Relativistic jets from feeding black holes in our Galaxy

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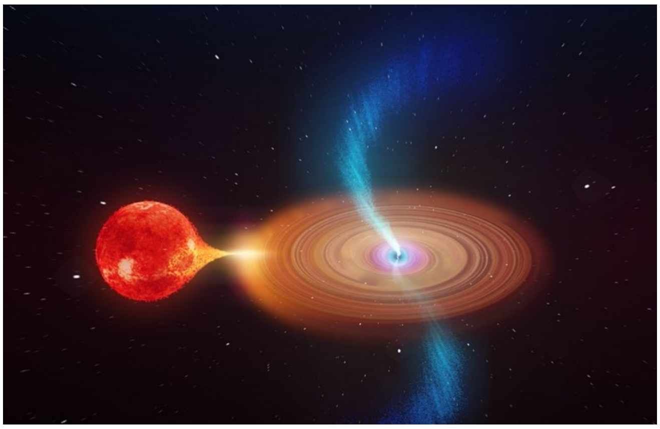
Description:

The release of gravitational potential energy as matter falls onto a compact object such as a black hole powers the most energetic phenomena in the Universe, allowing us to study higher energies and stronger gravitational fields than could ever be reproduced in a laboratory here on Earth.

As matter falls in towards a black hole, some fraction of the infalling material can be diverted outwards in powerful oppositely directed jets moving at close to the speed of light, and carrying away large amounts of the gravitational energy released, depositing it into the surrounding environment. The jets from the most massive, rapidly-feeding black holes at the centres of galaxies, known as quasars, can affect the evolution of their host galaxies, and even the galaxy clusters in which they reside. However, such massive systems evolve slowly, making it difficult to study the physics linking the launching of powerful jets and the inflow of gas in the accretion flow that feeds them.

Happily, smaller, stellar-mass black holes in our own Milky Way galaxy are governed by similar physics, but evolve on much faster timescales (days and weeks rather than millennia). These so-called 'microquasars' act as excellent probes of the physics governing the link between accretion and outflow around black holes. We can study explosive outbursts of these systems as they evolve in real time, providing new insights into their radiative and kinetic feedback that, when extended to the supermassive black holes in quasars, can have an impact on cosmological scales.

In this project, you will work as part of a large international team conducting multi-wavelength observational studies of the explosive outbursts of stellar-mass black holes and neutron stars in X-ray binary systems, aiming to understand the properties of these powerful events, how they evolve, and how the changing conditions in the inflow lead to the launching of relativistic jets. You will use a range of radio telescopes in Australia and around the world (including Square Kilometre Array pathfinder and precursor facilities) to probe the jets launched by these stellar-mass compact objects. You will use spectral line, multi-wavelength photometry, polarization, or high angular resolution imaging observations as appropriate to determine the jet properties, and understand how they carry energy outwards and deposit it into the surroundings.



ABOVE IMAGE: A schematic of a black hole accreting matter from a donor star, and launching relativistic jets.