AKjDPG 1: Tutorial: Gravitational Waves

Zeit: Montag 9:00–12:30 Raum: Z6 - HS 0.001

Tutorium AKjDPG 1.1 Mo 9:00 Z6 - HS 0.001

Gravitational Waves - Theory and Observation — •Claus Kiefer — Universität zu Köln

Gravitational waves were first predicted to exist by Albert Einstein in 1916. In September 2015, they were directly detected for the first time. Since then, a couple of other events were registered, among them one for which the optical counterpart has been seen. In 2017, the Nobel Prize for Physics was awarded for the observation of gravitational waves.

In my talk, I give a brief introduction into the physics of gravitational waves and discuss the indirect detection from observations of binary pulsars. I then describe the direct detection by laser interferometry and explain the physics behind it. I conclude with a brief outlook on gravitational wave astronomy and on the role that gravitational waves play for cosmology and quantum gravity.

Ref.: D. Giulini and C. Kiefer, Gravitationswellen (Springer Spektrum 2017)

30 min. break

Tutorium AKjDPG 1.2 Mo 11:00 Z6 - HS 0.001

Detecting gravitational waves — •Markus Pössel — Haus der Astronomie / Max-Planck-Institut für Astronomie, Heidelberg

In this tutorial, we will explore the basics of gravitational wave detection, from pulsar timing to interferometric detectors (with a sidelong glance at resonant detectors). I will try to keep the mathematics as simple as possible, resorting to models and analogies (e.g. with cosmic expansion) wherever feasible. Gravitational waves only interact very weakly with our detectors, which means a gravitational wave signal has plenty of competition in the form of noise. We will consider the most important types of noise, and examine some of the techniques used by detectors like LIGO and Virgo for noise suppression.

Tutorium AKjDPG 1.3 Mo 11:45 Z6 - HS 0.001

Numerical simulations of black hole and neutron star systems — •Bernd Brügmann — Uni Jena

Much anticipated and finally here, the first detection of gravitational waves from black holes and neutron star mergers is a fantastic success for gravitational wave physics. Part of the success story are great advances in numerical general relativity that allow us to simulate binaries with increasing levels of complexity. In this talk we focus on the methods of numerical general relativity which allow us to perform computer simulations of black holes and neutron stars, and how such simulations are connected to actual gravitational wave observations.