.194
.36	.215	.228	.267	.278	.258	.201
.90	.215	.229	.270	.286	.268	.217
1.80	.214	.230	.272	.295	.278	.235
3.60	.212	.229	.274	.303	.288	.252
7.20	.196	.215	.265	.300	.285	.252
14.40	.114	.141	.204	.247	.231	.197

TEMP1=2000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.361	.374	.411	.415	.449
.18	.357	.361	.373	.409	.412	.444
.36	.357	.360	.373	.407	.410	.439
.90	.356	.359	.370	.401	.403	.427
1.80	.353	.355	.366	.392	.393	.412
3.60	.342	.345	.356	.379	.379	.392
7.20	.322	.326	.340	.364	.363	.373
14.40	.318	.324	.341	.367	.366	.376

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.093	.105	.094	.083	.041
.18	.088	.093	.106	.096	.086	.046
.36	.088	.093	.107	.098	.088	.051
.90	.088	.094	.108	.104	.095	.062
1.80	.088	.094	.110	.110	.102	.075
3.60	.088	.095	.113	.117	.110	.088
7.20	.080	.089	.109	.117	.111	.091
14.40	.035	.047	.074	.086	.079	.058

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.790	.786	.801	.800	.808
.18	.798	.790	.786	.800	.799	.806
.36	.798	.790	.786	.799	.798	.804
.90	.798	.789	.785	.796	.795	.799
1.80	.796	.788	.783	.793	.791	.793
3.60	.792	.783	.779	.788	.786	.785
7.20	.784	.777	.774	.782	.780	.779
14.40	.791	.783	.779	.787	.785	.783

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.619	.642	.653	.646	.627
.18	.608	.619	.643	.654	.647	.629
.36	.608	.619	.643	.655	.648	.631
.90	.608	.620	.644	.657	.651	.636
1.80	.609	.621	.645	.660	.655	.642
3.60	.611	.623	.647	.664	.659	.648
7.20	.612	.624	.648	.666	.661	.651
14.40	.593	.607	.635	.655	.650	.640

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.380	.373	.380	.382	.392
.18	.385	.380	.373	.379	.381	.391
.36	.385	.380	.373	.378	.380	.389
.90	.385	.379	.372	.376	.377	.385
1.80	.383	.378	.371	.373	.374	.380
3.60	.380	.375	.368	.369	.369	.373
7.20	.376	.370	.364	.365	.365	.368
14.40	.383	.378	.370	.370	.371	.374

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.240	.251	.251	.247	.234
.18	.234	.240	.252	.252	.248	.236
.36	.234	.240	.252	.253	.249	.238
.90	.234	.241	.253	.255	.252	.242
1.80	.235	.242	.254	.257	.255	.247
3.60	.237	.244	.256	.261	.259	.253
7.20	.238	.245	.258	.263	.261	.256
14.40	.225	.234	.248	.255	.253	.248

TEMP1=2000.R,   TEMP2=6000.R
TEMR. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.656	.655	.662	.738	.805	.848
.18	.656	.655	.662	.736	.801	.843
.36	.656	.654	.661	.734	.797	.838
.90	.654	.652	.659	.729	.787	.825
1.80	.647	.645	.652	.720	.773	.808
3.60	.626	.625	.634	.702	.751	.783
7.20	.588	.590	.604	.676	.725	.756
14.40	.568	.572	.590	.669	.720	.751
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	.215	.226	.256	.299	.282	.265
.18	.215	.226	.256	.300	.286	.270
.36	.215	.226	.256	.302	.289	.275
.90	.215	.226	.257	.306	.298	.287
1.80	.215	.227	.259	.312	.309	.301
3.60	.214	.227	.260	.318	.320	.315
7.20	.204	.218	.254	.316	.322	.319
14.40	.142	.161	.206	.278	.286	.283

TEMP1=2000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.360	.367	.405	.445	.471
.18	.357	.359	.366	.404	.443	.468
.36	.357	.359	.366	.402	.440	.465
.90	.356	.358	.364	.399	.433	.456
1.80	.352	.354	.361	.393	.424	.444
3.60	.340	.343	.350	.382	.410	.428
7.20	.320	.323	.333	.367	.394	.411
14.40	.311	.316	.328	.366	.395	.412

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.092	.103	.108	.083	.064
.18	.088	.092	.104	.109	.086	.068
.36	.088	.092	.104	.110	.088	.071
.90	.088	.093	.105	.113	.094	.080
1.80	.088	.093	.106	.117	.102	.090
3.60	.089	.095	.108	.122	.111	.101
7.20	.085	.091	.106	.124	.115	.106
14.40	.052	.060	.079	.102	.094	.086

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.792	.785	.801	.818	.831
.18	.798	.792	.785	.801	.817	.830
.36	.798	.791	.784	.800	.816	.828
.90	.798	.791	.784	.799	.814	.825
1.80	.796	.789	.782	.797	.810	.820
3.60	.791	.784	.778	.792	.805	.814
7.20	.782	.777	.772	.787	.799	.809
14.40	.785	.779	.774	.789	.801	.811

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.617	.636	.661	.662	.660
.18	.608	.617	.636	.662	.663	.661
.36	.608	.617	.636	.662	.664	.663
.90	.609	.618	.637	.663	.667	.666
1.80	.609	.618	.638	.665	.670	.670
3.60	.612	.621	.640	.668	.674	.675
7.20	.614	.623	.642	.671	.677	.679
14.40	.601	.612	.633	.663	.670	.672

TEMP1=2000.R. TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.381	.374	.377	.387	.395
.18	.385	.381	.374	.377	.386	.394
.36	.385	.381	.374	.376	.385	.392
.90	.385	.380	.373	.375	.383	.389
1.80	.383	.379	.372	.373	.380	.385
3.60	.380	.375	.369	.370	.375	.380
7.20	.374	.370	.364	.366	.371	.376
14.40	.378	.374	.368	.369	.374	.379

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.239	.249	.255	.249	.243
.18	.234	.239	.249	.256	.250	.244
.36	.234	.239	.249	.256	.251	.246
.90	.234	.239	.250	.257	.253	.249
1.80	.235	.240	.251	.259	.256	.252
3.60	.237	.243	.253	.262	.260	.257
7.20	.240	.246	.256	.265	.263	.261
14.40	.232	.238	.249	.259	.258	.256

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.656	.654	.670	.721	.717	.739
.18	.656	.654	.670	.719	.714	.735
.36	.656	.654	.669	.717	.712	.732
.90	.654	.651	.666	.712	.706	.722
1.80	.647	.645	.660	.703	.696	.708
3.60	.626	.625	.643	.685	.677	.685
7.20	.588	.591	.614	.659	.651	.656
14.40	.568	.573	.602	.651	.642	.647

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.215	.229	.270	.289	.271	.223
.18	.215	.229	.271	.290	.273	.227
.36	.215	.230	.271	.292	.275	.230
.90	.215	.230	.273	.296	.280	.239
1.80	.215	.231	.274	.302	.286	.249
3.60	.214	.231	.277	.307	.293	.259
7.20	.204	.222	.271	.306	.291	.258
14.40	.142	.167	.226	.267	.251	.218

TEMP1=2000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.360	.371	.399	.401	.423
.18	.357	.360	.370	.398	.400	.421
.36	.357	.360	.370	.397	.398	.418
.90	.356	.358	.368	.393	.394	.411
1.80	.352	.354	.364	.388	.388	.402
3.60	.340	.343	.354	.377	.376	.387
7.20	.320	.324	.338	.362	.360	.370
14.40	.311	.317	.334	.360	.359	.368

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.094	.109	.105	.097	.067
.18	.088	.094	.109	.107	.098	.069
.36	.088	.094	.109	.108	.100	.071
.90	.088	.094	.110	.111	.103	.078
1.80	.088	.095	.112	.115	.108	.085
3.60	.089	.096	.114	.120	.113	.093
7.20	.085	.093	.113	.121	.115	.095
14.40	.052	.063	.088	.099	.092	.072

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.790	.785	.796	.794	.797
.18	.798	.790	.784	.795	.794	.796
.36	.798	.789	.784	.794	.793	.795
.90	.798	.789	.784	.793	.791	.793
1.80	.796	.787	.782	.791	.789	.789
3.60	.791	.783	.778	.786	.784	.783
7.20	.782	.775	.772	.781	.779	.778
14.40	.785	.777	.774	.783	.781	.779

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.620	.644	.658	.652	.638
.18	.608	.620	.644	.659	.653	.639
.36	.608	.620	.644	.659	.653	.640
.90	.609	.620	.645	.660	.655	.642
1.80	.609	.621	.646	.662	.657	.646
3.60	.612	.624	.648	.665	.660	.650
7.20	.614	.626	.650	.667	.663	.652
14.40	.601	.615	.641	.660	.655	.645

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.379	.372	.375	.377	.383
.18	.385	.379	.372	.375	.376	.382
.36	.385	.379	.372	.374	.375	.382
.90	.385	.379	.371	.373	.374	.379
1.80	.383	.378	.370	.371	.372	.376
3.60	.380	.374	.367	.368	.368	.372
7.20	.374	.369	.363	.364	.364	.367
14.40	.378	.373	.366	.367	.367	.370

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.241	.253	.255	.253	.243
.18	.234	.241	.253	.256	.253	.244
.36	.234	.241	.253	.256	.254	.245
.90	.234	.241	.253	.257	.255	.247
1.80	.235	.242	.255	.259	.257	.250
3.60	.237	.244	.257	.262	.260	.254
7.20	.240	.247	.259	.265	.263	.257
14.40	.232	.240	.253	.260	.258	.252

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.656	.654	.661	.732	.792	.831
.18	.656	.654	.660	.730	.787	.824
.36	.655	.653	.659	.727	.782	.818
.90	.648	.646	.652	.718	.769	.802
1.80	.627	.627	.636	.702	.751	.782
3.60	.592	.593	.607	.678	.727	.757
7.20	.566	.569	.587	.664	.715	.746
14.40	.600	.605	.624	.708	.763	.797

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.215	.226	.257	.304	.295	.282
.18	.215	.226	.257	.307	.299	.288
.36	.215	.227	.258	.309	.304	.294
.90	.215	.227	.259	.314	.313	.306
1.80	.216	.228	.261	.319	.322	.317
3.60	.210	.223	.259	.320	.325	.322
7.20	.168	.185	.227	.296	.303	.300
14.40	.001	.028	.089	.177	.188	.184

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.359	.366	.401	.437	.460
.18	.357	.359	.365	.399	.433	.455
.36	.357	.358	.365	.397	.430	.451
.90	.352	.354	.361	.392	.421	.440
1.80	.341	.343	.351	.382	.409	.427
3.60	.321	.325	.334	.368	.395	.412
7.20	.309	.313	.325	.362	.390	.407
14.40	.336	.342	.356	.398	.430	.450

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.092	.104	.112	.092	.076
.18	.088	.093	.105	.113	.095	.081
.36	.088	.093	.105	.115	.098	.085
.90	.088	.094	.106	.118	.105	.094
1.80	.090	.095	.109	.123	.112	.102
3.60	.088	.094	.109	.126	.117	.108
7.20	.066	.074	.092	.113	.105	.096
14.40	-.028	-.016	.009	.039	.032	.022

TEMP1=1000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.791	.784	.800	.815	.826
.18	.798	.791	.784	.799	.813	.825
.36	.798	.791	.784	.798	.812	.823
.90	.796	.789	.782	.796	.809	.819
1.80	.791	.785	.778	.792	.804	.814
3.60	.783	.777	.772	.787	.799	.808
7.20	.781	.775	.771	.786	.799	.808
14.40	.813	.805	.796	.808	.819	.829

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.617	.636	.663	.666	.665
.18	.608	.617	.637	.663	.667	.666
.36	.608	.617	.637	.664	.668	.668
.90	.609	.619	.638	.666	.671	.672
1.80	.612	.621	.640	.669	.675	.676
3.60	.615	.624	.643	.671	.678	.679
7.20	.609	.618	.638	.668	.674	.676
14.40	.559	.573	.601	.638	.646	.648

TEMP1=1000.R,   TEMP2=4000.R
TEMR. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.381	.374	.376	.384	.391
.18	.385	.380	.373	.375	.383	.389
.36	.385	.380	.373	.374	.381	.388
.90	.383	.379	.372	.373	.378	.384
1.80	.380	.376	.369	.369	.375	.380
3.60	.374	.370	.364	.365	.371	.376
7.20	.374	.370	.365	.366	.371	.376
14.40	.403	.397	.388	.386	.391	.396

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.239	.249	.257	.252	.247
.18	.234	.239	.250	.257	.253	.249
.36	.234	.239	.250	.258	.255	.250
.90	.235	.240	.251	.260	.257	.254
1.80	.237	.243	.253	.262	.260	.258
3.60	.241	.246	.256	.265	.264	.261
7.20	.237	.243	.253	.263	.262	.259
14.40	.200	.209	.225	.238	.238	.235

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.656	.654	.668	.715	.710	.727
.18	.656	.653	.668	.713	.707	.722
.36	.655	.652	.666	.710	.704	.717
.90	.648	.645	.660	.701	.694	.704
1.80	.627	.626	.644	.685	.677	.684
3.60	.592	.594	.616	.661	.653	.658
7.20	.566	.570	.599	.647	.638	.642
14.40	.600	.606	.637	.689	.679	.683

