E P6 The deforming effect of stellar magnetic fields on spectral line profiles

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The profile of a stellar spectral line is formed by the transfer of radiation through the atmosphere by atomic processes at different chemical elements distributed usually unequally over the surface of a star. The theory of model atmospheres accounts for all possible physical conditions, but is worked out mainly for a homogeneous element arrangement in a plane atmosphere stratification. This *plane atmosphere line profile,* however, is heavily deformed by the geometrical influence of the topographic element distribution and the magnetic surface field structure as well as the projection to the line of sight of the radiation outgoing from all surface points of the star's sphere and its integration over the visible disk.

The line forming by the geometry of projection and element distribution is used for the inverse procedure of Doppler imaging by V.L. Khokhlova and her followers. We consider here only the influence of the magnetic field on the line profile, which we study in separation from other effects. The outcome is, that the magnetic field and the projection make a symmetric "plane atmosphere profile" asymmetric in dependence on the aspect of the star's globe in phase of rotation. The effect is demonstrated graphically.

The line profile deformation by the magnetic field leads to a fatal consequence for the traditional measurement of stellar magnetic fields by the Zeeman displacement of the circularly polarized σ-components: The large scatter of measuring points is partly due to the uncontrolled asymmetry of line profiles!
