Detecting Extrasolar Planets by High-Precision Polarimetry

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The direct detection of close orbiting extrasolar planets (or Hot Jupiters) is difficult as these planets cannot be spatially resolved from their stars using existing instruments. Spectroscopic direct detection of the planets has so far proved unsuccessful. Photometric direct detection is possible but requires higher photometric precision than is possible from ground-based telescopes.

We are aiming to detect the scattered light from a planet by means of its polarization. This requires measurement of the fractional polarization of the combined light of the star and planet to levels of around one part in a million, about 100 times better than is normally achieved in astronomical stellar polarimetry. To do this we have designed and built a high-sensitivity stellar polarimeter (PLANETPOL). Test observations have demonstrated that we can correct the polarimetry for all instrumental effects and achieve the required sensitivity. Preliminary results indicate that normal nearby stars have very low polarizations. We have begun a series of observations of two bright hot Jupiter systems in order to search for the expected polarimetric variations around the orbital period. If successful, we should be able deduce information on the planet's albedo, orbital inclination (and hence mass), and on the nature of the scattering particles in the planet's atmosphere.