Bridging the Gap Between Stellar Mass and Supermassive Black Holes

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While it is widely accepted that most (perhaps all) galaxies host a supermassive black hole in their centres, how these black holes form is not understood. One theory proposes that they are formed from the mergers of intermediate mass black holes with masses in the range of ∼100 – 100,000 times the mass of the Sun. However, observational evidence for the existence of black holes in this mass range has until recently been lacking. The best candidates are the class of ultraluminous X-ray sources, which are extragalactic X-ray sources that are located outside the nuclei of their host galaxies with X-ray luminosities that exceed the theoretical Eddington limit for a stellar mass black hole but are below those of supermassive black holes. The Eddington limit is a function of the black hole mass, and so these luminosities have been interpreted as evidence for intermediate mass black holes. However, the bulk of ultraluminous X-ray sources have luminosities low enough that they can be explained via mild super-Eddington accretion or beamed emission. The brightest of these objects – the "hyperluminous" X-ray sources – have luminosities above 10^{41} erg/s that cannot be easily explained without intermediate mass black holes. Here I will describe the discovery and follow-up multi-wavelength observing campaign targeting ESO 243-49 HLX-1, the most luminous ULX currently known and the strongest candidate intermediate mass black hole with an estimated mass of 10,000 $M_\odot$. I will also present the results of a recent search for intermediate mass black holes in the nuclei of low mass dwarf galaxies, and outline future possibilities regarding hunting for intermediate mass black holes with the upcoming ASKAP radio and eROSITA X-ray sky surveys.