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Analysis of the Balmer discontinuity behavior of Be stars by the Monte Carlo method

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Abstract. For a given photospheric model, we study the behavior of the BD as different density and temperature distributions in the circumstellar envelope are assumed. For non spherically symmetric envelopes, we analyze the variation of the BD when the angle of observation varies. The radiation transfer through the medium is handled by means of the Monte Carlo method. We calculate the flux emitted by the star+envelope system in a small wavelength range around the BD. The calculations are made under LTE conditions.

Keywords. stars: early-type, circumstellar matter

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1. Methodology

The Monte Carlo technique we used to solve the radiation transfer through the medium is illustrated en Fig. 1

The ratios of the number of photons emitted at each frequency (N_ν) to the total number (N) have been set deterministically taking into account that $N_\nu/N = L_\nu V\nu/cL$, where V is the highest value of the velocity in the medium, L and L_ν are the ν and total luminosity, respectively.

2. Test

The photospheric jump of normal stars could be reproduced with our code. Also we have been able to reproduce some results obtained by conventional methods (Crivellari & Simonneau 1994, Gros *et al.* 1997) for spherically symmetric envelopes. These results constitute the test of our code.

3. Envelope Model

To describe the density distribution in the envelope we have considered monotonic decreasing functions with r, as well as distributions that take into account an accumulation of material near the star (Zorec *et al.* 2007). To take into account non spherically simetric matter distribution, decay from equator to pole have been considered. Regards the temperature, it is assumed constant through the envelope, taking values in the range 5000K-30000k.

The opacity sources we have considered are: hydrogen bound-free and free-free transitions, electron scattering and H Rayleigh scattering.

The calculations have been performed under LTE conditions.

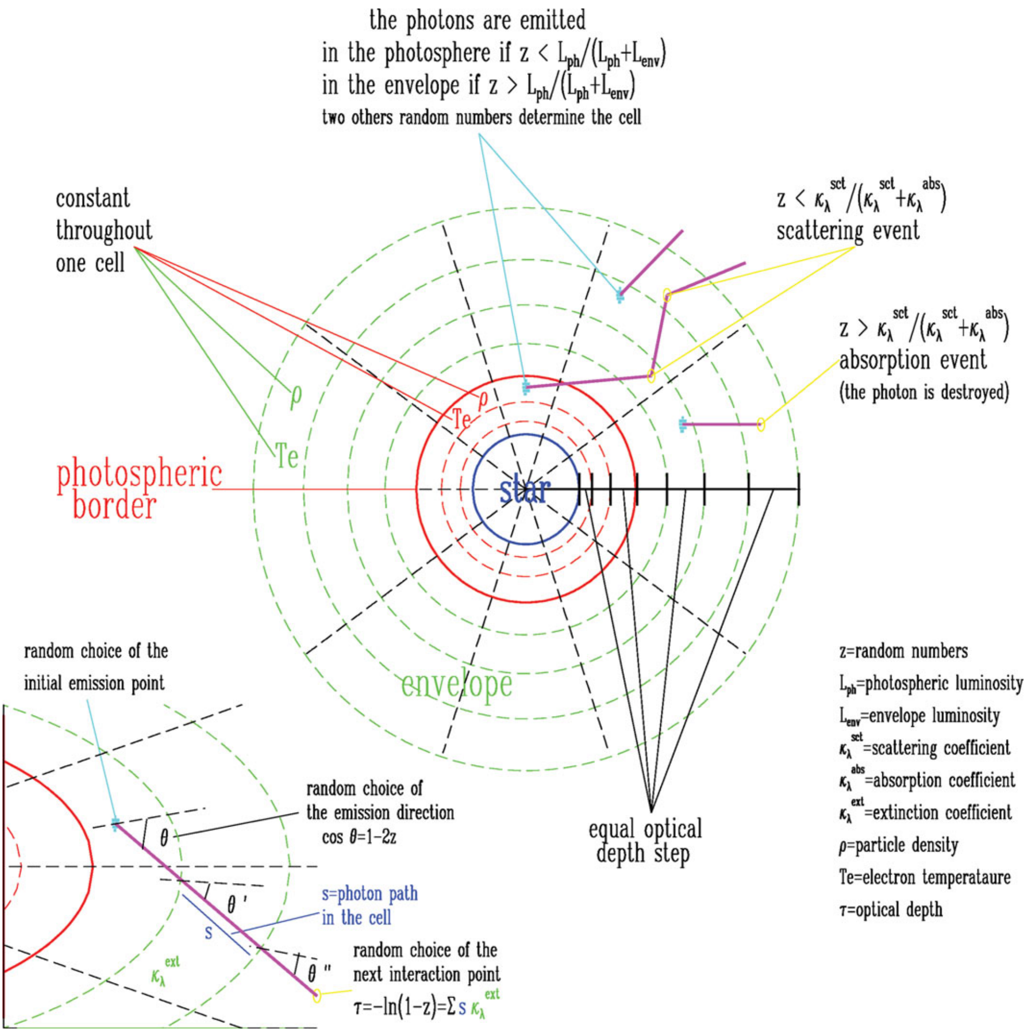

Figure 1. Monte Carlo Method illustration

4. Results and Conclusions

From our preliminary results some general trends could be observed. For a given spectral type, the appearance of the BD depends on the density distribution in the envelope, the temperature in the envelope, and the angle of observation. For very low densities and/or geometrically thin envelopes no second jump is observed. For a given spatial distribution of the material around the star, the size of a second jump in emission depends on the envelope temperature. In spatially not too extended envelopes, the second jump can be observed in absorption for low temperatures in the envelope.

References

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