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.215	.230	.272	.294	.278	.236
.18	.215	.230	.273	.297	.281	.240
.36	.215	.230	.273	.299	.283	.244
.90	.215	.231	.275	.304	.289	.253
1.80	.216	.232	.278	.309	.294	.261
3.60	.210	.228	.276	.309	.295	.262
7.20	.168	.190	.246	.285	.269	.236
14.40	.001	.037	.115	.167	.150	.114

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$					
.01	.357	.360	.370	.395	.396	.415
.18	.357	.359	.369	.394	.394	.411
.36	.357	.359	.368	.392	.392	.408
.90	.352	.355	.364	.386	.386	.399
1.80	.341	.344	.355	.377	.376	.387
3.60	.321	.326	.339	.362	.361	.371
7.20	.309	.314	.331	.356	.354	.364
14.40	.336	.343	.363	.391	.389	.400
	THE RATIO OF $Q_{\nu}(\tau_0)/Q_{\nu,bb}$					
.01	.088	.094	.110	.109	.102	.075
.18	.088	.094	.110	.111	.104	.078
.36	.088	.094	.111	.112	.105	.081
.90	.088	.095	.112	.116	.109	.088
1.80	.090	.097	.115	.120	.114	.094
3.60	.088	.096	.116	.123	.117	.097
7.20	.066	.076	.100	.110	.103	.083
14.40	-.028	-.013	.020	.036	.028	.006

TEMP1=1000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.789	.784	.794	.792	.794
.18	.798	.789	.784	.793	.791	.793
.36	.798	.789	.784	.792	.790	.791
.90	.796	.787	.782	.790	.788	.788
1.80	.791	.783	.778	.786	.784	.783
3.60	.783	.775	.772	.781	.779	.778
7.20	.781	.774	.771	.781	.778	.777
14.40	.813	.803	.795	.802	.799	.798

THE RATIO OF $Q_{\nu}(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.620	.644	.660	.654	.641
.18	.608	.620	.645	.660	.655	.643
.36	.608	.620	.645	.661	.656	.644
.90	.609	.621	.646	.663	.658	.647
1.80	.612	.624	.648	.665	.661	.650
3.60	.615	.627	.651	.668	.663	.653
7.20	.609	.621	.646	.664	.660	.649
14.40	.559	.577	.612	.635	.630	.619

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.379	.372	.374	.375	.380
.18	.385	.379	.372	.373	.374	.379
.36	.385	.379	.371	.372	.373	.378
.90	.383	.378	.370	.371	.371	.375
1.80	.380	.374	.367	.368	.368	.371
3.60	.374	.369	.363	.364	.364	.367
7.20	.374	.369	.363	.364	.364	.367
14.40	.403	.395	.385	.384	.385	.388

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.241	.253	.257	.254	.246
.18	.234	.241	.253	.257	.255	.248
.36	.234	.241	.254	.258	.256	.249
.90	.235	.242	.255	.260	.258	.251
1.80	.237	.244	.257	.262	.260	.255
3.60	.241	.248	.260	.265	.263	.258
7.20	.237	.244	.257	.263	.261	.255
14.40	.200	.211	.230	.239	.237	.231

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.657	.654	.660	.727	.782	.818
.18	.656	.654	.659	.726	.779	.814
.36	.655	.653	.658	.724	.776	.810
.90	.649	.647	.653	.718	.767	.799
1.80	.631	.630	.639	.704	.752	.783
3.60	.599	.600	.613	.683	.731	.761
7.20	.570	.573	.589	.664	.714	.744
14.40	.568	.573	.592	.673	.726	.758

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.214	.226	.258	.309	.305	.295
.18	.215	.227	.258	.310	.307	.299
.36	.215	.227	.259	.312	.310	.303
.90	.215	.228	.260	.315	.316	.311
1.80	.216	.229	.262	.319	.323	.319
3.60	.215	.228	.263	.323	.328	.324
7.20	.195	.210	.248	.313	.320	.317
14.40	.103	.124	.174	.251	.261	.257

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.359	.365	.398	.430	.450
.18	.357	.359	.365	.397	.428	.447
.36	.357	.358	.364	.395	.425	.445
.90	.353	.355	.361	.391	.419	.437
1.80	.343	.345	.353	.383	.410	.427
3.60	.325	.328	.337	.370	.397	.414
7.20	.310	.314	.325	.360	.388	.405
14.40	.313	.318	.332	.371	.401	.419

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.093	.105	.115	.099	.085
.18	.088	.093	.105	.116	.101	.088
.36	.088	.093	.105	.117	.103	.091
.90	.088	.094	.107	.119	.107	.097
1.80	.090	.095	.109	.123	.113	.103
3.60	.091	.097	.111	.127	.118	.109
7.20	.081	.088	.104	.123	.115	.106
14.40	.029	.039	.061	.086	.079	.070

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.791	.784	.798	.812	.823
.18	.798	.791	.784	.798	.811	.822
.36	.798	.791	.784	.797	.810	.821
.90	.797	.790	.782	.796	.808	.818
1.80	.792	.786	.779	.793	.805	.814
3.60	.784	.778	.773	.788	.800	.809
7.20	.779	.773	.769	.785	.797	.806
14.40	.790	.784	.778	.793	.805	.814

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.617	.637	.664	.669	.668
.18	.608	.617	.637	.665	.669	.670
.36	.608	.618	.637	.665	.670	.671
.90	.609	.618	.638	.666	.672	.673
1.80	.612	.621	.640	.668	.675	.676
3.60	.616	.624	.643	.671	.678	.679
7.20	.615	.624	.643	.671	.678	.679
14.40	.591	.602	.625	.657	.665	.666

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.380	.373	.374	.381	.387
.18	.385	.380	.373	.374	.381	.386
.36	.385	.380	.373	.374	.380	.385
.90	.384	.379	.372	.372	.378	.383
1.80	.380	.376	.369	.370	.375	.380
3.60	.375	.371	.365	.366	.371	.376
7.20	.371	.368	.363	.364	.369	.374
14.40	.383	.378	.372	.372	.377	.382

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.239	.250	.258	.255	.251
.18	.234	.239	.250	.258	.255	.252
.36	.234	.239	.250	.259	.256	.253
.90	.235	.240	.251	.260	.258	.255
1.80	.237	.242	.253	.262	.260	.258
3.60	.241	.246	.256	.265	.263	.261
7.20	.241	.246	.257	.265	.264	.261
14.40	.224	.231	.244	.255	.254	.251

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.657	.653	.667	.710	.704	.717
.18	.656	.653	.667	.709	.702	.714
.36	.655	.652	.666	.707	.700	.711
.90	.649	.646	.660	.701	.693	.702
1.80	.631	.630	.647	.687	.680	.686
3.60	.599	.601	.622	.666	.657	.663
7.20	.570	.574	.600	.647	.638	.643
14.40	.568	.574	.605	.655	.646	.650

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.214	.230	.273	.299	.284	.245
.18	.215	.230	.274	.300	.285	.248
.36	.215	.231	.274	.302	.287	.251
.90	.215	.231	.276	.305	.290	.256
1.80	.216	.233	.278	.309	.295	.262
3.60	.215	.232	.279	.312	.297	.265
7.20	.195	.215	.266	.302	.287	.254
14.40	.103	.131	.196	.240	.224	.190

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.359	.369	.392	.393	.408
.18	.357	.359	.369	.391	.391	.406
.36	.357	.359	.368	.390	.390	.404
.90	.353	.355	.365	.386	.385	.398
1.80	.343	.346	.357	.378	.377	.388
3.60	.325	.329	.342	.365	.364	.374
7.20	.310	.315	.330	.355	.353	.363
14.40	.313	.320	.338	.365	.363	.373

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.094	.111	.113	.105	.082
.18	.088	.094	.111	.113	.107	.084
.36	.088	.095	.111	.114	.108	.086
.90	.088	.095	.112	.117	.111	.090
1.80	.090	.097	.115	.121	.114	.095
3.60	.091	.098	.117	.124	.118	.099
7.20	.081	.090	.111	.120	.113	.094
14.40	.029	.042	.070	.083	.075	.055

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.799	.789	.784	.792	.791	.791
.18	.798	.789	.784	.792	.790	.790
.36	.798	.789	.783	.792	.789	.789
.90	.797	.787	.782	.790	.788	.787
1.80	.792	.784	.779	.787	.785	.784
3.60	.784	.777	.773	.782	.780	.778
7.20	.779	.772	.770	.779	.777	.775
14.40	.790	.782	.778	.787	.784	.783
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.608	.620	.645	.661	.656	.644
.18	.608	.620	.645	.661	.656	.645
.36	.608	.620	.645	.662	.657	.646
.90	.609	.621	.646	.663	.658	.648
1.80	.612	.623	.648	.665	.660	.650
3.60	.616	.627	.651	.668	.663	.653
7.20	.615	.626	.651	.668	.663	.653
14.40	.591	.606	.634	.654	.649	.639

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.379	.371	.372	.373	.378
.18	.385	.379	.371	.372	.373	.377
.36	.385	.379	.371	.372	.372	.376
.90	.384	.378	.370	.370	.371	.374
1.80	.380	.375	.368	.368	.368	.372
3.60	.375	.370	.364	.364	.365	.368
7.20	.371	.367	.361	.362	.363	.366
14.40	.383	.377	.370	.370	.371	.374

THE RATIO OF $Q_{\nu}(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.241	.253	.258	.256	.249
.18	.234	.241	.254	.258	.256	.250
.36	.234	.241	.254	.259	.257	.250
.90	.235	.242	.255	.260	.258	.252
1.80	.237	.244	.257	.262	.260	.255
3.60	.241	.248	.260	.265	.263	.258
7.20	.241	.248	.260	.265	.264	.258
14.40	.224	.233	.248	.255	.253	.247

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.656	.655	.663	.742	.812	.858
.18	.656	.655	.663	.740	.809	.854
.36	.656	.655	.662	.739	.806	.850
.90	.655	.654	.661	.734	.798	.839
1.80	.652	.650	.657	.728	.786	.824
3.60	.641	.639	.647	.715	.767	.801
7.20	.611	.612	.623	.692	.741	.772
14.40	.575	.578	.594	.669	.719	.750

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.215	.226	.255	.295	.274	.255
.18	.215	.226	.255	.296	.277	.259
.36	.215	.226	.255	.298	.280	.263
.90	.215	.226	.256	.302	.288	.273
1.80	.215	.226	.257	.307	.298	.287
3.60	.215	.227	.259	.313	.312	.304
7.20	.211	.225	.259	.318	.322	.318
14.40	.184	.199	.239	.305	.311	.308

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.360	.367	.407	.451	.479
.18	.357	.360	.367	.406	.449	.476
.36	.357	.359	.367	.405	.446	.473
.90	.357	.359	.366	.402	.441	.465
1.80	.355	.357	.364	.398	.433	.455
3.60	.349	.351	.358	.390	.420	.439
7.20	.332	.335	.343	.376	.403	.421
14.40	.313	.317	.328	.364	.392	.409

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.092	.103	.105	.078	.057
.18	.088	.092	.103	.106	.080	.060
.36	.088	.092	.103	.107	.082	.063
.90	.088	.092	.104	.110	.087	.070
1.80	.088	.093	.105	.113	.095	.080
3.60	.088	.094	.107	.118	.105	.093
7.20	.088	.094	.108	.123	.113	.104
14.40	.074	.081	.098	.118	.109	.101

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.798	.792	.785	.802	.821	.834
.18	.799	.792	.785	.802	.820	.833
.36	.798	.792	.785	.802	.819	.832
.90	.798	.791	.784	.800	.817	.829
1.80	.797	.790	.783	.799	.813	.825
3.60	.795	.788	.781	.795	.808	.819
7.20	.787	.781	.775	.790	.802	.812
14.40	.781	.776	.771	.787	.799	.808

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.617	.636	.660	.660	.657
.18	.608	.617	.636	.660	.661	.658
.36	.608	.617	.636	.661	.662	.659
.90	.608	.617	.636	.662	.664	.662
1.80	.609	.618	.637	.664	.667	.666
3.60	.610	.619	.638	.666	.671	.672
7.20	.613	.622	.641	.669	.676	.677
14.40	.611	.620	.640	.669	.676	.677

TEMP1=3000.R,   TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.381	.374	.378	.389	.397
.18	.385	.381	.374	.378	.388	.396
.36	.385	.381	.374	.377	.387	.395
.90	.385	.380	.374	.376	.385	.393
1.80	.384	.380	.373	.375	.382	.389
3.60	.382	.378	.371	.372	.378	.384
7.20	.377	.373	.367	.368	.373	.378
14.40	.374	.370	.364	.366	.371	.376

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.239	.249	.254	.247	.241
.18	.234	.239	.249	.255	.248	.242
.36	.234	.239	.249	.255	.249	.243
.90	.234	.239	.249	.256	.251	.245
1.80	.234	.240	.250	.257	.253	.249
3.60	.235	.241	.251	.260	.257	.254
7.20	.239	.244	.254	.263	.262	.259
14.40	.238	.244	.254	.264	.262	.260

