Using stars destroyed by supermassive black holes to learn how the biggest black holes launch jets and outflows

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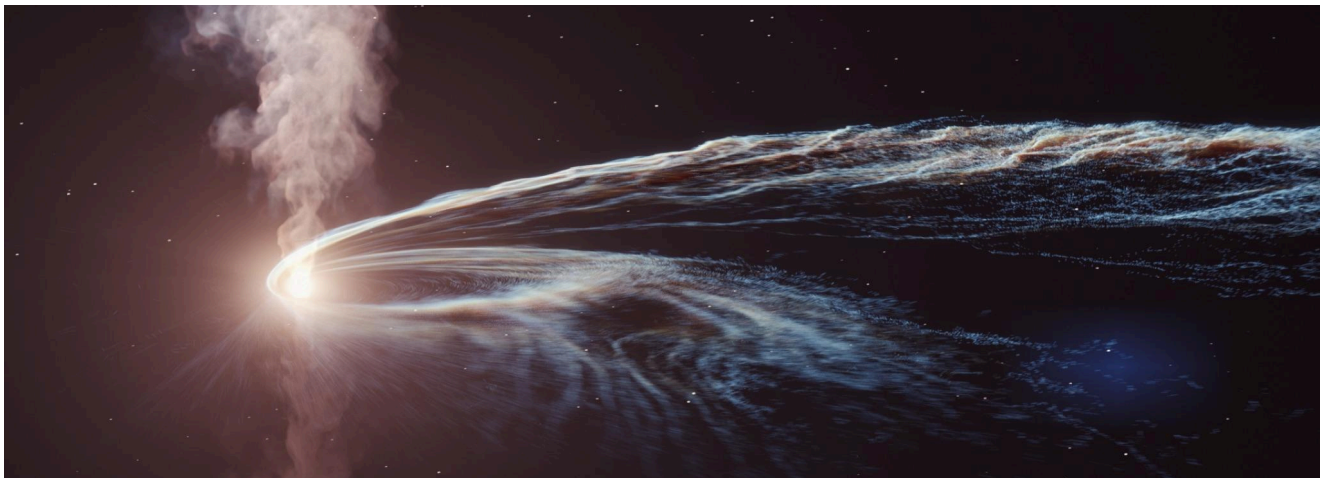

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Overview

Approximately once every 10,000 years an unlucky star wanders too close to a supermassive black hole at the center of a galaxy and is destroyed. Known as a tidal disruption event, the destruction of the star produces a bright flash that illuminates a previously invisible supermassive black hole millions to billions of light-years away. Gravitational energy released when mass is suddenly dumped onto black holes powers some of the most explosive phenomena in the Universe, but the specifics of the accretion process and how material is ejected are currently poorly understood due to the long timescales over which jets and outflows from supermassive black holes usually evolve. Tidal disruption events provide a unique opportunity to witness the accretion (and ejection) of material by a supermassive black hole on human timescales.

To date, we have discovered approximately 100 tidal disruption event candidates, and find approximately 20 new candidates per year. However, the upcoming Vera C. Rubin Observatory's Legacy Survey of Space and Time in Chile will provide the first opportunity to survey the Southern Sky in detail for tidal disruption events, and is expected to discover hundreds of new events per year. Australia is in a unique position to provide the fastest and most comprehensive follow-up support, and Australian radio observatories are a world-class addition to this. This project will work with international collaborations to follow up new tidal disruption events with Australian radio telescopes in order to answer fundamental questions about supermassive black holes such as: How much of each star is swallowed by the black hole, and how much is ejected? How do supermassive black holes eject material and launch outflows and jets? How do these jets and outflows feed back into the host galaxy and what can we learn about distant galaxies by constraining these jets and outflows?