Untangling Magnetic Variability in M Dwarfs: Implications for Stellar Characterization with PLATO

Accurate stellar characterization is fundamental for understanding the nature of exoplanets and their potential habitability. This is especially critical for low-mass stars, which are key targets for current and upcoming surveys such as PLATO, which will provide unique data for the precise characterization of Sun-like stars and M dwarfs. To make the most of these data, it is essential to assess, understand, and account for the numerous effects that can impact stellar characterization. Magnetic fields in M dwarfs are known to affect the determination of stellar atmospheric parameters and to induce spurious signals in radial velocity curves. They are also highly variable on both short and long timescales, complicating the precise study of exoplanetary systems. In this talk, I present recent efforts to improve the modeling of high-resolution near-infrared spectra of magnetically active low-mass stars. Our method aims to simultaneously constrain atmospheric parameters and magnetic field strengths by fitting forward models of spectra to observations, providing more accurate constraints. Using data from instruments such as SPIRou, and relying on approximately three years of observations, we investigate how small-scale magnetic field structures evolve and influence stellar spectra over time. We detect clear rotational modulation in the magnetic field measurements of several stars, along with long-term variations in both the amplitude and mean level of the modulated signal. Such an approach can provide complementary information to PLATO whose use in synergy with spectroscopy will allow the community to obatin unprecedented constraints on the properties of stars and planets.