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.656	.654	.671	.724	.721	.746
.18	.656	.654	.671	.723	.719	.743
.36	.656	.654	.670	.722	.717	.741
.90	.655	.653	.668	.717	.712	.732
1.80	.652	.650	.665	.711	.705	.720
3.60	.641	.639	.655	.698	.691	.701
7.20	.611	.612	.631	.675	.667	.673
14.40	.575	.579	.605	.652	.643	.648

THE RATIO OF $Q_{\nu}(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.215	.229	.269	.285	.267	.216
.18	.215	.229	.270	.286	.268	.219
.36	.215	.229	.270	.288	.270	.222
.90	.215	.230	.271	.291	.275	.229
1.80	.215	.230	.273	.296	.280	.239
3.60	.215	.231	.275	.303	.288	.252
7.20	.211	.229	.275	.308	.293	.260
14.40	.184	.204	.257	.294	.279	.246

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.360	.371	.402	.404	.428
.18	.357	.360	.371	.401	.403	.426
.36	.357	.360	.371	.400	.402	.424
.90	.357	.359	.370	.397	.398	.419
1.80	.355	.357	.368	.393	.393	.411
3.60	.349	.351	.361	.384	.384	.398
7.20	.332	.336	.348	.370	.370	.380
14.40	.313	.319	.334	.358	.357	.367

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.093	.108	.103	.094	.061
.18	.088	.094	108.746	.104	.095	.063
.36	.088	.094	.109	.105	.096	.065
.90	.088	.094	.109	.107	.099	.071
1.80	.088	.094	.110	.111	.104	.078
3.60	.088	.095	.112	.116	.109	.087
7.20	.088	.096	.114	.121	.114	.095
14.40	.074	.084	.106	.115	.108	.088

TEMP1=3000.R, TEMP2=8000.R
TEMR. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.798	.790	.785	.797	.795	.799
.18	.799	.790	.785	.796	.795	.799
.36	.798	.790	.785	.796	.795	.798
.90	.798	.789	.784	.795	.793	.795
1.80	.797	.788	.783	.793	.791	.792
3.60	.795	.786	.781	.789	.787	.787
7.20	.787	.779	.776	.784	.782	.781
14.40	.781	.774	.772	.781	.778	.777
	THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$					
.01	.608	.620	.644	.657	.651	.636
.18	.608	.620	.644	.657	.651	.637
.36	.608	.620	.644	.658	.652	.637
.90	.608	.620	.644	.659	.653	.640
1.80	.609	.620	.645	.661	.655	.643
3.60	.610	.622	.646	.663	.658	.647
7.20	.613	.625	.649	.666	.661	.651
14.40	.611	.623	.648	.666	.661	.651

TEMP1=3000.R,   TEMP2=8000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.379	.372	.376	.378	.385
.18	.385	.379	.372	.376	.377	.384
.36	.385	.379	.372	.375	.377	.384
.90	.385	.379	.372	.374	.376	.382
1.80	.384	.378	.371	.373	.374	.379
3.60	.382	.376	.369	.370	.371	.375
7.20	.377	.372	.365	.366	.366	.370
14.40	.374	.369	.363	.364	.364	.367

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.240	.252	.254	.251	.242
.18	.234	.241	.253	.255	.252	.242
.36	.234	.241	.253	.255	.252	.243
.90	.234	.241	.253	.256	.254	.245
1.80	.234	.241	.254	.258	.255	.248
3.60	.235	.243	.255	.260	.258	.251
7.20	.239	.246	.258	.263	.261	.256
14.40	.238	.246	.258	.264	.262	.256

TEMP1= 500.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.657	.654	.660	.725	.778	.812
.18	.655	.653	.658	.723	.773	.806
.36	.652	.650	.655	.720	.769	.800
.90	.635	.634	.641	.706	.754	.785
1.00	.606	.607	.618	.687	.735	.765
3.60	.576	.579	.594	.668	.717	.747
7.20	.561	.565	.584	.662	.714	.745
14.40	.623	.628	.647	.733	.789	.824
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.214	.227	.258	.311	.309	.301
.18	.215	.227	.259	.313	.313	.306
.36	.215	.227	.259	.315	.316	.311
.90	.217	.229	.262	.319	.323	.319
1.80	.217	.230	.264	.323	.328	.324
3.60	.206	.220	.257	.320	.326	.322
7.20	.150	.168	.212	.284	.293	.290
14.40	-.066	-.035	.031	.127	.139	.135

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.359	.365	.396	.427	.446
.18	.357	.358	.364	.395	.424	.442
.36	.355	.357	.362	.392	.420	.438
.90	.345	.347	.354	.384	.411	.428
1.80	.329	.332	.340	.373	.399	.416
3.60	.313	.317	.327	.362	.389	.406
7.20	.307	.312	.324	.362	.390	.408
14.40	.353	.358	.373	.417	.451	.471

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.093	.105	.116	.102	.090
.18	.088	.093	.106	.118	.105	.093
.36	.088	.093	.106	.119	.107	.096
.90	.090	.095	.109	.123	.112	.103
1.80	.092	.097	.111	.127	.117	.108
3.60	.087	.093	.109	.126	.118	.109
7.20	.056	.065	.084	.106	.099	.090
14.40	-.068	-.054	-.025	.008	.000	-.009

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.791	.784	.798	.811	.821
.18	.798	.791	.783	.797	.810	.820
.36	.797	.790	.783	.796	.808	.818
.90	.793	.786	.779	.793	.805	.814
1.80	.786	.780	.774	.789	.801	.810
3.60	.779	.774	.769	.785	.797	.806
7.20	.781	.776	.771	.787	.799	.809
14.40	.829	.820	.808	.819	.829	.839

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.617	.637	.665	.670	.670
.18	.608	.618	.637	.665	.671	.672
.36	.609	.618	.637	.666	.672	.673
.90	.611	.620	.640	.668	.675	.676
1.80	.615	.624	.643	.671	.677	.679
3.60	.617	.625	.644	.672	.679	.680
7.20	.605	.615	.635	.665	.672	.674
14.40	.537	.553	.585	.624	.633	.635

TEMP1= 500.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.385	.380	.373	.374	.380	.386
.18	.385	.380	.373	.373	.379	.385
.36	.384	.380	.372	.373	.378	.383
.90	.381	.377	.370	.370	.375	.380
1.80	.376	.372	.366	.367	.372	.377
3.60	.371	.368	.362	.364	.369	.374
7.20	.375	.371	.366	.367	.372	.377
14.40	.417	.410	.399	.396	.401	.406
			THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$			
.01	.233	.239	.250	.258	.256	.252
.18	.234	.239	.250	.259	.257	.253
.36	.234	.240	.250	.260	.258	.255
.90	.236	.242	.252	.262	.260	.257
1.80	.240	.245	.255	.264	.263	.260
3.60	.242	.247	.257	.266	.265	.262
7.20	.234	.240	.251	.261	.260	.257
14.40	.184	.194	.212	.227	.228	.225

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.657	.653	.667	.708	.702	.713
.18	.655	.652	.665	.706	.699	.708
.36	.652	.649	.663	.703	.695	.703
.90	.635	.633	.649	.690	.682	.688
1.80	.606	.607	.627	.670	.662	.668
3.60	.576	.580	.605	.651	.642	.647
7.20	.561	.566	.596	.645	.636	.640
14.40	.623	.629	.660	.713	.702	.707

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.214	.230	.274	.301	.286	.250
.18	.215	.231	.274	.303	.288	.253
.36	.215	.231	.275	.305	.290	.256
.90	.217	.233	.278	.309	.295	.262
1.80	.217	.234	.280	.313	.298	.266
3.60	.206	.225	.274	.309	.294	.261
7.20	.150	.174	.233	.273	.258	.224
14.40	-.066	-.026	.060	.117	.100	.062

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_{\nu}(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.357	.359	.369	.391	.391	.405
.18	.357	.359	.368	.389	.389	.402
.36	.355	.357	.366	.387	.387	.399
.90	.345	.348	.358	.379	.378	.389
1.80	.329	.333	.345	.367	.366	.376
3.60	.313	.318	.333	.356	.355	.365
7.20	.307	.313	.330	.356	.354	.364
14.40	.353	.360	.380	.410	.408	.419

THE RATIO OF $Q_{\nu}(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.088	.094	.111	.114	.107	.085
.18	.088	.095	.111	.115	.109	.087
.36	.088	.095	.112	.117	.110	.090
.90	.090	.097	.115	.120	.114	.095
1.80	.092	.099	.117	.124	.118	.099
3.60	.087	.095	.115	.124	.117	.098
7.20	.056	.067	.092	.103	.096	.076
14.40	-.068	-.050	-.012	.005	-.002	-.026

TEMP1= 500.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.799	.789	.784	.792	.790	.790
.18	.798	.789	.783	.791	.789	.789
.36	.797	.788	.783	.790	.788	.787
.90	.793	.784	.779	.787	.785	.784
1.80	.786	.778	.774	.783	.781	.779
3.60	.779	.772	.770	.779	.777	.775
7.20	.781	.774	.772	.781	.779	.777
14.40	.829	.817	.807	.812	.809	.808

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.608	.620	.645	.662	.657	.645
.18	.608	.620	.645	.662	.657	.646
.36	.609	.621	.646	.663	.658	.647
.90	.611	.623	.648	.665	.660	.650
1.80	.615	.626	.650	.668	.663	.653
3.60	.617	.628	.652	.669	.664	.654
7.20	.605	.618	.644	.662	.657	.647
14.40	.537	.558	.597	.622	.617	.606

TEMP1= 500.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 2.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.385	.379	.371	.372	.373	.377
.18	.385	.379	.371	.371	.372	.376
.36	.384	.378	.371	.371	.371	.375
.90	.381	.375	.368	.368	.369	.372
1.80	.376	.371	.364	.365	.365	.368
3.60	.371	.367	.361	.362	.363	.365
7.20	.375	.370	.364	.365	.365	.368
14.40	.417	.408	.396	.394	.394	.397

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.233	.241	.254	.259	.256	.250
.18	.234	.241	.254	.259	.257	.251
.36	.234	.241	.254	.260	.258	.252
.90	.236	.244	.256	.262	.260	.254
1.80	.240	.247	.259	.264	.263	.257
3.60	.242	.249	.261	.266	.264	.259
7.20	.234	.242	.255	.261	.259	.254
14.40	.184	.197	.218	.228	.226	.220

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.878	.868	.862	.940	1.028	1.089
.18	.878	.868	.861	.937	1.021	1.079
.36	.878	.868	.861	.934	1.015	1.070
.90	.880	.870	.861	.928	1.000	1.050
1.80	.887	.876	.867	.928	.990	1.034
3.60	.920	.909	.897	.954	1.009	1.049
7.20	1.083	1.068	1.051	1.108	1.164	1.208
14.40	1.887	1.853	1.800	1.856	1.935	2.005
	THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$					
.01	-.006	.012	.056	.096	.058	.024
.18	-.006	.012	.057	.100	.065	.033
.36	-.006	.012	.057	.102	.072	.042
.90	-.011	.008	.054	.106	.085	.061
1.80	-.029	-.008	.041	.101	.090	.072
3.60	-.101	-.075	-.018	.053	.052	.038
7.20	-.389	-.350	-.267	-.170	-.166	-.180
14.40	-1.672	-1.576	-1.383	-1.190	-1.180	-1.214

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}\ hr^{-1}$	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.492	.492	.496	.541	.600	.640
.18	.492	.492	.495	.539	.595	.633
.36	.493	.492	.495	.537	.591	.627
.90	.494	.493	.496	.534	.581	.613
1.80	.499	.498	.500	.534	.574	.602
3.60	.521	.520	.522	.553	.589	.615
7.20	.626	.626	.628	.664	.704	.732
14.40	1.141	1.139	1.137	1.194	1.263	1.314
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	-.046	-.040	-.025	-.028	-.071	-.103
.18	-.046	-.040	-.024	-.026	-.066	-.096
.36	-.047	-.040	-.024	-.024	-.061	-.090
.90	-.050	-.042	-.026	-.021	-.052	-.077
1.80	-.060	-.052	-.034	-.024	-.048	-.069
3.60	-.102	-.092	-.071	-.054	-.073	-.090
7.20	-.272	-.257	-.226	-.199	-.218	-.237
14.40	-1.031	-.996	-.923	-.864	-.895	-.933

TEMP1=2000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.879	.858	.867	.886	.903
.18	.894	.879	.858	.866	.884	.900
.36	.894	.879	.858	.865	.882	.898
.90	.895	.880	.858	.863	.878	.892
1.80	.900	.884	.861	.864	.876	.888
3.60	.922	.903	.877	.876	.885	.895
7.20	1.014	.988	.948	.934	.939	.950
14.40	1.444	1.379	1.275	1.210	1.202	1.215

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.530	.563	.596	.595	.588
.18	.513	.530	.563	.597	.597	.591
.36	.513	.530	.563	.598	.598	.594
.90	.511	.529	.562	.599	.602	.599
1.80	.504	.523	.558	.597	.604	.602
3.60	.478	.500	.539	.584	.593	.593
7.20	.370	.401	.458	.517	.531	.532
14.40	-.121	-.045	.087	.211	.242	.240

