the rotating black hole can act as a gigantic electric dynamo. This process is considered to play an important role for many black holes and their jets.

Early tests of the hypothesis of supermassive black holes in galactic nuclei

The angular resolution of telescopes in the early 1990s was insufficient to spatially resolve objects separated by distances comparable to the size of the Schwarzschild radius of a possible supermassive black hole at the centre of our galaxy, or even much heavier supermassive black holes in other galaxies. However, observations of the orbits of stars and gas can help determine the gravitational potential due to objects at the centre of the galaxy. One can then infer whether a single compact source or dense cluster of known stellar objects, e.g., neutrons stars, white dwarfs or even low-mass black holes, could account for the observations. Black hole mean densities, computed as the ratio of their mass to the volume enclosed within a radius of $3R_S$ (the ISCO), scale inversely with the square of their mass, $\rho = \frac{c^6}{288\pi G^3 M^2}$. For a supermassive black hole weighing $4 \times 10^6 M_\odot$, the density is actually only about 40 times larger than that of water. However, when converted to astronomical scales, this amounts to $6 \times 10^{23} M_\odot pc^{-3}$ (1 pc = 3.26 light-years), much larger than the density of any known stellar cluster. Globular clusters with a density of $10^5 M_\odot pc^{-3}$ are the densest-known long-lived multi-body systems in our galaxy.

Thus, the general observational strategy to identify the existence of supermassive black holes was based on the determination of mass density within the innermost region of galaxies, then comparing this density with known stellar clusters. An additional strategy based on direct imaging would come much later, with the observations of the Event Horizon Telescope reported in 2019.

The study of AGNs became much more accessible with the launch of the Hubble Space Telescope (HST) and its unprecedented angular resolution at optical wavelengths. About 50 nearby AGNs were targeted for observation. Multi-wavelength observations of a powerful jet originating at the nucleus of the nearby elliptical galaxy M87, in the Virgo cluster, were particularly interesting.

Early HST observations (Ford et al. 1994; Harms et al 1994) indicated the presence of a rotating disk in M87 with mass of a few times $10^9 M_\odot$, confined within 18 pc from the nucleus. This result was derived from the kinematics of the gas in the disk and the angular scale probed in this case corresponded to about $3 \times 10^4 R_S$. While very suggestive of a central supermassive black hole, the observations could not rule out the possibility that the gravitational potential was due to a dense cluster of stars, too faint for detection.

The first empirical claim that a dense stellar population *could not* account for the kinematic motion around a galactic centre was made by Miyoshi et al. (1995). They made observations of a rotating H_2O maser disc at 0.13 pc from the centre of one of the closest active AGNs, the nucleus of the galaxy NGC 4258 at a distance of 7.3 Mpc. Observations made at the 1.3-cm radio wavelength Very Long Baseline Array (VLBA) showed a thin disk containing H_2O masers surrounding the mildly active nucleus.

Exploiting the power of the very Long Baseline Interferometry (VLBI) technique, they mapped the location and velocity of the masers with an angular resolution better than a milliarcsecond. The rotation curves follow Keplerian orbits around compact central source with a mass of $3.7 \times 10^7 M_\odot$, corresponding to a density in excess of a few $\times\ 10^9 M_\odot pc^{-3}$. This density is inconsistent with a long-lived dense cluster of stellar-mass astrophysical sources.

The centre of the Milky Way as a laboratory for fundamental physics

The central few parsecs of the Milky Way harbours a rich cluster of stars and hot gas. These have been used to trace the gravitational potential of the Galactic centre defined by the compact radio source Sagittarius A* (Sgr A*), at a distance of 25,000 light years. If the mass concentration at the very centre of the Galaxy is made of a single supermassive black hole, the typical speeds of