
Contribution ID: **162** Type: **oral**

# Discovery of a Tight Binary Black Hole System Revealed via Quasi-Periodic Outflows

*Thursday, 26 September 2024 17:34 (17 minutes)*

Binaries containing a compact object orbiting a supermassive black hole are thought to be the precursors of gravitational wave events, but their identification has been extremely challenging. Here, we report the X-ray detection of quasi-periodic outflows (QPOuts) from a previously low-luminosity active galactic nucleus after an optical outburst, likely caused by a tidal disruption of a star. Using general relativistic magnetohydrodynamic simulations we show that these QPOuts, separated by 8.3 days, can be explained with an intermediate-mass black hole secondary (100-10000 solar masses) on a mildly eccentric orbit at a mean distance of about 100 gravitational radii from the primary supermassive black hole (10^7 solar masses). This suggests a scenario in which possibly multiple compact objects (such as black holes and stars) may be zooming through a gaseous disk, in comparison to the classical assumed picture of a simple accretion and ejection flow. Powerful and massive outflows, accelerated up to a velocity of 30% of the speed of light, are naturally enhanced when the secondary crosses the primary inner accretion disk. This discovery has significant implications for several key areas: the growth and evolution of black holes, the potential identification of counterparts to intermediate and extreme-mass ratio inspirals anticipated to be detected via gravitational waves, and particle acceleration through jets/outflows and shocks.

**Primary author:** TOMBESI, Francesco (Istituto Nazionale di Fisica Nucleare)

**Presenter:** TOMBESI, Francesco (Istituto Nazionale di Fisica Nucleare)

**Session Classification:** Searches for Extragalactic astrophysical sources 2