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.461	.451	.435	.434	.446	.458
.18	.461	.451	.435	.433	.445	.456
.36	.461	.451	.435	.432	.443	.454
.90	.462	.452	.436	.431	.440	.449
1.80	.466	.456	.439	.432	.438	.446
3.60	.484	.472	.453	.442	.446	.452
7.20	.561	.544	.514	.495	.496	.502
14.40	.914	.871	.797	.741	.734	.743

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.158	.168	.188	.199	.189	.180
.18	.158	.168	.188	.199	.191	.182
.36	.157	.168	.188	.200	.193	.184
.90	.156	.167	.187	.201	.196	.189
1.80	.151	.163	.184	.200	.198	.192
3.60	.131	.145	.169	.189	.189	.184
7.20	.048	.067	.102	.133	.136	.132
14.40	-.332	-.284	-.199	-.126	-.113	-.120

TEMP1=2000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.878	.865	.865	.920	.918	.960
.18	.878	.865	.864	.916	.914	.953
.36	.878	.865	.864	.913	.911	.947
.90	.880	.866	.864	.908	.904	.932
1.80	.887	.873	.869	.907	.901	.922
3.60	.920	.905	.899	.932	.925	.939
7.20	1.083	1.063	1.051	1.082	1.072	1.085
14.40	1.887	1.841	1.789	1.812	1.797	1.821
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.006	.018	.075	.090	.069	.002
.18	-.006	.018	.076	.093	.073	.009
.36	-.006	.018	.076	.096	.076	.015
.90	-.011	.014	.074	.100	.082	.028
1.80	-.029	-.001	.062	.095	.078	.032
3.60	-.101	-.067	.005	.048	.032	-.007
7.20	-.389	-.338	-.234	-.173	-.188	-.231
14.40	-1.672	-1.545	-1.310	-1.179	-1.198	-1.262

TEMP1=2000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.492	.499	.535	.539	.576
.18	.492	.492	.498	.532	.536	.571
.36	.493	.492	.498	.530	.534	.567
.90	.494	.493	.498	.527	.529	.557
1.80	.499	.498	.502	.527	.528	.551
3.60	.521	.520	.524	.546	.546	.564
7.20	.626	.625	.630	.654	.653	.673
14.40	1.141	1.137	1.139	1.175	1.174	1.208

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.038	-.018	-.029	-.040	-.085
.18	-.046	-.038	-.018	-.027	-.037	-.081
.36	-.047	-.038	-.018	-.025	-.035	-.076
.90	-.050	-.040	-.019	-.022	-.031	-.067
1.80	-.060	-.050	-.026	-.025	-.033	-.064
3.60	-.102	-.089	-.062	-.055	-.062	-.090
7.20	-.272	-.253	-.213	-.199	-.207	-.237
14.40	-1.031	-.985	-.894	-.858	-.871	-.923

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.874	.854	.859	.859	.867
.18	.894	.874	.853	.858	.858	.865
.36	.894	.874	.853	.857	.857	.863
.90	.895	.875	.854	.856	.855	.859
1.80	.900	.879	.857	.857	.855	.857
3.60	.922	.898	.871	.868	.866	.866
7.20	1.014	.980	.937	.925	.923	.922
14.40	1.444	1.360	1.244	1.194	1.191	1.191

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.535	.575	.594	.587	.568
.18	.513	.535	.575	.595	.588	.570
.36	.513	.535	.575	.596	.589	.572
.90	.511	.534	.575	.597	.591	.576
1.80	.504	.528	.571	.596	.590	.577
3.60	.478	.506	.553	.582	.577	.566
7.20	.370	.410	.477	.517	.513	.501
14.40	-.121	-.022	.131	.218	.213	.198

TEMP1=2000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.461	.448	.431	.431	.433	.444
.18	.461	.448	.431	.430	.432	.443
.36	.461	.448	.430	.429	.431	.441
.90	.462	.449	.431	.428	.430	.438
1.80	.466	.453	.433	.429	.430	.436
3.60	.484	.469	.447	.439	.440	.445
7.20	.561	.538	.505	.490	.491	.496
14.40	.914	.858	.773	.731	.732	.739
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.158	.172	.194	.200	.196	.183
.18	.158	.172	.194	.201	.197	.184
.36	.157	.172	.195	.201	.198	.186
.90	.156	.171	.194	.203	.199	.189
1.80	.151	.166	.191	.201	.199	.190
3.60	.131	.149	.177	.190	.188	.181
7.20	.048	.073	.114	.135	.133	.126
14.40	-.332	-.270	-.171	-.118	-.121	-.131

TEMP1=2000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.867	.858	.923	.991	1.038
.18	.878	.867	.858	.921	.987	1.034
.36	.878	.867	.858	.920	.984	1.029
.90	.879	.868	.858	.917	.977	1.019
1.80	.884	.873	.862	.918	.973	1.013
3.60	.906	.894	.884	.939	.991	1.028
7.20	1.017	1.004	.991	1.048	1.102	1.143
14.40	1.548	1.522	1.485	1.541	1.610	1.668

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.013	.060	.114	.096	.074
.18	-.006	.013	.060	.115	.099	.079
.36	-.006	.013	.060	.117	.103	.083
.90	-.010	.009	.057	.118	.108	.092
1.80	-.025	-.003	.046	.111	.107	.094
3.60	-.081	-.056	-.000	.072	.073	.062
7.20	-.291	-.257	-.182	-.091	-.087	-.100
14.40	-1.134	-1.061	-.914	-.760	-.752	-.778

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.492	.493	.530	.574	.604
.18	.492	.492	.493	.528	.572	.601
.36	.493	.492	.493	.528	.569	.598
.90	.494	.493	.494	.526	.565	.591
1.80	.497	.496	.497	.527	.563	.587
3.60	.512	.511	.513	.543	.577	.600
7.20	.585	.585	.587	.621	.659	.685
14.40	.924	.923	.922	.970	1.027	1.068

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.039	-.022	-.016	-.045	-.068
.18	-.046	-.039	-.022	-.015	-.042	-.064
.36	-.047	-.039	-.022	-.014	-.040	-.061
.90	-.049	-.041	-.024	-.013	-.036	-.055
1.80	-.057	-.049	-.031	-.017	-.036	-.054
3.60	-.090	-.081	-.060	-.042	-.058	-.074
7.20	-.214	-.201	-.172	-.148	-.165	-.182
14.40	-.712	-.686	-.630	-.584	-.609	-.639

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.878	.857	.861	.875	.889
.18	.894	.878	.857	.861	.874	.887
.36	.894	.878	.857	.861	.873	.886
.90	.895	.879	.857	.860	.872	.883
1.80	.899	.883	.860	.861	.871	.882
3.60	.915	.897	.872	.871	.879	.889
7.20	.981	.957	.922	.913	.919	.929
14.40	1.263	1.214	1.137	1.094	1.091	1.103

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.531	.564	.601	.605	.603
.18	.513	.531	.564	.602	.606	.604
.36	.513	.530	.564	.602	.607	.605
.90	.511	.529	.563	.602	.609	.607
1.80	.506	.525	.560	.600	.608	.608
3.60	.486	.507	.545	.589	.599	.600
7.20	.408	.436	.486	.541	.554	.555
14.40	.085	.143	.243	.340	.364	.363

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.461	.451	.434	.429	.437	.446
.18	.461	.451	.434	.429	.436	.445
.36	.461	.451	.434	.428	.435	.444
.90	.462	.452	.435	.428	.434	.441
1.80	.465	.455	.437	.429	.434	.440
3.60	.479	.467	.448	.438	.441	.447
7.20	.533	.518	.492	.476	.477	.483
14.40	.765	.733	.678	.637	.633	.642

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.158	.169	.189	.203	.199	.192
.18	.158	.169	.189	.203	.200	.193
.36	.158	.169	.189	.204	.200	.194
.90	.156	.168	.188	.204	.202	.197
1.80	.153	.164	.185	.203	.202	.197
3.60	.137	.150	.173	.193	.194	.190
7.20	.077	.095	.126	.153	.155	.151
14.40	-.171	-.135	-.071	-.016	-.007	-.013

TEMP1=2000.R, TEMP2=6000.R
TEMR. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.864	.860	.902	.898	.924
.18	.878	.864	.860	.901	.896	.920
.36	.878	.864	.860	.899	.894	.917
.90	.879	.865	.860	.897	.891	.910
1.80	.884	.869	.864	.898	.891	.906
3.60	.906	.891	.886	.917	.909	.921
7.20	1.017	1.000	.992	1.023	1.014	1.026
14.40	1.548	1.513	1.478	1.504	1.492	1.510

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.020	.080	.107	.090	.0[illegible]9
.18	-.006	.020	.080	.109	.092	.042
.36	-.006	.019	.080	.110	.093	.045
.90	-.010	.016	.078	.111	.095	.050
1.80	-.025	.003	.068	.105	.089	.048
3.60	-.081	-.048	.022	.066	.051	.013
7.20	-.291	-.246	-.151	-.095	-.110	-.151
14.40	-1.134	-1.038	-.858	-.755	-.773	-.827

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.491	.496	.523	.525	.551
.18	.492	.491	.495	.522	.523	.548
.36	.493	.491	.495	.521	.522	.546
.90	.494	.492	.496	.519	.520	.542
1.80	.497	.495	.499	.520	.521	.539
3.60	.512	.511	.514	.535	.535	.552
7.20	.585	.584	.589	.612	.612	.630
14.40	.924	.922	.924	.955	.954	.982

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.037	-.015	-.017	-.026	-.060
.18	-.046	-.037	-.015	-.016	-.024	-.058
.36	-.047	-.037	-.015	-.015	-.023	-.056
.90	-.049	-.039	-.016	-.014	-.022	-.052
1.80	-.057	-.047	-.023	-.018	-.025	-.053
3.60	-.090	-.078	-.051	-.043	-.050	-.075
7.20	-.214	-.196	-.160	-.148	-.155	-.184
14.40	-.712	-.677	-.608	-.581	-.591	-.634

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.874	.852	.854	.853	.856
.18	.894	.874	.852	.854	.852	.855
.36	.894	.874	.852	.853	.852	.854
.90	.895	.874	.852	.853	.851	.853
1.80	.899	.878	.855	.854	.852	.853
3.60	.915	.892	.866	.863	.861	.860
7.20	.981	.950	.913	.904	.902	.901
14.40	1.263	1.200	1.115	1.080	1.078	1.078

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.536	.576	.599	.594	.579
.18	.513	.536	.576	.600	.594	.580
.36	.513	.536	.576	.600	.595	.581
.90	.511	.534	.576	.601	.595	.582
1.80	.506	.530	.573	.599	.594	.582
3.60	.486	.513	.559	.588	.583	.572
7.20	.408	.444	.504	.541	.536	.525
14.40	.085	.160	.277	.344	.339	.326

TEMP1=2000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.461	.448	.429	.426	.428	.435
.18	.461	.448	.429	.426	.427	.434
.36	.461	.448	.429	.425	.427	.434
.90	.462	.449	.430	.425	.426	.432
1.80	.465	.452	.432	.426	.427	.432
3.60	.479	.464	.442	.434	.435	.439
7.20	.533	.513	.484	.472	.472	.477
14.40	.765	.723	.660	.630	.631	.636

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.158	.172	.195	.204	.201	.192
.18	.158	.172	.196	.205	.202	.192
.36	.158	.172	.196	.205	.202	.193
.90	.156	.171	.195	.205	.203	.195
1.80	.153	.168	.193	.204	.202	.194
3.60	.137	.154	.181	.195	.193	.186
7.20	.077	.100	.136	.155	.153	.146
14.40	-.171	-.125	-.050	-.011	-.013	-.022

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.867	.857	.912	.978	1.021
.18	.878	.867	.857	.915	.974	1.015
.36	.878	.867	.857	.913	.970	1.011
.90	.882	.870	.860	.914	.967	1.005
1.80	.896	.885	.875	.929	.980	1.017
3.60	.970	.958	.947	1.003	1.057	1.096
7.20	1.313	1.293	1.267	1.324	1.387	1.437
14.40	3.118	3.053	2.945	3.000	3.113	3.224

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.014	.061	.120	.109	.091
.18	-.006	.013	.061	.122	.113	.097
.36	-.008	.012	.060	.122	.116	.101
.90	-.021	.000	.050	.116	.114	.102
1.80	-.064	-.040	.013	.085	.087	.077
3.60	-.216	-.185	-.117	-.031	-.027	-.039
7.20	-.768	-.711	-.595	-.469	-.462	-.482
14.40	-3.618	-3.436	-3.078	-2.742	-2.724	-2.788

TEMP1=1000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.492	.493	.526	.565	.593
.18	.493	.492	.492	.524	.562	.588
.36	.493	.492	.493	.523	.560	.585
.90	.495	.494	.495	.524	.558	.582
1.80	.506	.505	.506	.536	.569	.591
3.60	.554	.554	.557	.590	.626	.651
7.20	.775	.774	.775	.817	.865	.900
14.40	1.928	1.923	1.915	2.004	2.117	2.204

