GR 502 Gravitationswellen

Zeit: Freitag 10:30–12:30 Raum: K

Hauptvortrag GR 502.1 Fr 10:30 K

Numerical implementation of a fully-constrained formulation of Einstein equations — •Jerome Novak, Silvano Bonazzola, Eric Gourgoulhon, Philippe Grandclement, and Lap-Ming Lin — Laboratoire de l'Univers et de ses Theories, CNRS / Observatoire de Paris, F-92195 Meudon, France

A maximally-constrained scheme for 3+1 numerical relativity is described using maximal slicing and spherical tensor components. Thanks to the additional introduction of a flat 3-metric on spatial hypersurfaces, corresponding to their asymptotic structure, it is possible to generalize the Dirac gauge to spherical coordinates. Thus, the Einstein equations can be written as a coupled system of five elliptic equations (including Hamiltonian and momentum constraints) and two scalar wave equations,which correspond to the dynamical degrees of freedom of the gravitational field. High-precision numerical models of rotating relativistic stars and evolution of 3D gravitational wave spacetime are presented as numerical examples. In particular, the accuracy of the resolution of the constraints equations is shown, as well as of those evolution equations which are not actually solved.

Hauptvortrag GR 502.2 Fr 11:10 K

Post-Newtonian dynamics of binaries and its relevance to relativistic astrophysics — •Achamveedu Gopakumar — Theoretisch-Physikalisches Institut, FSU , Max-Wien-Platz 1, 07743 Jena, Germany

The dynamics of compact binaries in post-Newtonian (PN) approximation is recently determined, both in near-zone orbital dynamics and in far-zone flux computations, to {\em third and half} PN order. I describe briefly importance and implications of these results for i) gravitational wave astronomy, realizable with Laser Interferometers and Square Kilometre Array, ii) timing of binary pulsars, iii) numerical relativity involving compact binaries, iv) N-body simulations to model globular clusters and supermassive black hole mergers and v) infra-red observations of stars orbiting our galactic center.

GR 502.3 Fr 11:50 K

Computationally effective gravitational waveforms for compact binaries with arbitrary eccentricity — •Manuel Tessmer and Achamveedu Gopakumar — Friedrich - Schiller - Universität, Max-Wien-Platz 1, 07743 Jena

Compact binaries in highly eccentric orbits are possible sources of gravitational waves for Laser Interferometer Space Antenna (LISA). We present an algorithm to compute highly accurate and efficient gravitational wave polarizations associated with bound compact binaries of arbitrary eccentricity and mass ratio moving in slowly precessing orbits. We also present reasons for the superior nature of our approach.

GR 502.4 Fr 12:10 K

Nachweis von Gravitationswellen: Bisherige Ergebnisse — •Peter Aufmuth und die GEO600 Kollaboration — Albert-Einstein-Institut, Universität Hannover, Callinstr. 38, D-30167 Hannover

Seit Ende 2001 arbeiten die laserinterferometrischen Gravitationswellendetektoren in den USA (LIGO, zwei Detektoren mit 4 km langen Meßstrecken) und in Deutschland (GEO600, 600 m lange Meßstrecken) in der LIGO Scientific Collaboration (LSC) zusammen. Seitdem hat sich die Empfindlichkeit der Detektoren um mehr als das hundertfache verbessert, so daß die Anlagen die gewünschte Empfindlichkeit fast erreicht haben. Die Anlagen laufen mit großer Zuverlässigkeit. Ende 2005 wurde eine Meßphase gestartet, die mindestens ein Jahr dauern soll.

Der Vortrag berichtet über die Ergebnisse der bisherigen Meßphasen, die jeweils einige Wochen gedauert haben. Dabei sind auch Messungen des japanischen Detektors TAMA300 (300 m lange Meßstrecken) berücksichtigt worden. Bisher konnten keine Gravitationswellen nachgewiesen werden, aber die erzielten Obergrenzen rücken immer mehr in den astrophysikalisch relevanten Bereich.