SCOPE AND OBJECT OF THE THESIS

The problem of the formation of spectral lines is essentially the problem of deducing the properties of the atmosphere by calculating the line contour and comparing it with our observations of the strength and shape of the spectral line. To obtain the theoretical line contour we have to form the equation of transfer on the basis of theoretical considerations and to solve it by some suitable methods. It was Eddington who first introduced the idea of noncoherent scattering to explain the observed central core of strong Fraunhofer lines. Houtgast used this novel idea to explain the center-limb variation of the line intensities of along the solar disc. After Houtgast,a good number of workers (e.g. Spitzer,L) investigated the physical problems behind the noncoherent scattering of radiation while others engaged themselves in the mathematical problems of solving the noncoherent equation of transfer. (e.g. Busbridge,I.W. ; Stibbs,D.W.N. ; Sobolev,V.V. ; Savedoff,M.P. ; Münch,G. ; Ueno,S. ; Miyamoto,S.)

In some forms of integral representations of the residual intensity the H-functions often appear within the integral sign. In such cases it is advantageous to have a good approximate form for the M H-function in a sufficiently simple form so that a single direct integration may give an appreciably good result from practical point of view. This difficulty was faced while working with the solution of Busbridge and Stibbs[2] for interlocked multiplets and the difficulty became all the more acute when we tried to find the residual intensities of triplets. Therefore, before undertaking the problem of triplet calculation we searched for an appropiate approximate form for the H-function. Sobolev's approximate form proved to be inadequate for our purpose and we have been able to construct approximate forms for the H-function which are proved to be quite suitable for the problems under consideration. The approximate forms involve some parameters which have been determined by a complex process of curve-fittings based on some analytical properties of H-function. One of these approximate forms of H-function has been succeslly used to construct numerical Tables of H-function(correct upto five places of decimals) corresponding to the fractional values of the albedo ω in the range $0 \leq \omega \leq 0.5$. Beyond this range any of the three forms can be used to get values of H-function correct upto third decimal places.

The equation of transfer for the interlocked multiplets has been solved by applying Sobolev's probabilistic method. The solution can be reduced to the same form as that obtained by Busbridge and Stibbs[2]. The contour of Mg b lines has been calculated on the basis of this exact solution and also on the basis of the solution obtained by considering the scattering to be coherent for each member of the triplet. The results so obtained show that the theoretical contours for the case of interlocking without redistribution and for the case of coherent sca-ttering exhibit very little difference.

In developing the theory of noncoherent scattering to explain the observed small central residual intensities of absorption lines(according to the theory of coherent scattering this central intensity should vanish) the noncoherent part of emission in the transfer equation has been attributed to the so called average intensity $\bar{J}(t)$. For the actual solution of the problem, however, $\bar{J}(t)$ has been approximated by different authors in different ways to explain the wings of a line. We consider two forms given by Geovenelli (3) and by Das Gupta (4) and get the residual intensities for the two cases using Eddington's approximate method. Line contours of solar Ca K line calculated with these solutions have been plotted. The graphs show certain interesting features.

The equation of transfer is often solved by using Eddington's approximation. This approximation, however, introduces unavoidable errors to a certain degree. Eddington gave another approximation known as Eddington's ammended approximation, where he introduced a new function $f(t) = 1/g(t)$. To show how this ammended approximation can be used for the solution of complex transfer equation we have solved the transfer equation for completely noncoherent scattering with the form of $g(t)$ given by Böhm-Vitense (6) and obtained improved results closer to observed ones.