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Evidence for IMBHs from ultra-luminous X-ray sources and in globular clusters

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Observational evidence for intermediate mass black holes has been weak. Two promising environments to search for such objects include the centres of massive globular clusters and in the most luminous of the ultra-luminous X-ray sources, which are simply defined as non-nuclear extra-galactic X-ray point sources that exceed the Eddington luminosity (where the radiation pressure is balanced by the gravitational pressure) for a stellar mass black hole. This talk will review the most interesting ultra-luminous X-ray sources that could host a black hole of more than 100 solar masses (Msun), and the search for intermediate mass black holes in globular clusters. I will particularly cover the serendipitous discovery of the X-ray source HLX-1 apparently associated with the galaxy ESO 243-49, situated at 95 Mpc. Follow-up spectroscopy of the optical counterpart confirmed the association. Using the maximum X-ray luminosity of $1.1\text{x}10^{42}$ erg s^{-1} (in the 0.2-10.0 keV range) and the conservative assumption that this value exceeds the Eddington limit by at most a factor of 10, implies a minimum mass of 500 Msun. Modeling of the X-ray spectra, and a clear analogy with stellar mass black holes but at higher X-ray luminosities, imply a mass of the order $1\text{x}10^4$ Msun, making HLX-1 a very strong intermediate mass black hole candidate. The possible presence of a surrounding young cluster of stars as detected with Hubble gives insights on the origin of the black hole, and on its role in the growth of super-massive black holes.