

Tracking Binary SMBH Orbits Using Global K/Q/W Simultaneous VLBI: Test Observations with KVN and Yebes-40m

We present results from long-baseline VLBI test observations evaluating the performance of Frequency Phase Transfer (FPT) and Source/Frequency Phase Referencing (SFPR) at 22, 43, and 86 GHz using the Korean VLBI Network (KVN) and the Yebes-40m telescope in Spain (~9,000 km baseline). The ultimate goal is to monitor the orbital motion of supermassive black hole binaries (SMBHBs) using high-precision VLBI astrometry with micro-arcsecond accuracy. In a 2021 pilot observation, the FPTed phase at 43 GHz on the Yebes–KVN baseline showed improved coherence, though rapid residual phase variations were also observed, indicating remaining technical challenges. To assess the reliability and repeatability of SFPR on global baselines, we have carried out multiple simultaneous K/Q-band observations between KVN and Yebes since November 2024. In this talk, we present recent results from these tests and discuss current progress and outstanding issues. We also outline upcoming plans for a K/Q/W-band fringe test and long-term monitoring of SMBHB candidates. These efforts are expected to evolve into global monitoring campaigns as multi-frequency receivers become more widely available, enabling μ as-level astrometry and establishing a foundation for future high-precision VLBI science.

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