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Odd-dimensional gravitational waves from the binary system on three-brane

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If the number of extra dimensions is odd, the full spacetime becomes odd-dimensional and the formation of gravitational radiation is obscured by violation of the Huygens principle. Gravitational waves must travel with the speed of light, while the full retarded gravitational field of a localized source propagates with all velocities lower or equal to the speed of light. To calculate gravitational radiation of the system in odd dimensions is, therefore, a difficult task, so here we consider a simplified model consisting of two point masses moving on a three-brane embedded in five-dimensional spacetime and interacting only through a massless scalar field living on the same brane, while gravitational radiation is emitted into the full five-dimensional bulk.
Such a system admits the stable elliptical orbits and the interaction field is free from the problems mentioned above. We use the Rohrlich-Teitelboim approach to radiation, extracting the radiative component of the retarded gravitational field via splitting of the energy-momentum tensor. The source term consists of the local contribution from the particles and the non-local contribution from the scalar field stresses. The latter is computed using the DIRE approach to the post-Newtonian expansions. In the non-relativistic limit, we find an analog of the quadrupole formula containing the integral over the full history of the particles' motion, preceding the retarded moment of time. We analyze the gravitational radiation of the non-relativistic circular binary system and the corresponding evolution of the orbit.

Primary authors: KHLOPUNOV, Mikhail (Lomonosov Moscow State University & ITMP MSU); GALTSOV, Dmitry

Presenter: KHLOPUNOV, Mikhail (Lomonosov Moscow State University & ITMP MSU)

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