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Low mass X-ray binaries: a polarimetric view

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Low mass X-ray binaries are binary systems hosting a compact object (a stellar mass black hole or a neutron star) which accretes mass from a low-mass companion star through an accretion disc.
These systems are perfect laboratories to study accretion mechanisms, and how these are coupled with ejections in the form of jets and/or winds. Optical and near-infrared (NIR) observations are of great importance, since at these frequencies, the companion star, accretion disc, the jet, the hot spot, the accretion disc wind and the hot accretion flow could be detected.
Carefully modeling the broad band spectral energy distribution of these systems can reveal sources of emission such as the disc and jet, but sometimes this is insufficient to disentangle all the components involved in the emission. Spectroscopic observations are an important tool in order to unambiguously detect the presence of discs or winds, thanks to the observation of specific features in the spectrum, like double-peaked emission lines and P-Cygni profiles. A very powerful tool is also offered by polarimetric observations, which, especially if combined with photometry or spectroscopy, can help to unveil unambiguously what physical processes are at play in the system, and can give important information about the geometry of the source.
Only a few physical processes are capable of producing polarized radiation in X-ray binaries. Jets emit synchrotron radiation, that is known to be intrinsically linearly polarized. Their synchrotron spectra are optically thick from the radio up to the synchrotron break frequency, which typically falls in the infrared when compact jets are produced in the hard state. Above this frequency, the spectrum turns optically thin. The polarization level is therefore expected to be high (up to tens of %) in the near infrared, depending on the level of ordering of the magnetic field lines in the jet. Observations have shown that this ordering is however quite low in the majority of cases, near the jet base. At optical wavelengths, despite the spectrum of the jet being optically thin, the expected level of polarization due to the jet will be low (a few per cent), because the jet contribution is low compared to other sources of emission, such as the accretion disc.
A few per cent linear polarization in the optical could also arise from Thomson scattering with free electrons in the accretion disc; in this case the polarization spectrum will typically rise towards higher frequencies. In addition, a possible variability of the polarization level with the orbital phase of the system can be observed. Similarly, scattering of the accretion disk's radiation in the hot accretion flow located close to the inner radius of the disk can give rise to linear polarization.
In this talk I will present a review of the most recent and significant polarimetric measurements of Low Mass X-ray binaries. I will first focus on the polarization measurements aimed at detecting the emission of jets, showing how these can be crucial to probe the accretion/ejection coupling scenario proposed for these sources. I will also review how polarimetric observations can give important information on the geometry of the systems, and I will show how the contribution of jets and hot flows to the emission of X-ray binaries can be constrained thanks to polarimetric observations.

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