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Polarization-corrected light propagation in gravitational fields

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The propagation of electromagnetic waves in vacuum is commonly modeled within the geometric optics approximation according to which light rays follow null geodesics. This is a sensible model whenever the wavelength is much smaller than the characteristic length scale of the medium through which it propagates since distinct wave phenomena such as diffraction are negligible in this case. However, in general the dynamical evolution of electromagnetic waves depends on the photon polarization and deviates from that of a null geodesic, which is often referred to as the gravitational spin Hall effect. We use a perturbative approach based on the Newman-Penrose formalism to numerically model trajectories of null tetrads and analyze the consequences of the gravitational spin Hall effect for solar system observations. In addition, we describe the properties of polarization-corrected photon trajectories in Schwarzschild spacetimes.

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