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Gravitational wave probes of axion-like particles

Friday, 26 June 2020 16:00 (1 hour)

Zoom meeting: https://cern.zoom.us/j/7930190483 (password: see email)

Format: 40 minutes talk + 20 min discussion

Virtual Axion Institute: The discussion on this talk can be continued in Benjamin's virtual guest office. https://mattermost.web.cern.ch/axions/channels/benjamin-stefanek

Abstract: Conventional approaches to probing axions and axion-like particles (ALPs) typically rely on a coupling to photons. However, if this coupling is extremely weak, ALPs become invisible and are effectively decoupled from the Standard Model. Such particles, which are viable candidates for dark matter, can also produce a stochastic gravitational wave (GW) background in the early universe. This occurs if the axion couples to a dark gauge boson that experiences a tachyonic instability when the axion begins to oscillate. This instability exponentially amplifies vacuum fluctuations of a single dark photon helicity, resulting in a rapidly time-varying, anisotropic energy distribution that sources chiral GWs. We identify the regions of ALP parameter space which may be probed by future GW detectors, including ground- and space-based interferometers and pulsar timing arrays. Interestingly, these experiments have the ability to probe axions from the bottom up, i.e. in the very weakly coupled regime which is otherwise unconstrained. A smoking gun for the model is the completely chiral nature of the GW peak, which could be detected by LISA or Einstein Telescope if the signal amplitude is large. (40 minutes talk + 20 min discussion)

Presenter: STEFANEK, Benjamin A. (JGU Mainz)

Session Classification: Gravitational waves