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Intensity Interferometry Search for Ultralight Bosonic Dark Matter in GNOME Data

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The Global Network of Optical Magnetometers for Exotic physics searches (GNOME) [1] uses precise atomic spin-based sensors (magnetometers and comagnetometers) to search for ultralight dark matter (e.g., axions and axion-like particles). GNOME searches for the global exotic spin perturbations that could be simultaneously observed in distant laboratories. It was recently proposed to use GNOME to search for ultralight bosonic dark matter virialized in the galactic halo by possible quadratic coupling to fermion spins [2]. This so-called intensity interferometry approach is based on searches for correlations in stochastically fluctuating signals recorded in different GNOME stations. Compared to the resonant searches aiming at a direct detection of oscillations in signals arising at the dark matter Compton frequency, this approach allows us to extend the probed Compton frequency range by around six orders of magnitude (corresponding to the ratio of carrier Compton frequency to the frequency dispersion caused by the relativistic Doppler effect). With a bandwidth of around 100 Hz, GNOME is expected to probe quadratic coupling in a mass range 10^{-14}-10^{-9} eV. Working progress and analysis prospects will be discussed during the presentation.

[1] S. Pustelny, et al., The global network of optical magnetometers for exotic physics (gnome): A novel scheme to search for physics beyond the standard model, Annalen der Physik 525, 659 (2013).

[2] H. Masia-Roig, et al., Intensity interferometry for ultralight bosonic dark matter detection, arXiv:2202.0264510.48550/arXiv.2202.02645 (2022).

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