

Classical and Quantum Gravity 2000 vol.17 N24, pages 5009-5023

Motions and worldline deviations in Einstein-Maxwell theory

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Abstract

We examine the motion of charged particles in gravitational and electromagnetic background fields. We study in particular the deviation of worldlines, describing the relative acceleration between particles on different spacetime trajectories. Two special cases of background fields are considered in detail: (a) pp-waves, a combination of gravitational and electromagnetic polarized plane waves travelling in the same direction; (b) the Reissner-Nordstrøm solution. We perform a non-trivial check by computing the precession of the periastron for a charged particle in the Reissner-Nordstrøm geometry both directly by solving the geodesic equation, and using the worldline deviation equation. The results agree to the order of approximation considered.

<http://dx.doi.org/10.1088/0264-9381/17/24/306>
