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## Black holes Nature's most powerful and efficient engines

I will first discuss the observational appearance of astrophysical black holes that we know to exist in the real Universe: the "stellar" black holes with masses about 10 solar masses and the "super-massive" ones with masses from a few millions to a few tens of billions solar masses. We now observe black holes using radio, optical, X-ray,  $\gamma$ -ray and gravitational wave telescopes. The new Event Horizon Telescope started to collect data just this month. It is able to resolve details of matter structures around a super-massive black hole at our Galaxy centre which are comparable with the black hole size.

Black holes accrete matter from their surroundings. The black hole accretion is remarkably powerful and efficient. Indeed, there is no other non-explosive process known in the whole Universe that would surpass the black holes power and efficiency. Roger Penrose suggested the rotational energy of a spinning black hole may be, in principle, tapped. Recently it was demonstrated that an electromagnetic version of this process (the Blandford-Znajek mechanism) may power powerful jets that are observed in many black hole sources.

Collisions of black holes lead emission of gravitational waves. The gravitational wave burst detected by the LIGO interferometers in 2015 was energetically the most powerful event ever detected by the humans.

**Tuesday 2 May 2017 at 4.00 P.M.**

**COFFEE AND TEA WILL BE SERVED AT 3.45 P.M.**

**SOLVAY ROOM**

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