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Graviton-to -photon conversion effect in magnetized relativistic plasma

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The graviton-to-photon conversion effect in a magnetized relativistic lepton plasma is considered. This effect can be important for the possible generation of electromagnetic radiation accompanying coalescence of relativistic compact neutron star – black hole binaries. The relativistic electron-positron plasma can be generated near the surface of a rotating magnetized neutron star (a radio pulsar). The formation of a relativistic compact binary containing a pulsar and a black hole is predicted by the evolution of massive binary stars. Prior to the coalescence of such a binary due to gravitational wave (GW) emission, a fraction of the GW power can be converted in the plasma outflow into a low-frequency electromagnetic (EM) waves, which can lead to additional radio power prior to the coalescence. Using the graviton-to-photon conversion mechanism in an external magnetic field, we calculate the fraction of GW power converted into the EM radiation in the relativistic plasma. The result is found to depend on the neutron star spin period P, plasma Lorentz factor γ and the cascade multiplicity λ, but independent of the neutron star magnetic field: $K \simeq 10^{-35}(P/1\mathrm{s})^2(\gamma/10^5)^2(\lambda/10^5)^{-2}$. The possibility of the detection of the non-thermal EM counterparts from neutron star – black hole coalescences in the forthcoming GW observations by aLIGO/Virgo detectors is briefly discussed.

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