Polarized line formation in spherically symmetric expanding atmospheres

Megha A.[1], Sampoorna Malali*[1], Nagendra K.n.[1], Anusha L.s.[2], and Sankarasubramanian K.[3,4]

[1]Indian Institute of Astrophysics, Koramangala, Bengaluru – India
[2]Max-Planck-Institut für Sonnensystemforschung, Justus-von-Liebig-Weg 3, 37077, Göttingen, Germany – Germany
[3]Space Astronomy group, ISRO Satellite Centre, Bengaluru, India – India
[4]CESSI, IISER, Kolkata – India

Abstract

In this paper we consider the problem of polarized line formation in the spherically symmetric expanding atmospheres. The presence of velocity fields in the line forming regions produces Doppler shift, aberration of photons and also gives rise to advection. All these effects can modify the amplitudes and shapes of the emergent Stokes profiles. However, in this paper, we consider only non-relativistic regime wherein mainly Doppler shift effects are significant. Thus only Doppler shift terms are considered in the polarized transfer equation and aberration and advection terms are ignored. For the solution of the concerned polarized transfer equation we use the comoving frame formulation, and apply the Accelerated Lambda Iteration (ALI) method. We present the results by considering the scattering on a two-level atom, including the effects of partial frequency redistribution (PFR). The polarized line profiles would be shown for few velocity laws representative of expanding spherical atmospheres. It is shown that the degree of polarization in the lines sensitively depends on the extendedness R, and velocity gradient dV/dr within the atmosphere. We also present a comparison of polarized profiles computed under complete frequency redistribution (CFR) and PFR in the case of static as well as expanding atmospheres.

*Speaker