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Chasing Shadows: Unveiling the Electromagnetic Secrets of Binary Black Hole Mergers

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The detection of electromagnetic counterparts of gravitational wave events from binary neutron star mergers has laid the foundation for multi-messenger astronomy. However, counterparts to neutron star-black hole (NSBH) mergers and binary black hole (BBH) mergers have not been detected with high confidence. The state-of-the-art theoretical description of physical processes involving merged stellar-mass to intermediate-mass black holes within the accretion disks of active galactic nuclei (AGNs) opens the possibility of discovering transient emissions within a feasible timeframe, just days after gravitational wave detection. Our focus is on conducting follow-up observations of gravitational wave detections LIGO/Virgo/KAGRA, utilizing Mount Wendelstein's 2.1 m telescope with the 3KK imager in visible to near-infrared bands. In close collaboration with the "Gravitational Wave MultiMessenger Astronomy Decam Survey" (GW-MMADS) and the DESI time domain team, we aim to identify astrophysical transients directly associated with BNS, NSBH and BBH merger events. For BBH merger, our target selection involves matching AGNs from catalogs within a constrained localization area determined by gravitational wave detections and narrowing the sample down with reasonable constraints. As the theory evolves rapidly, our plan is to improve selection criteria and gain a better understanding of BBH light curve modelling given sensible parameter estimates. We would like to take advantage of the opportunity of this conference to showcase the first successes and results of our follow-up campaigns.

Presenter: SOMMER, Julian (LMU München)