GR 1: Most recent developments in gravitational waves and relativistic astrophysics

Zeit: Montag 16:00–18:30 Raum: NW-Bau - HS3

Hauptvortrag GR 1.1 Mo 16:00 NW-Bau - HS3

The Physics Nobel Prize 2017: Gravitational Waves — •Bernd Brügmann — University of Jena

Albert Einstein predicted gravitational waves already hundred years ago as a consequence of his newly formulated theory of general relativity. In highly publicized news, the LIGO/Virgo collaboration announced in 2016 the first direct detection of a gravitational wave signal, and in the end of 2017 the Nobel Prize for Physics was awarded "for decisive contributions to the LIGO detector and the observation of gravitational waves". There is excellent evidence that the first signals correspond to the inspiral and merger of two black holes. Most recently, the first gravitational waves from the collision of two neutron stars have been detected. In this talk we give an overview of the theory and the numerical methods that allow the prediction and analysis of gravitational wave signals. Part of the success story are great advances in numerical general relativity that allow us to simulate binaries with increasing levels of complexity, providing models that explain the observed gravitational wave signals.

Hauptvortrag GR 1.2 Mo 16:50 NW-Bau - HS3

The gravitational wave detection of a binary neutron star merger: expectations, surprises, and prospects — •Jochen Greiner — Max-Planck-Institute for Extraterrestrial Physics, Garching, Germany

On August 17, 2017, Advanced LIGO & Virgo detected gravitational waves from a binary neutron star merger. A short-duration gamma-ray burst was detected in temporal coincidence by the INTEGRAL and Fermi satellites. A few hours later, an optical/NIR transient was found which turned out to be compatible with the predictions of a kilonova, powered by the radioactive decay of heavy r-process nuclei produced in the merger. I will give an overview of the observational results of this event which will go down in history as the start of multi-messenger gravitational wave astronomy. I will contrast the original expectations with the actual findings, and will spend most of the time on the mismatches, i.e. the new questions which emerged.

Hauptvortrag GR 1.3 Mo 17:40 NW-Bau - HS3

Neutron star mergers and the begin of multi-messenger astrophysics — •Stephan Rosswog — The Oskar Klein Centre, Department of Astronomy, Stockholm University

Neutron star mergers had long been suspected to produce gravitational wave "chirps", gamma ray bursts and produce heavy elements via the rapid neutron capture process. While overall convincing, all these conjectures were based on indirect arguments and none was proven directly. This changed on August 17, 2017: a gravitational wave signal from a merging neutron star binary was detected, closely followed by a short gamma-ray burst and week-long transients accross the electromagnetic spectrum coming from the radioactive decay of freshly synthesised r-process elements. In this talk I will give an overview over these recent developments.