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APPLICATION OF THE KINETIC THEORY OF PARTLY IONIZED GASES TO RADIATION TRANSFER AND IONIZATION IN HYDROGEN NEBULAE

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SUMMARY

The problem of ionization produced by a hot star embedded in a hydrogen nebula is studied from a basic standpoint. The necessary equation of radiative transfer is derived by introducing a distribution function in photon phase-space, and subjecting it to the procedures of classical kinetic theory. It is found that the distribution function can be separated into a singular part corresponding to "direct" radiation from the star, and a non-singular part corresponding to "diffuse" radiation. The concept of statistical equilibrium is applied to the electron population to provide an auxiliary equation, and the Stromgren equation derived as an approximation.

A qualitative discussion of the exact equations shows that for a wide range of physical parameters a well defined ionized region surrounds the star. Ionizing radiation undergoes little absorption within this region, but it is rapidly extinguished at the boundary. The radius of the ionized region and the form of the boundary are discussed, and their dependence on the various physical parameters interpreted. Numerical solutions neglecting the effect of diffuse radiation confirm the predictions for that case.

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and that to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text.