

Black holes are compact and super dense objects which prevent even light escaping their gravitational pull. They are the both fascinating and mysterious, therefore both scientists and movie makers invent weird and fantastic theories involving black holes, e.g., breaking the laws of physics or travelling between galaxies and parallel universes. In the recent movie hit “Interstellar”, a black hole named Gargantua helped humans travel between different parts of the Universe in search for new Earth. However, as usual, the sci-fi movies tend to exaggerate or ignore some scientific facts. Observations of very massive black holes in the centres of galaxies have shown that objects or stars getting very close to a black hole get ripped apart by the huge gravitational pull. Theory of disruption of stars in events called Tidal Disruption Events (TDEs) have been proposed by Lord Martin Rees from the University of Cambridge in the eighties of last century. However, only in recent years a few of such events has been observed thanks to large scale observing programmes. TDE looks like a temporal flare at the centre of a galaxy and usually lasts from couple of days to years. An observation of such event is already an indirect proof of existence of a black hole with a mass of several millions of Suns.

In this project we aim at detecting flares due to tidal disruption of stars by central black holes using two the best suited large sky monitoring astronomical surveys. The European Space Agency’s space mission Gaia (<http://gaia.esa.int>) was launched in 2013 and since then keeps scanning the entire sky with its main goal to prepare a 3D map of our Galaxy. As a side-product, in its real-time data flow Gaia detects transient events, e.g., supernovae and TDEs. Gaia is equipped with advanced and sensitive astronomical instruments, hence can precisely measure position and brightness of detected objects, as well as can provide rapid classification of transients (e.g., can distinguish a supernova from an asteroid).

OGLE (Optical Gravitational Lensing Experiment, <http://ogle.astrouw.edu.pl>) has been run by Polish astronomers from the University of Warsaw for more than 20 years and uses a dedicated telescope located at Atacama desert in Chile. OGLE has discovered millions of variable stars, hundreds of supernovae and dozens of extrasolar planets. In this project we will use OGLE to search for tidal disruption events in the intensively observed region of the Southern sky. Excellent OGLE image quality along with years-long experience yield in superb measurements of stars’ brightness in the most challenging regions of centres of galaxies, which are very dense in stars.

Using Gaia mission and OGLE project we expect to detect about 100 tidal disruption events due to central black holes, allowing for studies of supermassive Gargantuas and their distribution in different type of galaxies. We will be able to say if black holes exist also in the least massive galaxies, including dwarfs, and how massive they are. These are the key questions in our understanding of the origins of supermassive central black holes in most massive galaxies and galaxies evolution in general.