

Search for Axion domain walls using the Global Network of Optical Magnetometers for Exotic physics (GNOME)

Hector Masia-Roig^{1,2}, and Joseph A. Smiga^{1,2} on behalf of the GNOME collaboration

¹ *Helmholtz-Institut Mainz, GSI Helmholtzzentrum für Schwerionenforschung, 55128 Mainz, Germany*

² *Johannes Gutenberg-Universität Mainz, 55128 Mainz, Germany*

The Global Network of Optical Magnetometers for Exotic physics (GNOME) is a network of geographically separated, time-synchronized atomic magnetometers and comagnetometers in magnetically shielded environments [1]. This configuration allows monitoring the Zeeman levels' energy splitting of an atomic ensemble continuously and simultaneously at different places around the globe.

Axion-like particles (ALP) could form topological defects in the form of domain walls. The transit of a domain wall through Earth may alter the levels energy splitting in atoms which can be measured with atomic magnetometers. A time-domain analysis method was applied to the data gathered by GNOME in order to identify possible domain-wall events [2]. We concluded that no significant signals are present in the GNOME science run performed between the 29th of November and the 22nd of December 2017. The sensitivity of the GNOME to domain walls during this science run was evaluated and the parameter space of the ALP which form domain walls was constrained [3].

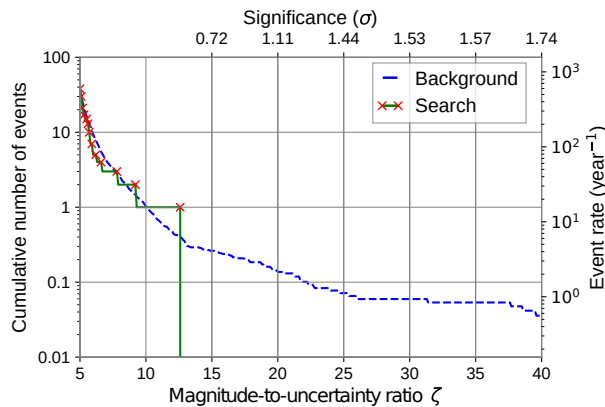


Figure 1: Significance of the events found in the search data with respect to the background.

References

- [1] S. Afach, D. Budker et al., *Physics of the Dark Universe*, **22**, 162-180 (2018).
- [2] H.Masia-Roig, J. A. Smiga et al., *Physics of the Dark Universe*, **28**, 100494 (2020).
- [3] S. Afach, Ben C. Buchler et al., arXiv:2102.13379v2.