Powerful Black Holes Accreting at Extreme Rates

The release of gravitational energy as mass is suddenly dumped onto a black hole powers some of the most explosive phenomena in the Universe. This is the most extreme example of a universal process called accretion, which is responsible for the growth of all astrophysical systems, from stars to galaxies. In this project, the student will seek to understand how black holes transform the material they consume into powerful outflows, and quantify how much energy these jets can carry away. You will study the most powerful black holes to probe how this process works at its most extreme limit known as the Eddington limit, investigating short-lived, explosive events to unveil how the process proceeds in real time. These include stellar-mass black holes rapidly consuming material torn off a binary companion star, known as transient ultraluminous X-ray sources (ULXs), and supermassive black holes tearing apart unlucky stars that wander too close, known as tidal disruption events (TDEs).

Research Field
Accretion and slow transients

Project Suitability
PhD, Masters, Honours

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The new X-ray telescope eROSITA was launched in 2019, and is conducting sensitive surveys of the X-ray sky. These are projected to discover large numbers of transient ultraluminous X-ray sources and tidal disruption events. The PhD student will join an international team following up newly-detected explosive events detected by eROSITA. They will be expected to perform and analyse follow-up radio and optical observations of these rapidly-evolving systems, using facilities such as the Australia Telescope Compact Array (ATCA), the South African Square Kilometre Array (SKA) pathfinder telescope MeerKAT, and the SKA low frequency precursor the Murchison Widefield Array (MWA; based in Western Australia). Such observations will probe the powerful jets that are launched by these rapidly accreting black holes, exploring of the connection between the infalling matter and the launching of jets in some of the most extreme environments known in the Universe.