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

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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 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 $m_a < 1$ 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.

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