Contribution ID: **12** Type: **not specified**

High frequency gravitational waves shining in photons in Galactic magnetic fields

Tuesday, 17 December 2024 15:50 (20 minutes)

High-frequency gravitational waves (f
$gtrsim$ MHz) are a smoking gun for the existence of exotic physics. Indeed, GW backgrounds generated in the early Universe could be characterized by high-frequency signals, allowing one to probe inflation, first-order phase transitions, topological defects and primordial black holes. The lack of current and future gravitational waves experiments sensitive at those frequencies leads to the need of employing different indirect techniques. Notably, one of the most promising one is constituted by graviton-photon conversions in magnetic fields. In this talk, I will focus on conversions of a stochastic gravitational wave background into photons inside the Milky-Way B-fields, taking into account the state-of-the-art models for both regular and turbulent components. I will discuss how graviton-to-photon conversions may lead to unexpected imprints in the Cosmic Photon Background (CPB) spectrum in the range of frequencies $f \sim 10^9 - 10^{26}$ Hz. Hence, the absence of any significant evidence for a diffuse photon flux induced by gravitational-wave conversions induce stringent constraints on the gravitational-wave strain h_c.

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Session Classification: Session 4