GR 16: Hauptvorträge: Numerische Relativitätstheorie und Wurmlöcher

Zeit: Freitag 9:15–10:45 Raum: HS 6

Hauptvortrag GR 16.1 Fr 9:15 HS 6

Numerical evolution of the Einstein equations to future null infinity — •Oliver Rinne — Albert-Einstein-Institut

In numerical simulations of isolated systems, one usually adopts the Cauchy formulation of general relativity and foliates spacetime by spacelike hypersurfaces that are truncated at a finite distance. Boundary conditions must be imposed so that the resulting initial-boundary value problem is well posed and, ideally, the artificial boundary is transparent to gravitational radiation. However, the latter is only defined unambiguously at future null infinity (Scri+) and so a far more elegant solution is to include Scri+ in the numerical domain. This can be accomplished by a conformal transformation of the metric combined with a compactifying coordinate transformation. With Vince Moncrief we have developed a constrained ADM-like formulation of the Einstein equations on hypersurfaces of constant mean curvature approaching Scri+. Although the equations contain terms that are formally singular at Scri+, these can nevertheless be evaluated in a regular way. Numerical results based on this formulation include evolutions of perturbed vacuum axisymmetric black holes and studies of late-time power-law tails of scalar and Yang-Mills fields coupled to the Einstein equations in spherical symmetry.

Hauptvortrag GR 16.2 Fr 10:00 HS 6

Spherical and cylindrical wormholes in general relativity — •Kirill Bronnikov — Center for Gravitation and Fundamental Metrology, VNIIMS, Ozyornaya 46, Moscow 119361, Russia — Institute of Gravitation and Cosmology, PFUR, ul. Miklukho-Maklaya 6, Moscow 117198, Russia

After a brief review of the current situation in wormhole physics, some recent results will be presented concerning wormhole models with spherical and cylindrical symmetries in general relativity. Among them are (i) some new wormhole models with electric and/or magnetic charges (and closely related regular black hole models, the so-called black universes); (ii) results on the stability of static, spherically symmetric wormholes; (iii) the existence conditions and properties of cylindrical wormholes with and without rotation. It has been shown, in particular, that rotation, representing a vortex gravitational field, can provide a cylindrical wormhole geometry without violating the standard energy conditions, but the main problem is that such geometries are not asymptotically flat. The latter is a necessary requirement if a wormhole should be seen as a local object by distant observers like ourselves. We try to solve this problem by matching the wormhole throat region with flat-space regions in a rotating reference frame. The junctions comprise thin shells co-rotating with the whole configuration, and their physical properties are analyzed.