Probing binary supermassive black holes through spectropolarimetry

Nearly all galaxies are believed to host a supermassive black hole (SMBH) at their center. In the context of galaxy mergers, the SMBHs from the progenitor galaxies are expected to form a bound binary system. Given the high frequency of such mergers throughout cosmic time, binary SMBHs should be relatively common in active galactic nuclei (AGNs). Yet, their direct detection remains a major observational challenge, with most candidates inferred only through indirect signatures.

In this presentation, I will explore the potential of spectropolarimetry as a tool to detect and characterize SMBH binaries in AGNs. By modeling the full spectral energy distribution (SED), the polarization degree, and the polarization angle over a broad wavelength range, it becomes possible to disentangle the contributions from various AGN components—accretion disk, dusty torus, and host galaxy—and to identify features consistent with a binary SMBH configuration.

Such investigations support the case for future high-sensitivity UV spectropolarimeters. In particular, a next-generation instrument like POLLUX, proposed for the Habitable Worlds Observatory, would enable stringent tests of binary SMBH scenarios through features such as double peaks in polarized flux. These observations will provide critical constraints on black hole growth, feedback mechanisms, and the evolution of AGNs.