exception, and in a very influential paper two years later, Lynden-Bell and Martin Rees (Lynden-Bell & Rees, 1971) argued for the existence of a supermassive black hole in the Galactic centre and proposed key observations to explore the nature of the compact object. Earlier, Kerr (1963) had generalized the Schwarzschild solution to describe a rotating black hole, adding angular momentum to mass and electric charge (Newman et al. 1965) as the principal physical parameters describing black holes, irrespective of how they were formed.

A critical observable is the innermost stable circular orbit (ISCO), which is at a distance $3R_S$ from a Schwarzschild (non-rotating) black hole. Matter closer than that will therefore fall directly into the black hole, adding to its mass. Furthermore, as matter spirals in to its final destiny, up to between 6% and 42% of its rest-mass energy can be released, depending on the rotational energy and the black hole spin direction with respect to the spiralling in-falling matter. This supermassive black hole hypothesis thus provided a plausible explanation for the high luminosity of quasars.

In 1969, Penrose realized that the rotational energy of a Kerr black hole could be another important source of energy, further elaborating this realization two years later (Penrose & Ford 1971). The mechanism by which this energy is released is far from trivial. In classical mechanics there are a few ways to obtain energy from a rotating body. Projectiles can be shot so that they bounce off the surface, increasing their speed while the rotation of the body decreases. Tidal forces transfer the rotational energy of the Earth to the orbital energy of the moon. A black hole has no hard surface, so how can the energy transfer occur?

Outside of any rotating object, including the Earth, space-time is dragged along with the rotation giving rise to the *Lense-Thirring effect*. The effect is small for Earth, but close to a rotating black hole the effect is dramatic. Just outside of the horizon there is an *ergosphere*, within which it is impossible for an observer to resist the rotation of space-time. If the black hole is rotating, say, in a clockwise direction, the observer will be carried around in a clockwise direction – even if the observer is trying hard to move in the opposite direction.

Penrose found that it is possible to make use of the ergosphere to extract energy. He envisioned how a projectile sent inside of the ergosphere splits into two, with one piece entering through the horizon and the other leaving the ergosphere and escaping from the black hole. Penrose showed that this process can happen in such a way that the escaping piece has a total energy that is *larger* than the energy of the original projectile, with the extra energy extracted from the rotating black hole.

This process seems contrary to the conventional wisdom that nothing can get out of a black hole and that a black hole can only grow in size. The solution to the apparent paradox lies in how to define the size of a black hole. As understood by Stephen Hawking (Hawking 1972), it is *the area of the horizon* of a black hole that never can decrease in size. A Schwarzschild black hole has mass in direct proportion to its area. If the area cannot decrease, neither can the mass. The case of a rotating black hole is more complicated. The Kerr metric leads to $A = 8\pi M\left(M + \sqrt{M^2 - a^2}\right)$, where the parameter a measures the angular momentum of the black hole. Remarkably, the mass can decrease even if the area grows, thus making the Penrose process possible.

Following work of Jacob Bekenstein (Bekenstein 1972), Hawking went on to study the remarkable connection between black hole physics and thermodynamics, with area acting as entropy (Hawking 1975). He discovered that as a consequence of quantum mechanics, black holes have a tiny temperature and are expected to emit radiation. Even though the radiation is far too weak to be measured in the case of astrophysical black holes, the discovery of this process has been of fundamental importance for the development of theories of quantum gravity.

In 1977, Roger Blandford and Roman Znajek used Penrose's insight to construct a realistic model of how the rotation of a black hole could be used to generate power (Blandford & Znajek 1977). If magnetic fields are present, these will be carried along with the ergosphere. In this way,