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.039	-.021	-.012	-.036	-.056
.18	-.047	-.039	-.022	-.011	-.033	-.052
.36	-.048	-.040	-.022	-.010	-.031	-.049
.90	-.055	-.047	-.028	-.014	-.032	-.047
1.80	-.080	-.071	-.051	-.033	-.049	-.064
3.60	-.169	-.157	-.131	-.109	-.125	-.142
7.20	-.496	-.475	-.430	-.394	-.415	-.440
14.40	-2.184	-2.119	-1.983	-1.877	-1.927	-1.993

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.878	.856	.860	.872	.884
.18	.894	.878	.856	.859	.871	.882
.36	.894	.878	.856	.859	.870	.881
.90	.898	.881	.859	.860	.870	.880
1.80	.909	.892	.868	.867	.875	.885
3.60	.956	.934	.903	.897	.903	.914
7.20	1.139	1.102	1.043	1.014	1.016	1.027
14.40	2.098	1.975	1.773	1.630	1.602	1.620

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.531	.564	.603	.609	.607
.18	.513	.531	.564	.603	.610	.609
.36	.512	.530	.564	.603	.611	.610
.90	.508	.526	.561	.602	.610	.611
1.80	.492	.512	.550	.593	.603	.604
3.60	.437	.462	.508	.559	.571	.572
7.20	.226	.271	.349	.428	.447	.447
14.40	-.871	-.725	-.477	-.255	-.200	-.203

TEMP1=1000.R,   TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.461	.451	.434	.428	.434	.442
.18	.461	.451	.434	.427	.433	.440
.36	.461	.451	.434	.427	.432	.439
.90	.464	.454	.436	.428	.432	.438
1.80	.474	.463	.444	.434	.438	.443
3.60	.513	.499	.475	.461	.463	.469
7.20	.664	.639	.596	.566	.565	.572
14.40	1.451	1.371	1.229	1.116	1.096	1.111
			THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$			
.01	.158	.169	.189	.205	.202	.196
.18	.158	.169	.189	.205	.203	.198
.36	.157	.168	.189	.205	.204	.199
.90	.154	.165	.186	.204	.204	.199
1.80	.142	.155	.177	.197	.197	.194
3.60	.100	.115	.143	.168	.170	.166
7.20	-.062	-.034	.014	.057	.063	.058
14.40	-.912	-.821	-.660	-.521	-.493	-.505

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.863	.859	.896	.891	.911
.18	.878	.863	.858	.894	.888	.907
.36	.878	.863	.858	.893	.887	.904
.90	.882	.867	.861	.894	.886	.900
1.80	.896	.881	.876	.908	.900	.911
3.60	.970	.954	.948	.980	.971	.982
7.20	1.313	1.287	1.264	1.293	1.282	1.297
14.40	3.118	3.030	2.917	2.927	2.905	2.945

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.020	.082	.113	.097	.051
.18	-.006	.020	.082	.115	.099	.055
.36	-.008	.018	.081	.115	.100	.058
.90	-.021	.007	.071	.109	.095	.056
1.80	-.064	-.033	.036	.079	.065	.027
3.60	-.216	-.175	-.088	-.036	-.051	-.090
7.20	-.768	-.694	-.550	-.468	-.484	-.533
14.40	-3.618	-3.378	-2.947	-2.710	-2.735	-2.832

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.491	.495	.519	.520	.542
.18	.493	.491	.494	.517	.518	.539
.36	.493	.491	.494	.517	.517	.537
.90	.495	.494	.497	.517	.518	.535
1.80	.506	.504	.508	.529	.528	.544
3.60	.554	.554	.559	.582	.581	.598
7.20	.775	.773	.777	.805	.804	.827
14.40	1.928	1.919	1.916	1.971	1.968	2.026

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.036	-.014	-.013	-.021	-.052
.18	-.047	-.037	-.014	-.012	-.019	-.049
.36	-.048	-.037	-.015	-.011	-.019	-.047
.90	-.055	-.044	-.020	-.015	-.022	-.048
1.80	-.080	-.068	-.042	-.034	-.041	-.066
3.60	-.169	-.153	-.120	-.109	-.117	-.143
7.20	-.496	-.468	-.413	-.392	-.401	-.438
14.40	-2.184	-2.098	-1.931	-1.863	-1.882	-1.968

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.873	.852	.852	.851	.853
.18	.894	.873	.852	.852	.850	.852
.36	.894	.874	.852	.852	.850	.851
.90	.898	.877	.854	.853	.851	.851
1.80	.909	.887	.862	.859	.857	.857
3.60	.956	.928	.895	.888	.886	.885
7.20	1.139	1.090	1.027	1.003	1.001	1.000
14.40	2.098	1.938	1.713	1.603	1.601	1.602

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.536	.577	.601	.596	.582
.18	.513	.536	.577	.602	.596	.583
.36	.512	.535	.577	.602	.597	.584
.90	.508	.531	.574	.600	.595	.584
1.80	.492	.518	.563	.592	.587	.576
3.60	.437	.469	.524	.558	.553	.542
7.20	.226	.284	.376	.430	.425	.413
14.40	-.871	-.683	-.396	-.238	-.244	-.262

TEMP1=1000.R, TEMP2=4000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.461	.448	.429	.425	.426	.432
.18	.461	.448	.429	.424	.425	.431
.36	.461	.448	.429	.424	.425	.430
.90	.464	.451	.431	.425	.426	.430
1.80	.474	.460	.439	.431	.432	.436
3.60	.513	.495	.468	.457	.458	.462
7.20	.664	.631	.583	.560	.561	.566
14.40	1.451	1.346	1.183	1.098	1.100	1.111

THE RATIO OF $Q_\nu(\tau_o)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.158	.172	.196	.206	.203	.195
.18	.158	.172	.196	.206	.204	.196
.36	.157	.172	.196	.206	.204	.196
.90	.154	.169	.193	.205	.203	.196
1.80	.142	.158	.185	.198	.196	.190
3.60	.100	.120	.153	.170	.168	.161
7.20	-.062	-.026	.031	.061	.059	.051
14.40	-.912	-.793	-.607	-.505	-.509	-.525

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.866	.856	.912	.968	1.008
.18	.878	.866	.856	.911	.965	1.004
.36	.878	.867	.856	.910	.963	1.002
.90	.880	.868	.857	.911	.961	.998
1.80	.887	.876	.865	.919	.969	1.005
3.60	.923	.913	.903	.959	1.011	1.049
7.20	1.098	1.084	1.067	1.125	1.182	1.226
14.40	1.876	1.841	1.788	1.843	1.920	1.989

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.014	.062	.124	.119	.105
.18	-.006	.014	.062	.125	.121	.108
.36	-.007	.013	.061	.126	.123	.110
.90	-.016	.004	.054	.121	.121	.110
1.80	-.045	-.022	.030	.101	.103	.093
3.60	-.138	-.110	-.049	.030	.033	.022
7.20	-.433	-.392	-.305	-.203	-.198	-.213
14.40	-1.642	-1.547	-1.356	-1.165	-1.155	-1.188

TEMP1=1000.R.　　TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.491	.492	.522	.558	.583
.18	.493	.491	.492	.522	.557	.581
.36	.493	.492	.492	.521	.555	.579
.90	.494	.493	.493	.522	.554	.577
1.80	.499	.499	.500	.529	.561	.583
3.60	.525	.525	.527	.559	.593	.616
7.20	.637	.637	.639	.677	.717	.746
14.40	1.133	1.131	1.128	1.184	1.251	1.302

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.039	-.021	-.009	-.029	-.047
.18	-.047	-.039	-.021	-.008	-.027	-.044
.36	-.047	-.039	-.021	-.008	-.026	-.042
.90	-.053	-.044	-.026	-.011	-.027	-.042
1.80	-.069	-.060	-.040	-.023	-.038	-.053
3.60	-.123	-.112	-.089	-.069	-.084	-.099
7.20	-.297	-.282	-.248	-.220	-.238	-.258
14.40	-1.014	-.979	-.906	-.848	-.879	-.916

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.878	.856	.858	.869	.880
.18	.894	.878	.856	.858	.868	.879
.36	.894	.878	.856	.858	.868	.878
.90	.896	.880	.858	.859	.868	.878
1.80	.904	.887	.863	.863	.871	.881
3.60	.930	.911	.883	.880	.888	.898
7.20	1.026	.999	.957	.942	.947	.957
14.40	1.434	1.370	1.268	1.204	1.196	1.209

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.531	.565	.604	.612	.611
.18	.513	.531	.565	.604	.612	.612
.36	.512	.530	.564	.605	.613	.613
.90	.509	.528	.562	.603	.612	.613
1.80	.499	.519	.555	.598	.608	.608
3.60	.466	.489	.530	.577	.588	.589
7.20	.355	.387	.446	.508	.523	.523
14.40	-.109	-.034	.096	.218	.249	.247

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.461	.451	.434	.426	.432	.438
.18	.461	.451	.434	.426	.431	.437
.36	.461	.451	.434	.426	.430	.437
.90	.463	.453	.435	.427	.431	.436
1.80	.469	.459	.440	.431	.434	.440
3.60	.492	.479	.458	.447	.449	.455
7.20	.571	.553	.522	.502	.503	.509
14.40	.906	.864	.791	.735	.728	.738

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.158	.169	.189	.206	.204	.200
.18	.158	.169	.189	.206	.205	.201
.36	.157	.169	.189	.206	.205	.201
.90	.155	.167	.187	.205	.205	.201
1.80	.148	.160	.182	.200	.201	.198
3.60	.122	.136	.162	.183	.185	.181
7.20	.036	.057	.093	.125	.129	.124
14.40	-.323	-.275	-.192	-.119	-.107	-.114

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.863	.857	.892	.885	.902
.18	.878	.863	.857	.891	.884	.899
.36	.878	.863	.857	.890	.883	.897
.90	.880	.865	.859	.890	.883	.895
1.80	.887	.872	.867	.898	.890	.901
3.60	.923	.909	.905	.937	.929	.939
7.20	1.098	1.079	1.067	1.099	1.089	1.102
14.40	1.876	1.829	1.777	1.799	1.785	1.808

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.021	.083	.118	.102	.061
.18	-.006	.020	.083	.119	.104	.063
.36	-.007	.019	.082	.119	.104	.064
.90	-.016	.011	.076	.115	.100	.062
1.80	-.045	-.015	.052	.094	.080	.043
3.60	-.138	-.101	-.023	.024	.009	-.028
7.20	-.433	-.379	-.270	-.205	-.221	-.264
14.40	-1.642	-1.516	-1.284	-1.154	-.000	-1.236

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.491	.494	.516	.516	.536
.18	.493	.491	.494	.515	.515	.534
.36	.493	.491	.494	.514	.515	.532
.90	.494	.492	.495	.515	.515	.531
1.80	.499	.498	.502	.521	.521	.537
3.60	.525	.524	.529	.551	.550	.566
7.20	.637	.637	.642	.667	.666	.685
14.40	1.133	1.129	1.130	1.165	1.164	1.198

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.036	-.013	-.010	-.017	-.045
.18	-.047	-.036	-.013	-.009	-.016	-.043
.36	-.047	-.037	-.014	-.009	-.016	-.042
.90	-.053	-.042	-.018	-.012	-.018	-.043
1.80	-.069	-.057	-.032	-.024	-.031	-.055
3.60	-.123	-.109	-.079	-.069	-.076	-.102
7.20	-.297	-.277	-.235	-.220	-.228	-.258
14.40	-1.014	-.968	-.878	-.843	-.855	-.907

TEMP1=1000.R,   TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.601
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.873	.851	.851	.849	.850
.18	.894	.873	.851	.851	.849	.849
.36	.894	.874	.851	.851	.849	.849
.90	.896	.875	.853	.851	.849	.849
1.80	.904	.882	.858	.856	.853	.853
3.60	.930	.905	.877	.872	.870	.869
7.20	1.026	.991	.946	.933	.930	.930
14.40	1.434	1.351	1.238	1.188	1.185	1.186

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.536	.577	.602	.597	.585
.18	.513	.536	.577	.603	.598	.586
.36	.512	.536	.577	.603	.598	.586
.90	.509	.533	.575	.602	.597	.586
1.80	.499	.524	.568	.596	.591	.581
3.60	.466	.495	.545	.576	.571	.561
7.20	.355	.397	.467	.508	.503	.492
14.40	-.109	-.011	.139	.225	.220	.206

TEMP1=1000.R, TEMP2=6000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.461	.448	.429	.424	.424	.430
.18	.461	.448	.429	.423	.424	.429
.36	.461	.448	.429	.423	.424	.429
.90	.463	.450	.430	.424	.425	.429
1.80	.469	.455	.435	.428	.428	.432
3.60	.492	.475	.452	.443	.444	.448
7.20	.571	.547	.512	.497	.498	.502
14.40	.906	.851	.767	.726	.727	.734

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.158	.172	.196	.207	.205	.197
.18	.158	.172	.196	.207	.205	.198
.36	.157	.172	.196	.207	.205	.198
.90	.155	.170	.195	.206	.204	.198
1.80	.148	.163	.189	.202	.200	.194
3.60	.122	.141	.170	.185	.183	.177
7.20	.036	.063	.106	.128	.126	.118
14.40	-.323	-.261	-.164	-.112	-.115	-.125

