with falling B, at roughly the same rate as has been found to hold for other laminar flows.

Also included on Fig. 4 is a curve valid for infinite values of σ. This case was not considered by Sparrow and Gregg, but has been solved by us, using the methods of Paper 3; it is included for comparison. It will be seen that the role of the Prandtl/Schmidt number in modifying the ordinate is similar for a rotating disk to that which it plays in the different aerodynamic flow patterns discussed in Paper 3.

A few extra points are available on the line $B = 0$; these have been deduced from solutions presented by Millsaps and Pohlhausen [4] and Sparrow and Gregg [5] as quoted by Kreith, Taylor and Chong [6].

4. OTHER NEW SOLUTIONS

Koh and Hartnett [7] have recently published solutions for negative B, $\beta = 0$, $\frac{1}{2}$ and 1, and a σ-value of 0·73. In translating these results into the present form, we have found: (i) that the necessity to read from small-scale diagrams leads to considerable uncertainty in the location of the corresponding lines on a plot such as that of Fig. 1; (ii) that the Koh–Hartnett solutions deviate systematically and considerably as $B \to -1$ from the asymptotically correct solution of Acrivos. For these reasons, we have not reproduced any of the Koh–Hartnett solutions in the present note.

The most interesting feature of the work of Koh and Hartnett is that they also obtained solutions for cases in which, though B was uniform along the surface, P_G was not.

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RADIATION AS A DIFFUSION PROCESS

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The paper "On the regularities of composite heat transfer" by Konakov, appearing in the March 1961 issue of the Journal, is in my opinion quite misleading in suggesting that combined conduction and radiation in absorbing–emitting–conducting bodies may be so treated as to obtain a simple explicit solution of the problem which is valid over the full range of variation in body dimensions—measured in mean free paths. Konakov recommends equations purporting to give the flux from hot to cold wall due to radiation and conduction acting together, for the three cases of a diathermanous medium in steady state between hot and cold parallel plates, between concentric cylinders or between concentric spheres. His recommendations for parallel walls are easy to test, since several authors have treated that case rigorously. Fig. 1 (from a lecture "Some Problems in Radiative Transport" presented by the present author at the International Heat Transfer Conference, Boulder, Colorado, August 1961) shows the Konakov recommendations, heavy lines, for comparison with the rigorous solution, light line. The graph adequately supports the generalization that radiative flux is expressible as a diffusion process $D_r(\mathrm{d}\phi/\mathrm{d}x)$ only where $\mathrm{d}\phi/\mathrm{d}x$ is constant for several mean free paths on either side of the plane of interest. Here D_r is the diffusivity of photons and ϕ is the radiation density of local space $= 4E/c$; $E = \sigma T^4$; c = velocity of light. Konakov does distinguish between molecular temperature T and radiation temperature T_r, but the equations he finally recommends do not permit the distinction. It is clear on physical grounds that when KL is small there is no dodging the solution of an integral equation or its equivalent.

The Konakov analysis also makes use of what the present author believes is an incorrect value of D_r, namely $cl_s/4$ instead of $cl_s/3$, where l_s is the mean free path of a photon or $1/K$ (K is the absorption coefficient).

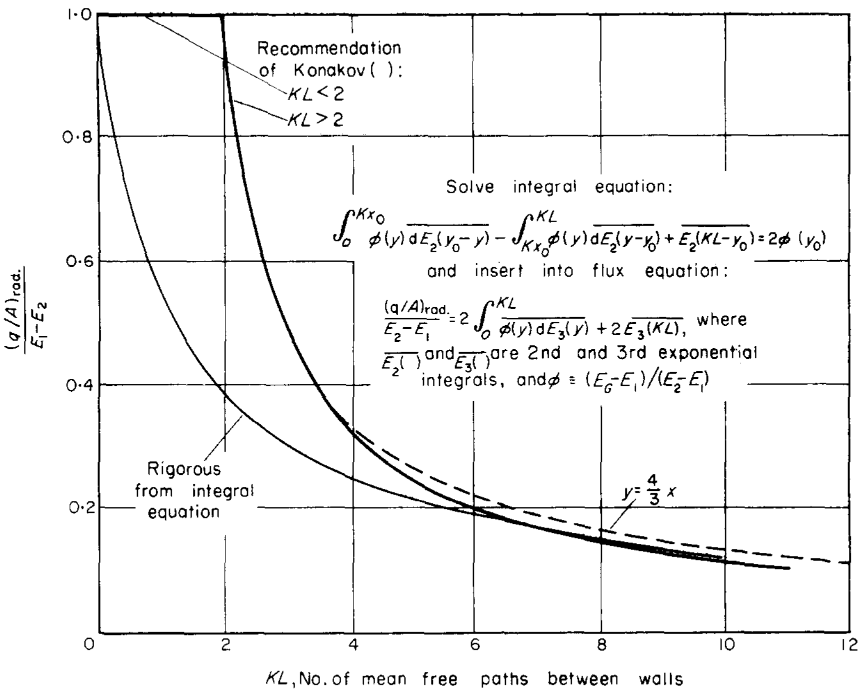

FIG. 1.

This difference is discussed by the present author in the referenced paper.

Many problems of practical interest lie in the KL range 0 to 3 where, as the figure indicates, the proposed approximation has negligible value. When KL is large the technique of adding λ_c and $16\sigma T_{AV}^3/3K$ to obtain λ_T, where λ_c is the true thermal conductivity and λ_T is the effective or "total" conductivity due to conduction plus radiation, is well known.

FREE CONVECTION FROM A SPHERE IN AIR

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PRINCIPAL MEASUREMENTS AND RESULTS

EXPERIMENTS were carried out to measure overall convection heat transfer from a sphere. The aluminium sphere, 4 in external diameter and ⅜ in thick, was heated internally by an electric element. It was suspended in air, with all heating and thermocouple wires entering at the top, and protected from draughts by a large polythene "tent".

Temperatures were measured with calibrated copper–constantan thermocouples and a Tinsley portable otentiometer. Power input was found with a Cambridge dynamometer wattmeter. Radiation losses were determined separately by measurement in a vacuum chamber (better than 10^{-4} mm Hg).

The approximate ranges covered in the experiments were:

temperature difference between surface and air	$43 < \theta_w < 312°F$
heat input	$4 < q < 50$ W
Grashof number	$3 \times 10^6 < G_d < 8 \times 10^6$

The worst non-uniformity of θ_w over the surface was