Handedness of photons and gravitational wave polarization.

Ivan Agullo,1 Adrian del Rio,2 and Jose Navarro-Salas3

1Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA 70803-4001;
2Centro de Astrofísica e Gravitação (CENTRA), Departamento de Física, Instituto Superior Técnico (IST), Universidade de Lisboa, Portugal;
3Departamento de Física Teórica, IFIC. Centro Mixto Universitat de Valencia - CSIC. Valencia 46100, Spain.

I will show that the electric-magnetic classical symmetry of Maxwell theory breaks down by quantum fluctuations in spacetimes admitting gravitational radiation that propagates to future null infinity with an excess of one polarization mode. Typical scenarios where this gravitational asymmetry occurs include mergers of binary black holes and stellar gravitational collapse. The classical electric-magnetic symmetry is associated to the conservation of the net number between right- and left-handed photons. It will be argued then that potential implications of this quantum effect are expected in the astrophysics of black holes through combined measurements of photon and gravitational wave polarizations, and this may be useful to test the geometry in the vicinity of black holes.


