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Dark matter searches by the planned gamma-ray telescope GAMMA-400

Our work reviews the planned space-based gamma-ray telescope GAMMA-400 and evaluates in details its opportunities in the field of dark matter (DM) indirect searches. We estimated the GAMMA-400 mean sensitivity to the diphoton DM annihilation cross section in the Galactic center for DM particle masses in the range of 1–500 GeV. We obtained the sensitivity gain at least by 1.2–1.5 times (depending on DM particle mass) with respect to the expected constraints from 12 years of observations by Fermi-LAT for the case of Einasto DM density profile. The joint analysis of the data from both telescopes may yield the gain up to 1.8–2.3 times. Thus the sensitivity reaches the level of annihilation cross section $\langle\sigma v\rangle_{\gamma\gamma}(m_\chi = 100\text{ GeV}) \approx 10^{-28}$ cm^3/s. This will allow us to test the hypothesized narrow lines predicted by specific DM models, particularly the recently proposed pseudo-Goldstone boson DM model. We also considered the decaying DM - in this case the joint analysis may yield the sensitivity gain up to 1.1–2.0 times reaching the level of DM lifetime $\tau_{\gamma\nu}(m_\chi = 100\text{ GeV}) \approx 2 \cdot 10^{29}$ s. We estimated the GAMMA-400 sensitivity to axion-like particle (ALP) parameters by a potential observation of the supernova explosion in the Local Group. This is very sensitive probe of ALPs reaching the level of ALP-photon coupling constant $g_{a\gamma} \sim 10^{-13}$ GeV^{-1} for ALP masses $m_a \leq 1$ neV. We also calculated the sensitivity to ALPs by constraining the modulations in the spectra of the Galactic gamma-ray pulsars due to possible ALP-photon conversion. GAMMA-400 is expected to be more sensitive than the CAST helioscope for ALP masses $m_a \approx (1 - 10)$ neV reaching $g_{a\gamma}^{min} \approx 2 \cdot 10^{-11}$ GeV^{-1}. Other potentially interesting targets and candidates are briefly considered too. The talk is based on the paper JCAP 11, 049 (2020).

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