# HOST STAR AND EXOPLANET CHARACTERIZATION WITH TRANSIT POLARIMETRY.

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Stellar intrinsic polarization from scattering is an important effect for investigating the physical and geometrical properties of stars and stellar environments. Scattering and absorption processes in stellar atmospheres affect the center-to-limb variation of the intensity (CLVI) and the linear polarization (CLVP) of the stellar radiation. There are several theoretical and observational studies of CLVI using different stellar models (see, [1, 6]). However, previous studies of CLVP is mostly concentrated on the solar atmosphere [2, 7, 8], while the CLVP in cooler non-gray stellar atmospheres was for the first time considered by us in [4]. Here we present our theoretical study of the CLV of the intensity and the linear polarization in continuum spectra of different spectral type stars. We solve the radiative transfer equations for polarized light iteratively assuming no magnetic field, a plane-parallel model atmosphere and various opacity sources. We calculate the CLVI and the CLVP for Phoenix stellar model atmospheres [3] for the range of effective temperatures (4500 K - 6900 K), gravities (log g = 3.0 – 5.0) and wavelengths (4000 - 7000 Å). We show that linear polarization is a sensitive tool to test stellar model atmospheres with respect to their temperature profiles and particle density distributions.

In most cases it is not possible to resolve stellar disks to measure the CLVP of its radiation directly. It is expected that any intrinsic polarization of solar-type stars integrated over the disk is likely to be very small, and it can only be increased if the symmetry of the disc is broken. This is the case if a star possesses a non-spherical radiation field as a result of geometric distortion, due to fast rotation or tides in binaries, or due to a non-uniform photospheric surface brightness. For example, the latter can happen in case of: a) starspots, b) inhomogeneities in the outer atmosphere where scattering takes place, c) because of transiting exoplanets that blocks a part of the stellar radiation and, hence, breaks the symmetry of the stellar disc. We present results of numerical simulations of the variation of flux and linear polarization in transiting exoplanetary systems, caused by braking of the symmetry of the host star disk [5]. Various configurations of planetary transits with different orbital parameters were considered. The contribution of starspots to the polarized signal is also estimated. Applying our method to known systems and simulating observational conditions, a number of targets are selected where transit polarization effects could be detected. We investigate several principal benefits of transit polarimetry, particularly, the determination of the spatial orientation of the planetary orbit and the distinction between grazing and near-grazing planets. Simulations show that the polarization parameters are also sensitive to starspots, and can be used to determine spot positions and sizes.

**References:**

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