

CTP PAS and Okeanos

The astrophysics team at the Center of Theoretical Physics (Polish Academy of Sciences), led by Professor Agnieszka Janiuk, conducts research on large-scale computer simulations describing processes in the vicinity of cosmic black holes. We are also interested in such phenomena as the coalescence of pairs of black holes, such as the event recently registered by the LIGO gravitational wave detector, and the processes involved as gas collapses into a black hole in active galactic nuclei.

Work of this sort requires major computing power. We have gained access to such computing capacity on the recently launched supercomputer Okeanos, situated at the University of Warsaw's Interdisciplinary Centre for Mathematical and Computational Modelling (the opening ceremony of the building in Warsaw's Targówek district took place on 17 June 2016). The Cray XC40 machine installed there consists of more than 1,000 computing nodes, each of which has two 12-core Intel Xeon processes and 128 GB of RAM. Since June of this year, we have been running our test-phase calculations on it, under the "Early Science" program. Annual computation grants for using this supercomputer can be won on a competitive basis, responding to the announcements on the ICM's website. Projects are judged solely in terms of the criterion of their scientific value. Our project, under the guidance of Professor Agnieszka Janiuk, is led by Dr. Szymon Charzyński from the University of Warsaw's Department of Mathematical Methods in Physics and also involves Dr. Petra Sukova from the Center CFT PAN.

Fig. 1: An example of a gravitational wave signal, as calculated in our simulations. (The figure shows the real component $l = 2, m = 2$ of the multipole moment of the Weyl scalar.) The signal was produced by a pair of colliding black holes with a mass ratio of 1.2 and dimensionless angular momentum of 0.2 and 0.3. These values correspond to the limits obtained thanks to the LIGO detector's measurements.

