ERC Co-Grant 2015

Proposal Title ”Astrophysical processes in the environment of cosmic black holes”

Proposal Acronym: AstroBHs

Project duration: 60 months

Project PI: Agnieszka Janiuk

Requested funding: 1,491,250 Eur

Abstract

Astrophysical black holes are one of the greatest mysteries for astronomers and physicists since the Einstein's theory of general relativity was published a hundred years ago.
One one hand, these simple objects are characterized only by their mass, which packed into a very small volume in spacetime prevents the light from escaping and makes them undetectable. On the other hand, by means of accretion of the surrounding matter, they are responsible for releasing huge amounts of gravitational potential energy, which converted into the high energy radiation is visible from the most distant parts of our Universe.
By means of the still unknown mechanism, black holes are also responsible for ejections of the fastest known, collimated streams of matter, observed power of the radio loud quasars, and for the origin of the most violent and spectacular cosmic explosions, the gamma ray bursts. Locally, black holes should be present in our neighbourhood, as they might have formed from the primordial density inhomogeneities just after Big Bang. Via the Hawking radiation they evaporate and emit photons and particles. This process, however described theoretically quite well, is still awaitening clear observational signal.
This project proposes comprehensive study of black holes in their cosmic environment. With joined efforts of astronomers and physicists, we aim to answer the fundamental questions related to the black hole mystery: what is the fate of hot, magnetized plasma accreting in the centers of galaxies and in the black hole binary stars? how do the black holes merge in the cosmic scale and what happens in their surrounding? Can the evaporating black hole give a visible signal? How is the energy extracted from the black holes, to power the high velocity outflows and streams of plasma? We will use the most advanced tools of numerical relativity and hydrodynamics, and we'll continuously confront them with available observations, from both space satellites and ground based facilities.