SHORT ORAL CONTRIBUTIONS
(ABSTRACTS)

THE EFFECTS OF SCATTERING BY INTERNAL DUST ON THE SPECTRA OF EMISSION NEBULAE

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The intrinsic reddening of H II-regions, as indicated by the Balmer decrement and the ratio between the auroral (PD) and transauroral (PS) lines of [S II], has been modeled on basis of analytical solutions for the transfer of radiation in a semi-infinite homogeneous distribution of emitting atoms and intermixed scattering dust. The scattering phase function has been specified by albedo \( \omega \) and asymmetry \( <\cos \theta> = g \) as calculated by White (Ap. J., 229, 954, 1979) for uncoated graphite and silicate particles. It has been found that the intrinsic color excess, over the recombination value, between the H\(\alpha \) and H\(\beta \) lines is \( E(\beta - \alpha) = 0.520 \). The intrinsic color excess between the [S II] lines, over their collisional excitation values, is \( E([S II]PS-PD) = 0.571 \). The effects of scattering by dust in a thin layer overlying the model H II-region has also been calculated. It has been found that for a layer with extinction optical depth \( \tau_\beta = 0.50 \), produces color excesses \( E'(\beta - \alpha) = 0.003 \) and \( E'( [S II]PS-PD) = 0.112 \), practically impossible to discriminate against truly interstellar reddening. The results have been extended to obtain the unreddened UV energy fluxes of HH-objects, on the assumption that they contain well mixed scattering dust. For HH-1 it is found that the external extinction amounts only to \( \tau_\beta = 0.50 \), in comparison with the value \( \tau_\beta = 1.67 \) found from the [S II] lines when the extinction is assumed to be entirely interstellar. Consequently, the energy distribution of HH-1 in the UV, taking into account internal scattering, falls one full order of magnitude below that estimated by Bohm et al. (Ap. J. [Letters] 245, L113, 1981).

DISCUSSION

Bohm: In view of the small column density in HH-objects would not (for normal dust-to-gas ratio) the internal scattering in HH-objects always be very small?

Münch: If the dust to gas ratio were normal, the path for line formation would be indeed larger than observed (filling factor \( \sim 10^{-3} \)). In order to have the H\(\beta \) path of formation accounting for the fitting factor, the gas column density corresponding to optical depth at H\(\beta \) would have to be about \( 10^2 - 10^3 \) smaller than -say- in the Orion Nebula.

Boettger: How do your analytical results compare with the recent numerical work by Mathis?

Münch: In regard to the H\(\beta \) - H\(\alpha \) color excess over recombination value they essentially agree.