GR 7: Klassische Allgemeine Relativitätstheorie 2

Zeit: Dienstag 16:30–18:00 Raum: SFG 0140

GR 7.1 Di 16:30 SFG 0140

Rotating Excited Boson Stars — •Lucas Gardai Collodel, Burkhard Kleihaus, and Jutta Kunz — University of Oldenburg

We investigate axially symmetric, rotating boson stars which are radially excited. These objects exist only for a limited range of the field's frequency. Given different coupling strengths with gravity we determine its domain of existence, as well as the frequency dependence behaviour of the star's parameters, which is then compared with the non-excited case. The circular orbit's tangential velocity of test particles around such objects is also analysed in order to determine if their existence offers a good alternative for dark matter at the galactic scale.

GR 7.2 Di 16:45 SFG 0140

Spinning Wormholes in Scalar-Tensor Theories — •Burkhard Kleihaus, Xiao Yan Chew, and Jutta Kunz — Carl von Ossietzky Universität Oldenburg

Wormholes are solutions of the Einstein equations discribing spacetimes with two asymptotically flat regions connected by a throat. A textbook example is the Ellis wormhole supported by a scalar phantom field. Although this solution is known since a long time in the static case, the stationary rotating generalizations have been found only recently.

Here we present stationary rotating wormholes in Scalar-Tensor theories. We show that certain Scalar-Tensor theories allow for spontaneously scalarized wormholes. We discuss their domain of existence and their physical properties. Especially we compare the solutions in the Einstein frame and in the Jordan frame. Whereas global charges like mass and angular momentum are similar in both frames, the geometric properties can be very different. E.g. wormholes which possess a single throat in the Einstein frame can possess a double throat in the Jordan frame.

GR 7.3 Di 17:00 SFG 0140

Properties of Rotating Ellis Wormholes — •Xiao Yan Chew, Burkhard Kleihaus, and Jutta Kunz — Institut of Physics, University of Oldenburg, D-26111, OLdenburg, Germany

Wormholes are regular solutions of the Einstein equation. They describe spacetimes with two asymptotically flat regions connected by a throat. A classical example is the static Ellis wormhole which is supported by a phantom scalar field. The stationary rotating generalization of the Ellis wormhole with symmetrical properties has been found and discussed recently.

Here we consider the non-symmetric rotating Ellis wormholes. We present their mass formulae, and discuss the geometry of the throat and ergoregion. We show that the limiting configurations of these wormholes are the extremal Kerr black holes. Furthermore, the geodesics of these wormholes are analyzed and we demonstrate that they possess bound orbits.

GR 7.4 Di 17:15 SFG 0140

Five-dimensional wormholes at the core of rotating boson stars — •Sarah Kahlen, Burkhard Kleihaus, and Jutta Kunz — Carl von Ossietzky Universität, Oldenburg

We consider rotating wormhole spacetimes in five dimensions whose throat is immersed in bosonic matter. They represent boson star like configurations with non-trival topology supported by a phantom field. We discuss their physical properties and point out an unexpected richness of configurations. We also present their geometrical features like the existence of single throat and double throat wormholes. We show, that rotation can stabilize these systems.

GR 7.5 Di 17:30 SFG 0140

Parametrized post-Newtonian limit of ghost-free bimetric massive gravity — •Manuel Hohmann — Physikalisches Institut, Universität Tartu, Estland

We consider the unique action of ghost-free massive gravity with two metric tensors and a coupling potential. In our setting we allow for two different types of matter, both modelled as perfect fluids, coupled to their corresponding metrics. Since there is no direct, non-gravitational interaction between these two matter sectors, they mutually appear dark, and can hence be interpreted as dark and visible matter.

Here we focus on the gravitational interaction both within each sector and between the sectors in the parametrized post-Newtonian (PPN) limit. We derive the PPN parameters of the theory and discuss their consistency with observations in the solar system.

GR 7.6 Di 17:45 SFG 0140

Weyl-invariant extension of the Metric-Affine Gravity — •Zahra Altaha Motahar — Oldenburg University, Oldenburg, Germany

Metric-affine geometry provides a non-trivial extension of the general relativity where the metric and connection are treated as the two independent fundamental quantities in constructing the space-time (with non-vanishing torsion and non-metricity). We study the generic form of action in this formalism, and then construct the Weyl-invariant version of this theory. It is shown that in Weitzenbock space, the obtained Weyl-invariant action can cover the conformally invariant teleparallel action. Finally the related field equations are obtained in the general case.