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Integral X-ray constraints on sub-GeV dark matter

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Dark matter (DM) in cosmic structures is expected to produce signals originating from its particle physics nature, among which the electromagnetic emission represents a relevant opportunity. One of the major candidates for DM are weak-scale particles, however no convincing signal of them has been observed so far. For this reason, alternative candidates are getting increasing attention, notably sub-GeV particles, which are the subject of our work. The challenge in indirect detection of sub-GeV DM is that there is scarcity of competitive experiments in the energy range between 1 MeV and hundreds of MeV, hence we need to find alternative ways to study DM candidates with mass in this energy window. In our work we proposed to look at energies much lower than the mass of the sub-GeV DM particles by including the contribution from Inverse-Compton scattering (ICS) in the total flux. In particular, the electrons and positrons produced by DM particles give rise to X-rays by upscattering the low-energy photons of the radiation fields in the Galaxy (CMB, infrared from dust, optical starlight). These X-rays fall in the energy range covered by the INTEGRAL data, which we used to determine conservative bounds on the DM annihilation cross-section. We considered three annihilation channels: electron, muon and pion. As a result, we derived competitive constraints for DM particles with a mass between 150 MeV and 1.5 GeV.

Author: Mrs PINETTI, Elena (University of Turin & INFN Turin & Sorbonne University)

Presenter: Mrs PINETTI, Elena (University of Turin & INFN Turin & Sorbonne University)

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