Solar polarimetry and the need for fast and low-noise detectors
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Studies of the Sun's magnetic field are the key to our understanding of solar activity and related phenomena, like e.g. space weather or the influence of the Sun on our climate system. In collaboration with the MPI semiconductor lab we are developing a novel Fast Solar imaging Polarimeter (FSP) to measure the polarization of sunlight which carries the magnetic field information. In contrast to existing instruments, the emphasis of FSP is on increased polarimetric accuracy in combination with high spatial and temporal resolution. The main scientific focus of FSP will be on studies of small-scale and rapidly evolving magnetic structures which are believed to play a major role in the energy balance of the solar atmosphere. The current FSP concept is based on a high frame-rate (400 fps), low-noise (< 4 e^- RMS) pnCCD camera, and ferroelectric liquid crystals for polarization modulation. The fast modulation suppresses spurious signals induced by external disturbances such as atmospheric turbulence, and allows to conserve spatial resolution by means of post-facto image restoration algorithms. An FSP prototype based on a small pnCCD camera has been successfully tested at the German Vacuum Tower Telescope of the Tenerife Observatory. The first science-ready version of FSP, equipped with a dedicated 1kx1k pnCCD, will become operational in 2016. As a future step a system based on DEPFET sensors will be assessed, which will potentially allow us to further increase the extent of the parameter space while relaxing the data rates.