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.25i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.867	.859	.926	.998	1.049
.18	.878	.867	.859	.925	.995	1.045
.36	.878	.867	.858	.924	.993	1.041
.90	.878	.868	.858	.921	.986	1.031
1.80	.881	.870	.860	.919	.979	1.021
3.60	.891	.880	.869	.925	.979	1.019
7.20	.940	.929	.918	.973	1.026	1.064
14.40	1.188	1.171	1.151	1.207	1.267	1.313

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.013	.059	.110	.088	.064
.18	-.006	.013	.059	.112	.091	.068
.36	-.006	.013	.059	.113	.094	.072
.90	-.008	.011	.058	.115	.100	.081
1.80	-.015	.005	.053	.114	.105	.088
3.60	-.042	-.020	.031	.098	.096	.083
7.20	-.150	-.122	-.060	.018	.021	.009
14.40	-.568	-.520	-.422	-.310	-.305	-.322

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.492	.494	.532	.579	.612
.18	.492	.492	.494	.531	.577	.609
.36	.493	.492	.494	.530	.575	.606
.90	.493	.492	.494	.528	.571	.600
1.80	.495	.494	.495	.527	.566	.593
3.60	.502	.501	.502	.532	.568	.592
7.20	.535	.534	.536	.568	.603	.627
14.40	.694	.694	.696	.735	.778	.810

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.039	-.023	-.018	-.050	-.075
.18	-.046	-.039	-.023	-.018	-.048	-.072
.36	-.047	-.039	-.023	-.017	-.046	-.069
.90	-.048	-.040	-.023	-.015	-.042	-.063
1.80	-.052	-.044	-.026	-.016	-.038	-.057
3.60	-.068	-.059	-.040	-.025	-.044	-.061
7.20	-.131	-.120	-.096	-.077	-.093	-.109
14.40	-.377	-.360	-.322	-.291	-.310	-.332

TEMP1=3000.R,   TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.894	.878	.857	.862	.877	.891
.18	.894	.878	.857	.862	.877	.890
.36	.894	.878	.857	.862	.876	.889
.90	.894	.879	.857	.861	.874	.887
1.80	.896	.880	.858	.861	.872	.884
3.60	.904	.887	.864	.864	.874	.885
7.20	.936	.916	.888	.884	.892	.902
14.40	1.073	1.041	.992	.972	.975	.986
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.513	.530	.564	.600	.603	.600
.18	.513	.530	.564	.600	.604	.601
.36	.513	.530	.564	.601	.605	.602
.90	.512	.530	.564	.601	.606	.604
1.80	.510	.528	.562	.601	.608	.607
3.60	.500	.519	.555	.597	.605	.605
7.20	.461	.483	.526	.573	.585	.585
14.40	.303	.340	.407	.475	.492	.492

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=1.25-1.251
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
			THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$			
.01	.461	.451	.435	.430	.439	.448
.18	.461	.451	.435	.430	.438	.447
.36	.461	.451	.434	.429	.438	.446
.90	.461	.451	.435	.429	.436	.444
1.80	.463	.453	.436	.429	.435	.442
3.60	.469	.459	.441	.432	.436	.443
7.20	.496	.484	.462	.450	.453	.459
14.40	.609	.588	.552	.528	.528	.535
			THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$			
.01	.158	.169	.188	.202	.197	.190
.18	.158	.169	.189	.203	.198	.191
.36	.158	.169	.189	.203	.198	.192
.90	.157	.168	.188	.203	.200	.194
1.80	.155	.167	.187	.203	.201	.196
3.60	.148	.160	.182	.200	.199	.195
7.20	.118	.132	.158	.180	.182	.178
14.40	-.003	.019	.061	.097	.102	.097

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.878	.864	.861	.906	.902	.931
.18	.878	.864	.861	.904	.900	.928
.36	.878	.864	.861	.903	.899	.925
.90	.878	.864	.860	.900	.895	.919
1.80	.881	.866	.862	.898	.892	.912
3.60	.891	.876	.871	.904	.897	.911
7.20	.940	.925	.919	.951	.942	.954
14.40	1.188	1.166	1.149	1.179	1.169	1.183

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.006	.020	.079	.104	.086	.031
.18	-.006	.020	.080	.105	.087	.034
.36	-.006	.019	.080	.106	.089	.037
.90	-.008	.018	.079	.108	.091	.043
1.80	-.015	.012	.075	.108	.092	.047
3.60	-.042	-.013	.053	.092	.077	.037
7.20	-.150	-.113	-.034	.013	-.001	-.040
14.40	-.568	-.506	-.383	-.311	-.327	-.372

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING=1.0
REFLECTIVITY AT SURFACE 1,2= .5

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.492	.492	.496	.525	.528	.556
.18	.492	.491	.496	.524	.527	.554
.36	.493	.491	.496	.523	.525	.552
.90	.493	.492	.496	.521	.523	.547
1.80	.495	.493	.497	.520	.521	.543
3.60	.502	.500	.504	.525	.526	.544
7.20	.535	.534	.538	.560	.560	.576
14.40	.694	.693	.698	.724	.723	.744

THE RATIO OF $Q\nu(\tau_0)/Q\nu_{,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	-.046	-.037	-.016	-.019	-.029	-.065
.18	-.046	-.037	-.016	-.018	-.028	-.063
.36	-.047	-.037	-.015	-.018	-.027	-.061
.90	-.048	-.038	-.016	-.016	-.025	-.057
1.80	-.052	-.041	-.018	-.016	-.024	-.054
3.60	-.068	-.056	-.032	-.026	-.033	-.060
7.20	-.131	-.117	-.087	-.077	-.084	-.111
14.40	-.377	-.354	-.307	-.289	-.298	-.331

TEMP1=3000.R, TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60I
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .1

THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.894	.874	.852	.855	.854	.858
.18	.894	.874	.852	.855	.854	.858
.36	.894	.874	.852	.854	.853	.857
.90	.894	.874	.852	.854	.852	.855
1.80	.896	.876	.853	.854	.852	.854
3.60	.904	.882	.858	.857	.855	.855
7.20	.936	.911	.881	.876	.874	.873
14.40	1.073	1.031	.979	.961	.959	.959

THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
.01	.513	.536	.576	.598	.592	.577
.18	.513	.536	.576	.599	.593	.578
.36	.513	.536	.576	.599	.593	.578
.90	.512	.535	.576	.600	.594	.580
1.80	.510	.533	.575	.600	.594	.581
3.60	.500	.525	.568	.595	.590	.578
7.20	.461	.490	.541	.573	.568	.557
14.40	.303	.351	.430	.477	.472	.460

TEMP1=3000.R,   TEMP2=8000.R
TEMP. DISTR. PARAMETER= 4.
REFRACTIVE INDEX=2.00-0.60i
OPTICAL SPACING= .2
REFLECTIVITY AT SURFACE 1,2= .5

$\nu \times 10^{17}$ hr^{-1}	α = .0	.6	1.0	2.0	3.0	4.0
	THE RATIO OF $Q_\nu(0)/Q_{\nu,bb}$					
.01	.461	.448	.430	.427	.429	.437
.18	.461	.448	.430	.427	.428	.436
.36	.461	.448	.430	.426	.428	.436
.90	.461	.448	.430	.426	.427	.434
1.80	.463	.450	.431	.426	.427	.433
3.60	.469	.455	.435	.429	.430	.435
7.20	.496	.480	.456	.446	.447	.451
14.40	.609	.582	.541	.523	.524	.529
	THE RATIO OF $Q_\nu(\tau_0)/Q_{\nu,bb}$					
.01	.158	.172	.195	.203	.200	.190
.18	.158	.172	.195	.204	.201	.190
.36	.158	.172	.195	.204	.201	.191
.90	.157	.172	.195	.205	.202	.193
1.80	.155	.170	.194	.205	.202	.194
3.60	.148	.163	.189	.201	.199	.192
7.20	.118	.136	.167	.182	.180	.173
14.40	-.003	.026	.075	.101	.098	.091

APPENDIX VIII

THE COMPUTER PROGRAMS

```
C  The Program of the Scattering Functions and the Eigenvalues
      DIMENSION U(6), W(6), P(18,6), PL(18,3,6), PLE(3,6),
      S(6,6), B(18), X(6), Y(6), XNO(6), T(6), EI(6),
      SMO(6,6), SC(6,6)
      READ 47, (W(J),J=1,6)
   47 FORMAT(6E12.6)
      READ 47, (U(J),J=1,6)
      READ 47, (X(J),J=1,6)
      READ 47, ((P(J,I),I=1,6),J=1,18)
    7 READ 1, NN, ADB1, ADB2, SUM1, SUM2
    1 FORMAT(I2, 4E12.6)
      PRINT 1, NN, ADB1, ADB2, SUM1, SUM2
      IF (NN-1)2,2,3
    2 READ 47, (B(I), I=1,18)
      PRINT 47, (B(I),I=1,18)
C     THE SCATTERING FUNCTIONS AND THE MATRIX
      N=0
   33 N=N+1
      IF(2*(N/2)-N)11,25,11
   11 DO 19 I=1,3
```

```
19 PL(N,1,I)=P(N,I)
   DO 20 I=4,6
20 PL(N,1,I)=-P(N,I-3)
   PL(N,2,1)=P(N,2)
   DO 21 I=2,3
21 PL(N,2,I)=P(N,I+2)
   PL(N,2,4)=-P(N,2)
   DO 22 I=5,6
22 PL(N,2,I)=-P(N,I-1)
   PL(N,3,1)=P(N,3)
   DO 23 I=2,3
23 PL(N,3,I)=P(N,I+3)
   PL(N,3,4)=-P(N,3)
   DO 24 I=5,6
24 PL(N,3,I)=-P(N,I)
   GO TO 33
25 DO 26 I=1,3
26 PL(N,1,I)=P(N,I)
   DO 27 I=4,6
27 PL(N,1,I)=P(N,I-3)
   PL(N,2,1)=P(N,2)
   DO 28 I=2,3
28 PL(N,2,I)=P(N,I+2)
   PL(N,2,4)=P(N,2)
   DO 29 I=5,6
29 PL(N,2,I)=P(N,I-1)
   PL(N,3,1)=P(N,3)
```

```
      DO 31 I=2,3
   31 PL(N,3,I)=P(N,I+3)
      PL(N,3,4)=-P(N,3)
      DO 32 I=5,6
   32 PL(N,3,I)=P(N,I)
      IF(N-18)33,34,34
   34 DO 37 M=1,3
      DO 37 J=1,6
      PLE(M,J)=0.0
      DO 37 N=1,18
   37 PLE(M,J)=PLE(M,J)+B(N)*PL(N,M,J)
      DO 38 M=1,3
      DO 38 J=1,6
   38 S(M,J)=0.5*ADB1*W(J)/U(M)*(1.+PLE(M,J))
   45 DO 39 M=1,3
   39 S(M,M)=S(M,M)-1./U(M)
      DO 40 M=4,6
      DO 40 J=1,3
   40 S(M,J)=-S(M-3,J+3)
      DO 41 M=4,6
      DO 41 J=4,6
   41 S(M,J)=-S(M-3,J-3)
      PRINT 42, ((S(M,J), J=1,6), M=1,6)
   42 FORMAT (///(6E16.8))
      PUNCH 47, ((S(M,J), J=1,6), M=1,6)
      GO TO 8
    3 DO 44 M=1,3
```

```
      DO 44 J=1,6
   44 S(M,J)=0.5*ADB2*W(J)/U(M)
      GO TO 45
    8 KM=0
   49 DO 50 M=1,6
      DO 50 J=1,6
      SC(M,J)=0.0
      DO 50 K=1,6
   50 SC(M,J)=SC(M,J)+S(M,K)*S(K,J)
C     EIGEN VALUES OF THE MATRIX
      KK=0
   68 KK=KK+1
      IK=0
   57 DO 51 N=KK,6
      Y(N)=0.0
      DO 51 J=KK,6
   51 Y(N)=Y(N)+SC(N,J)*X(J)
      DO 52 J=KK,6
   52 XNO(J)=Y(J)/Y(KK)
      DO 54 J=KK,6
      T(J)=ABSF(XNO(J)-X(J))
      IF(T(J)-SUM1)54,54,55
   55 IK=IK+1
      IF(IK-25)4,4,5
    5 KM=KM+1
      IF(KM-2)6,7,7
    4 DO 56 M=KK,6
```

```
56 X(M)=XNO(M)
   GO TO 57
54 CONTINUE
   PRINT 48, (XNO(J), J=KK,6)
48 FORMAT (E13.6)
   EI(KK)=0.0
   DO 58 J=KK,6
58 EI(KK)=EI(KK)+SC(KK,J)*XNO(J)
   IF(KK-1)59,60,59
59 IF(KK-3)61,60,61
61 IF(KK-5)64,60,64
60 EI(KK)=-SQRTF(EI(KK))
   PRINT 62, EI(KK)
62 FORMAT(2X, 11HEIGENVALUE=, E13.6)
   GO TO 63
64 EI(KK)=SQRTF(EI(KK))
   PRINT 62, EI(KK)
63 DO 65 J=KK,6
   DO 65 M=KK,6
65 SMO(J,M)=SC(J,M)-SC(KK,M)*XNO(J)
   PRINT 48, ((SMO(J,M), M=KK,6), J=KK,6)
   DO 66 M=KK,6
   DO 66 J=KK,6
66 SC(M,J)=SMO(M,J)
   DO 67 J=KK,6
67 X(J)=1.
   IF(KK-5)68,68,7
```

```
    6 SUM1-SUM2
      DO 100 J=KK,6
  100 X(J)=1.
      GO TO 49
      STOP
      END
```

