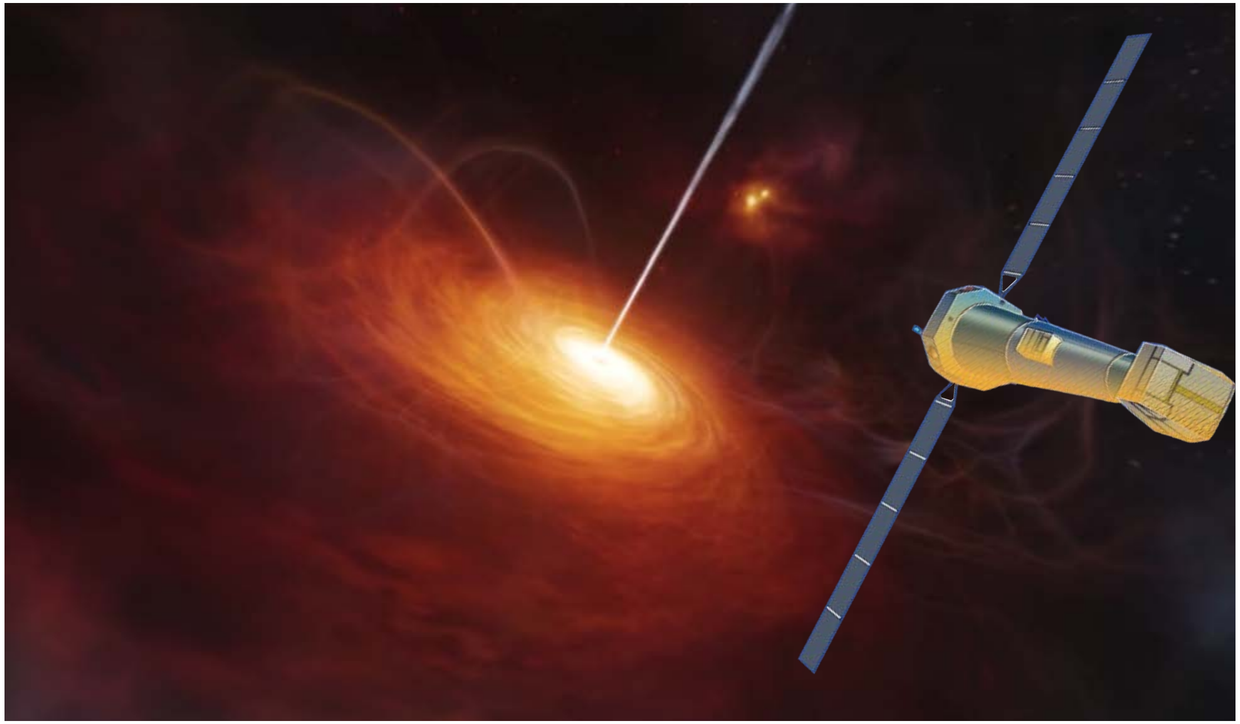
Accretion and Ejection Around Black Holes: the Disc-Jet Connection

by Chris Done (Center for Extragalactic Astronomy, Department of Physics, University of Durham, United Kingdom)

Black holes are black, but material captured by their immense gravity can be heated to extremely high temperatures as it spirals down towards the event horizon, resulting in intense X-ray emission. As well as blasting out radiation, the infalling material sometimes produces powerful jets. At their most extreme, these are ejected from close to the black hole at speeds close to the speed of light. However, these ultra-relativistic jets are only seen from a small fraction of supermassive black holes, and understanding how these are launched and accelerated remains one of the biggest unsolved issues in astrophysics. It is important not just for its own sake, but because these jets can transport energy and momentum across huge distances, from the black hole in a galaxy centre all the way out to gas in a halo around the galaxy and beyond. This additional power input affects the way the entire galaxy grows, as it prevents the gas cooling and forming more stars.



Background: This artist's impression shows how ULAS J1120+0641, a very distant quasar powered by a black hole with a mass two billion times that of the Sun, may have looked. This quasar is the most distant yet found and is seen as it was just 770 million years after the Big Bang. This object is by far the brightest object yet discovered in the early Universe.
Credit: ESO/M. Kornmesser

The stellar mass black holes can also produce relativistic jets, though these are not as fast as those from the supermassive black holes. However, here the smaller size scale means that we can track changes more easily, so we can follow how variations in the accretion flow affect both the X-rays and the jet emission. The jet radiates most of its power in the infrared, so the key to tracing how it is launched is to use variability to map out the connection between the X-ray emitting flow and the infrared jet by monitoring these two wavebands simultaneously. Athena will allow us to look in unprecedented detail at the X-ray emission from the accretion flow, but we also need the synergy with other instruments and wavebands to get the best science out of these new data.