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On the propagation of photons in rotating neutron stars including quantum and gravitational effects.

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Observational evidence indicates that there is a difference between the times of arrival at terrestrial detectors of electromagnetic radiation of different frequencies from space. This delay time has been observed for photons from cosmic rays, galaxies, neutron stars and even black holes. The origin of this delay is due to dispersion of the wave on his journey to Earth, caused by quantum contributions in the presence of the interstellar plasma and effects of space-time curvature. The objective of this work is to estimate the time delay of photons in an external magnetic field and apply the results to an astrophysical scenario: the magnetosphere of neutron stars. For their study the contribution of the medium analyzing the propagation of photons perpendicular to the magnetic field. We start from quantum electrodynamics considering radiative corrections, the photon polarization operator, in the one loop approximation. From this one, the dispersion equations of the polarization modes are solved in terms of analytical functions. Also, we employ a model to describe the pulsar's magnetosphere; composed by matter (electron-positron charged plasma) and a toroidal magnetic field. We obtain a general result valid in a wide range of energies and fields considering only the degenerate gas limit. We also include the effects of space-time curvature that modify the trajectory of light and add an extra time delay.

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