C <u>The Program of the Idempotents, the Particular Solution, and the Net Monochromatic Heat Flux at Bounding Walls</u>

```
      DIMENSION U(6), W(6), S(6,6), E(6), Y1(6), A1(6,6,6),
      ER(6,6,6), Q(6,6,6), EMT(6,6), B1(6,6,6), C1(6,6),
      C4(6,6), T1(12), T2(12), TZ(2), TE(6), T3(12),
      EMT1(6,6), EMT2(10,6,6), TS1(8), TS2(8), V(9),
      G(20,20), Y2(6,6), Y3(6,6), TEM(4), TOU(4), W4(4),
      D(4), YZ1(6,6), YZ2,(6,6), PI1(6), PI2(6), BC(3),
      FL1(2), FL2(2), Z(2,6,6, QIP1(6), QIP2(6), QIP(6),
      PIC(6), PJ1(6), PJ2(6), R1(9,2,6), R2(9,2,6),
      FLUX1(9,2), FLUX2(9,2)
      READ INPUT TAPE 2,47 , (W(J), J=1,6)
      READ INPUT TAPE 2, 47, (U(J), J=1,6)
      READ INPUT TAPE 2, 47, H, C, FK, (BC(J), J=1,3)
   47 FORMAT(6E12.6)
      READ INPUT TAPE 2, 1, (TZ(J), J=1,2), (TE(I), I=1,6)
      READ INPUT TAPE 2, 1, (TS1(J), J=1,8)
      READ INPUT TAPE 2, 1, (TS2(J), J=1,8)
      READ INPUT TAPE 2, 1, (W4(J), J=1,4)
      READ INPUT TAPE 2, 1, (FL1(J), FL2(J), J=1,2)
    1 FORMAT (4E12.6)
```

```
      READ INPUT TAPE 2, 3, (V(J), J=1,9)
    3 FORMAT(3E12.6)
  183 READ INPUT TAPE 2, 4, NN, ADB1, ADB2
    4 FORMAT(I2, 2E12.6)
      READ INPUT TAPE 2,47, (E(I), I=1,6)
      READ INPUT TAPE 2,47, ((S(M,J), J=1,6), M=1,6)
C     THE IDEMPOTENTS OF THE MATRIX
      DO 70 I=1,6
      DO 70 J=1,6
      DO 70 K=1,6
      IF(K-J)71,72,71
   71 ER(I,J,K)=0.0
      GO TO 70
   72 ER(I,J,K)=E(I)
   70 CONTINUE
      DO 74 M=1,6
      DO 74 I=1,6
      DO 74 K=1,6
   74 A1(M,I,K)=S(I,K)-ER(M,I,K)
      DO 78 N=1,6
      Y1(N)=1.
      K=0
   75 K=K+1
      IF(K-N)76,75,76
   76 IF(K-6)77,77,78
   77 Y1(N)=Y1(N)*(E(N)-E(K))
      GO TO 75
```

```
78 CONTINUE
   M=0
81 M=M+1
   IF(M-6)79,79,91
79 L=0
84 L=L+1
   IF(M-L)80,84,80
80 IF(L-6)82,82,81
82 N=0
86 N=N+1
   IF(L-N)83,86,83
83 IF(N-M)85,86,85
85 IF(N-6)87,87,84
87 IF(L+N+M-6)88,89,88
88 IF(L+N+M-15)86,89,86
89 DO 90 J=1,6
   DO 90 K=1,6
   B1(M,J,K)=0.0
   DO 90 I=1,6
90 B1(M,J,K)=B1(M,J,K)+A1(L,J,I)*A1(N,I,K)
   GO TO 81
91 DO 92 J=1,6
   DO 92 K=1,6
   C1(J,K)=0.0
   DO 92 I=1,6
92 C1(J,K)=C1(J,K)+A1(1,J,I)*B1(1,I,K)
   DO 93 J=1,6
```

```
      DO 93 K=1,6
      C4(J,K)=0.0
      DO 93 I=1,6
   93 C4(J,K)=C4(J,K)+A1(4,J,I)*B1(4,I,K)
      DO 94 N=1,3
      DO 94 I=1,6
      DO 94 J=1,6
      Q(N,J,I)=0.0
      DO 94 K=1,6
   94 Q(N,J,I)=Q(N,J,I)+B1(N,J,K)*C4(K,I)
      DO 95 N=4,6
      DO 95 I=1,6
      DO 95 J=1,6
      Q(N,J,I)=0.0
      DO 95 K=1,6
   95 Q(N,J,I)=Q(N,J,I)+B1(N,J,K)*C1(K,I)
      DO 98 N=1,6
      DO 98 J=1,6
      DO 98 I=1,6
   98 Q(N,J,I)=Q(N,J,I)/Y1(N)
      DO 99 J=1,2
      II=6*J-6
      DO 99 I=1,6
      K=I+II
   99 T3(K)=TZ(J)*TE(I)
      LL=0
  125 LL=LL+1
```

```
      IF(LL-2)100,100,183
  100 J1=6*LL-5
      J2=6*LL
      DO 101 J=J1,J2
  101 T1(J)=T3(J)
      DO 102 J=J1,J2
  102 T2(J)=T3(J)-TZ(LL)
      IF(LL-1)103,103,104
  103 DO 105 K=1,6
      DO 105 M=1,6
      EMT(K,M)=0.0
      DO 105 I=1,6
  105 EMT(K,M)=EMT(K,M)+Q(I,K,M)
      DO 106 K=1,6
      DO 106 M=1,6
  106 EMT1(K,M)=EMT(K,M)
  104 DO 107 L=J1,J2
      DO 108 K=1,6
      DO 108 M=1,6
      EMT(K,M)=0.0
      DO 108 I=1,3
  108 EMT(K,M)=EMT(K,M)+EXPF(E(I)*T1(L))*Q(I,K,M)
      IF(L-J1-1)109,109,110
  110 J3=2*(L-6*(LL-1))-3
      DO 111 K=1,6
      DO 111 M=1,6
  111 EMT2(J3,K,M)=EMT(K,M)
```

```
  109 DO 112 K=1,6
      DO 112 M=1,6
      IF(L-J1-1)113,113,114
  114 EMT(K,M)=0.0
  113 DO 112 I-4,6
  112 EMT(K,M)=EMT(K,M)-EXPF(E(I)*T2(L))*Q(I,K,M)
      IF(L-J1-1)115,115,116
  115 J5=L-J1+1
      DO 117 K=1,6
      DO 117 M=1,6
  117 EMT2(J5,K,M)=EMT(K,M)
      GO TO 107
  116 J4=2*(L-6*(LL-1))-2
      DO 118 K=1,6
      DO 118 M=1,6
  118 EMT2(J4,K,M)=EMT(K,M)
  107 CONTINUE
C     THE PARTICULAR SOLUTION OF THE PROBLEM
  194 DO 119 J=1,2
      DO 120 K=1,6
      DO 120 L=1,6
  120 G(K,L)=EMT2(J,K,L)
      CALL INV20(G,6)
      DO 119 K=1,6
      DO 119 L=1,6
  119 EMT2(J,K,L)=G(K,L)
      DO 121 K=1,6
```

```
      DO 121 L=1,6
  121 G(K,L)=EMT1(K,L)
      CALL INV20(G,6)
      DO 122 K=1,6
      DO 122 L=1,6
  122 EMT1(K,L)=G(K,L)
      DO 123 J=1,4
  123 TOU(J)=TZ(LL)*TE(J+2)
      MM=0
  127 MM=MM+1
      IF(MM-3)124,124,125
  124 MN=0
  133 MN=MN+1
      IF(MN-8)126,126,127
  126 WRITE OUTPUT TAPE 3, 163, NN, LL, MM, MN, ADB1, ADB2
  163 FORMAT(2X, 3HNN=, I4, 3HLL=, I4, 3HMM=, I4, 3HMN=, I4,
      2E12.6)
      DO 128 J=1,4
  128 TEM(J)=(TS2(MN)-TS1(MN))*(TOU(J)/TZ(LL)+BC(MM)*TOU(J)/
      TZ(LL)*(1.-TOU(J)/TZ(LL)))+TS1(MN)
      KL=0
  170 KL=KL+1
      IF(KL-2)146,146,133
  146 IF(MN-1)150,150,149
  150 IF(MM-1)500,500,149
  500 DO 151 K=1,6
      DO 151 L=1,3
```

```
151 Z(KL,K,L)=EMT2(2,K,L)+2.*FL2(KL)*W(L)*U(L)*(EMT2(2,K,4)
    +EMT2(2,K,5)+EMT2(2,K,6))
    DO 152 K=1,6
    DO 152 L=4,6
152 Z(KL,K,L)=-1.*(EMT2(1,K,L)+2.*FL1(KL)*W(L-3)*U(L-3)*
    (EMT2(1,K,1)+EMT2(1,K,2)+EMT2(1,K,3)))
    DO 153 K=1,6
    DO 153 L=1,6
153 G(K,L)=Z(KL,K,L)
    CALL INV20(G,6)
    DO 154 K=1,6
    DO 154 L=1,6
154 Z(KL,K,L)=G(K,L)
149 LM=0
147 LM=LM+1
    IF(LM-9)132,132,133
132 DO 134 J=1,4
134 D(J)=H/FK*V(LM)/TEM(J)
    DO 303 J=1,4
303 D(J)=0.1E-02*D(J)
    DO 135 K=1,6
    DO 135 L=1,6
135 Y2(K,L)=W4(1)*TZ(LL)*1./(EXPF(D(1))-1.)*EMT2(9,K,L)
    +W4(2)*TZ(LL)*1./(EXPF(D(2))-1.)*EMT2(7,K,L)+W4(3)*
    TZ(LL)*1./(EXPF(D(3))-1.)*EMT2(5,K,L)+W4(4)*TZ(LL)*
    1./(EXPF(D(4))-1.)*EMT2(3,K,L)
    DO 136 K=1,6
```

```
      DO 136 L=1,6
  136 Y3(K,L)=W4(1)*TZ(LL)*1./(EXPF(D(1))-1.)*EMT2(10,K,L)
      +W4(2)*TZ(LL)*1./(EXPF(D(2))-1.)*EMT2(8,K,L)+W4(3)*
      TZ(LL)*1./(EXPF(D(3))-1.)*EMT2(6,K,L)+W4(4)*TZ(LL)*
      1./(EXPF(D(4))-1.)*EMT2(4,K,L)
      IF(NN-1)137,137,138
  137 DO 139 K=1,6
      DO 139 L=1,6
      YZ2(K,L)=0.0
      DO 139 J=1,6
  139 YZ2(K,L)=YZ2(K,L)+(1.-ADB1)*EMT1(K,J)*Y2(J,L)
      DO 140 K=1,6
      DO 140 L=1,6
      YZ1(K,L)=0.0
      DO 140 J=1,6
  140 YZ1(K,L)=YZ1(K,L)+(1.-ADB1)*EMT1(K,J)*Y3(J,L)
      GO TO 143
  138 DO 141 K=1,6
      DO 141 L=1,6
      YZ2(K,L)=0.0
      DO 141 J=1,6
  141 YZ2(K,L)=YZ2(K,L)+(1.-ADB2)*EMT1(K,J)*Y2(J,L)
      DO 142 K=1,6
      DO 142 L=1,6
      YZ1(K,L)=0.0
      DO 142 J=1,6
  142 YZ1(K,L)=YZ1(K,L)+(1.-ADB2)*EMT1(K,J)*Y3(J,L)
```

```
  143 DO 144 K=1,6
      PI2(K)=0.0
      DO 144 L=1,6
  144 PI2(K)=PI2(K)+2.*H*V(LM)*V(LM)*V(LM)/(C**2)*YZ2(K,L)*
      1./U(L)
      DO 304 K=1,6
  304 PI2(K)=0.1E-02*PI2(K)
      DO 145 K=1,6
      PI1(K)=0.0
      DO 145 L=1,6
  145 PI1(K)=PI1(K)+2.*H*V(LM)*V(LM)*V(LM)/(C**2)*YZ1(K,L)*
      1./U(L)
      DO 305 K=1,6
  305 PI1(K)=0.1E-02*PI1(K)
C     THE BOUNDARY CONDITIONS AND HEAT FLUX
  186 D1=H/FK*V(LM)/TS1(MN)
      D1=0.1E-02*D1
      BI1=2.*H*V(LM)*V(LM)*V(LM)/(C**2)*1./(EXPF(D1)-1.)
      BI1=0.1E-02*BI1
      D2=H/FK*V(LM)/TS2(MN)
      D2=0.1E-02*D2
      BI2=2.*H*V(LM)*V(LM)*V(LM)/(C**2)*1./(EXPF(D2)-1.)
      BI2=0.1E-02*BI2
      DO 155 L=4,6
  155 PJ2(L)=(FL2(KL)-1.)*BI2+PI2(L)
      DO 156 L=1,3
  156 PJ2(L)=PI2(L)
```

```
      DO 157 L=1,3
157   PJ1(L)=(FL1(KL)-1.)*BI1+PI1(L)
      DO 158 L=4,6
158   PJ1(L)=PI1(L)
      DO 159 L=1,6
      QIP2(L)=0.0
      DO 159 K=1,6
159   QIP2(L)=QIP2(L)+EMT2(2,L,K)*PJ2(K)
      DO 160 L=1,6
      QIP1(L)=0.0
      DO 160 K=1,6
160   QIP1(L)=QIP1(L)+EMT2(1,L,K)*PJ1(K)
      DO 161 L=1,6
161   QIP(L)=QIP2(L)-QIP1(L)
      DO 162 L=1,6
      PIC(L)=0.0
      DO 162 K=1,6
162   PIC(L)=PIC(L)+Z(KL,L,K)*QIP(K)
      DO 166 L=1,3
166   R2(LM,KL,L)=PIC(L)
      DO 167 L=4,6
167   R2(LM,KL,L)=(1.-FL2(KL))*BI2+2.*FL2(KL)*(W(1)*U(1)*
      PIC(1)+W(2)*U(2)*PIC(2)+W(3)*U(3)*PIC(3))
      DO 168 L=1,3
168   R1(LM,KL,L)=(1.-FL1(KL))*BI1+2.*FL1(KL)*(W(1)*U(1)*
      PIC(4)+W(2)*U(2)*PIC(5)+W(3)*U(3)*PIC(6))
      DO 169 L=4,6
```

```
169 R1(LM,KL,L)=PIC(L)
    IF(LM-9)147,187,147
187 IF(KL-2)170,171,170
171 DO 172 LM=1,9
    DO 172 KL=1,2
    FLUX1(LM,KL)=0.0
    DO 172 L=1,6
172 FLUX1(LM,KL)=FLUX1(LM,KL)+2.*3.1416*W(L)*U(L)*R1
    (LM,KL,L)
    WRITE OUTPUT TAPE 3,201,((FLUX1(LM,KL), LM=1,9), KL=1,2)
201 FORMAT (2X, 36 HMONOCHROMATIC HEATFLUX AT SURFACE 1=,
    3E15.8/38X, 3E15.8/38X, 3E15.8)
    DO 173 LM=1,9
    DO 173 KL=1,2
    FLUX2(LM,KL)=0.0
    DO 173 L=1,6
173 FLUX2(LM,KL)=FLUX2(LM,KL)+2.*3.1416*W(L)*U(L)*R2(LM,KL,L)
    WRITE OUTPUT TAPE 3,202, ((FLUX2(LM,KL), LM=1,9), KL=1,2)
202 FORMAT (2X, 36HMONOCHROMATIC HEATFLUX AT SURFACE 2=,
    3E15.8/ 38X, 3E15.8/38X, 3E15.8)
    GO TO 133
    STOP
    END
```

APPENDIX IX

TABLE OF THE GAUSSIAN DIVISIONS AND GAUSSIAN WEIGHT FOR THE THIRD AND FOURTH APPROXIMATIONS REFERRED TO LOWAN, DAVIDS, AND LEVENSON (14)

n=3, m=6:

$$\mu_{\pm 1} = \pm 0.2386192 \qquad a_{\pm 1} = 0.4679139$$
$$\mu_{\pm 2} = \pm 0.6612094 \qquad a_{\pm 2} = 0.3607616$$
$$\mu_{\pm 3} = \pm 0.9324695 \qquad a_{\pm 3} = 0.1713245$$

n=4, m=8:

$$\mu_{\pm 1} = \pm 0.1834346 \qquad a_{\pm 1} = 0.3626838$$
$$\mu_{\pm 2} = \pm 0.5255324 \qquad a_{\pm 2} = 0.3137066$$
$$\mu_{\pm 3} = \pm 0.7966665 \qquad a_{\pm 3} = 0.2223810$$
$$\mu_{\pm 4} = \pm 0.9602899 \qquad a_{\pm 4} = 0.1012285$$

TABLE OF INTEGRATED LEGENDRE POLYNOMIALS, THIRD ORDER APPROXIMATION

n	$P_n(+\mu_1,+\mu_1)$	$P_n(+\mu_1,+\mu_2)$	$P_n(+\mu_1,+\mu_3)$	$P_n(+\mu_2,+\mu_2)$
1	.083170	.177115	.233393	.452862
2	.177624	-.054783	-.326990	.045114
3	.123265	.087905	-.212980	.084691
4	.045990	-.069298	.064960	.194083
5	.124093	-.102421	.072519	.104347
6	.017844	-.007148	-.002877	.017180
7	.090047	-.073157	.049056	.068439
8	.035460	-.049135	.041250	.110693
9	.048076	.025144	-.071122	.044922
10	.055190	-.010973	-.084438	.019821
11	.019626	.021881	.022974	.071360
12	.057995	.056623	.067804	.075864
13	.013412	.009060	.012817	.026853
14	.058879	.025865	-.009703	.028458
15	.042883	.029331	.004731	.064570
16	.032371	-.020633	-.023095	.050039
17	.040719	-.006057	-.044087	.017846
18	.017877	-.008308	.008275	.035083

n	$P_n(+\mu_2, +\mu_3)$	$P_n(+\mu_3, +\mu_3)$	$P_n(+\mu_1, -\mu_1)$	$P_n(+\mu_1, -\mu_2)$
1	.624263	.873727	-.030783	-.136235
2	.140093	.657685	.168326	-.078664
3	-.155543	.411817	-.083645	-.086542
4	-.154715	.198545	.021110	-.083130
5	.064966	.062078	-.099942	.096450
6	-.007536	.015778	-.017126	.006416
7	-.050322	.041814	-.079606	.071050
8	-.100782	.102207	-.003313	-.031162
9	-.069635	.156276	-.028929	-.039743
10	.023301	.176058	.014998	-.015203
11	.087184	.155291	.011194	-.025020
12	.073327	.107697	.035936	.054676
13	.022357	.057354	.021579	.004190
14	.001598	.026166	.025373	.019543
15	.022085	.024054	.007841	-.018125
16	.035849	.045962	.004359	-.030504
17	.005750	.077834	-.009762	.000685
18	-.045706	.094963	-.009696	-.006802

n	$P_n(+\mu_1,-\mu_3)$	$P_n(+\mu_2,-\mu_2)$	$P_n(+\mu_2,-\mu_3)$	$P_n(+\mu_3,-\mu_3)$
1	-.213026	-.420927	-.607880	-.866778
2	-.339656	.002891	.110154	.639543
3	.194897	-.061276	.179839	-.382485
4	.084897	.175422	-.180096	.161996
5	-.066480	-.070954	.052868	-.024347
6	-.009180	-.016692	.005184	-.017704
7	-.063837	-.053967	.045083	-.015185
8	.041969	.088265	-.095385	.081439
9	.072634	-.012198	.058923	-.137416
10	-.078353	-.009969	.038435	.154535
11	-.034253	-.047623	-.094882	-.127955
12	.060162	.045446	.066544	.074234
13	.003920	.007818	-.007141	-.020305
14	-.009071	.003457	-.010363	-.010443
15	-.017496	-.032851	-.017685	.008545
16	-.020430	.020828	.033527	.018895
17	.048193	.014344	-.000146	-.053591
18	.010019	.011100	-.051415	.076079

TABLE OF INTEGRATED LEGENDRE POLYNOMIALS

FOURTH ORDER APPROXIMATION

n	$P_n(+\mu_1,-\mu_1)$	$P_n(+\mu_1,+\mu_2)$	$P_n(+\mu_1,+\mu_3)$	$P_n(+\mu_1,+\mu_4)$
1	.060346	.118601	.161768	.183722
2	.204447	.044337	-.196369	-.392131
3	.091523	.117545	-.022210	-.211749
4	.071589	-.072916	-.059499	.152844
5	.101788	.007691	-.120900	.143648
6	.024757	-.027607	.032087	-.027429
7	.095832	-.079485	.063185	-.043008
8	.015045	-.007411	.002980	-.004713
9	.070910	-.059530	.052640	-.038418
10	.029122	-.032584	.033506	-.022655
11	.048347	-.002388	-.051665	.068382
12	.038203	-.034687	-.023221	.061777
13	.032148	.021955	-.001827	-.050468
14	.051489	.013408	-.038030	-.075155
15	.020543	.012458	.003840	.014553
16	.050996	.041560	.041556	.053533
17	.015357	.006153	.003881	.006944
18	.044806	.027032	.007522	-.014572

n	$P_n(+\mu_2,+\mu_2)$	$P_n(+\mu_2,+\mu_3)$	$P_n(+\mu_2,+\mu_4)$	$P_n(+\mu_3,+\mu_3)$
1	.297287	.432832	.511819	.645738
2	.025509	-.020681	-.065280	.224459
3	.189742	-.022319	-.326040	.022567
4	.116792	.080104	-.216411	.068461
5	.016154	-.008075	.004498	.170157
6	.100947	-.112889	.093804	.163786
7	.089726	-.066657	.045902	-.026506
8	.019044	-.005705	.004902	.017682
9	.069709	-.051285	.032514	.051325
10	.073611	-.076116	.058164	.102054
11	.017208	-.011055	.009501	.093426
12	.048634	.026741	-.071953	.042008
13	.063011	-.007940	-.089149	.019211
14	.019880	-.012064	-.021763	.047804
15	.038452	.036121	.051493	.078281
16	.055848	.044193	.058630	.064924
17	.023262	.008808	.016729	.026967
18	.036524	.012178	-.010167	.015339

n	$P_n(+\mu_3,+\mu_4)$	$P_n(+\mu_4,+\mu_4)$	$P_n(+\mu_1,-\mu_1)$	$P_n(+\mu_1,-\mu_2)$
1	.769846	.924308	-.006160	-.072026
2	.410413	.786026	.198812	-.093966
3	.068167	.608558	-.046710	.102402
4	-.141682	.420673	.056400	-.094906
5	-.188013	.250581	-.067598	-.013170
6	-.124094	.120385	-.003685	-.035153
7	-.040891	.042147	-.067202	.074684
8	-.006980	.016389	-.019952	.007032
9	0.033268	.033223	-.054134	.060409
10	-.080496	.075692	-.010782	-.014452
11	-.097886	.124414	-.030199	-.006372
12	-.062584	.162266	.002805	-.029999
13	.006810	.178105	.011399	-.034392
14	.068174	.168603	.021386	.008864
15	.088380	.137978	.010286	-.013792
16	.065435	.095877	.027565	.038964
17	.025637	.054103	.017810	.006338
18	.000781	.023154	.026126	.025003

n	$P_n(+\mu_1,-\mu_3)$	$P_n(+\mu_1,-\mu_4)$	$P_n(+\mu_2,-\mu_2)$	$P_n(+\mu_2,-\mu_3)$
1	-.127871	-.167725	-.255609	-.404048
2	-.212236	-.391792	-.009739	-.057276
3	.009067	.190778	-.173121	.036383
4	-.056458	.167688	.090286	.078539
5	.114259	-.132567	.015074	.017612
6	.050333	-.042780	.082439	-.120564
7	-.062636	.039807	-.055685	.055325
8	-.006181	.004429	-.018764	.007296
9	-.051758	.037788	-.045135	.045764
10	.023272	-.022967	.042039	-.067700
11	.061760	-.069858	.016690	-.005969
12	.200314	.055977	.024999	.037651
13	-.003263	.057362	-.030381	.009552
14	-.035607	-.068765	-.018760	-.012796
15	-.015018	-.025414	-.010823	-.040776
16	.043759	.050672	.025028	.041962
17	.004469	.003189	.012698	.002531
18	.005228	-.015253	.009026	.003280

n	$P_n(+\mu_2,-\mu_4)$	$P_n(+\mu_3,-\mu_3)$	$P_n(+\mu_3,-\mu_4)$	$P_n(+\mu_4,-\mu_4)$
1	-.498002	-.625254	-.760630	-.919974
2	-.085125	.185236	.389189	.773995
3	.333607	.015892	-.040622	-.587167
4	-.203161	.043843	-.164996	.390264
5	-.025579	-.152741	.198365	-.213297
6	.103244	.139339	-.119730	.079577
7	-.039961	-.037391	.027321	-.001485
8	-.006787	-.015904	.007388	-.021044
9	-.027216	-.025795	.023764	-.000823
10	.058141	.079708	-.075871	.048541
11	-.008234	-.065473	.094047	-.101244
12	-.074198	.008841	-.055710	.140854
13	.085793	.010641	-.016609	-.158763
14	-.011597	.025147	.076652	.129921
15	-.059674	-.056241	-.090368	-.109601
16	.054046	.035502	.058827	.064267
17	-.005830	.007985	-.013084	-.020710
18	-.018649	-.016145	-.012126	-.009953