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Constraints on Axion-Like Particles from a Hard X-Ray Observation of Betelgeuse MENGJIAO XIAO, KERSTIN PEREZ, Massachusetts Institute of Technology, MAURIZIO GIANNOTTI, Barry University, OSCAR STRANIERO, INAF, ALESSANDRO MIRIZZI, INFN, BRIAN GREFENSTETTE, California Institute of Technology, BRANDON ROACH, MELANIA NYNKA, Massachusetts Institute of Technology — Axion-like particles (ALPs) can be produced in stellar plasmas via the Primakoff process due to the photon-ALP coupling. Light ALPs produced in this way can easily escape the star and be converted back into photons in the Galactic magnetic field. Betelgeuse (α-Orionis, spectral type M2Iab), a nearby red supergiant star, provides an excellent laboratory for ALP searches, as it (i) has a hot core, and thus is potentially a copious producer of ALPs that, after re-conversion, produces a photon signal peaked in the hard X-ray (E>10 keV) range, (ii) is in region of Hertzsprung-Russel diagram where no stable corona is expected, and thus has essentially zero standard astrophysical X-ray background, and (iii) is nearby, at a distance d 200 pc, and thus in a region of the local magnetic field that is relatively easier to constrain with future observations. We use the first observation of Betelgeuse in hard X-rays to perform a novel search for ALPs. With a 50 ks observation by the NuSTAR satellite telescope, we find no significant excess of events above the expected background and set a stringent upper limit on the ALP-photon coupling. In this contribution, I will detail this work while focusing on the data analysis, results and impact, and emphasizing the uncertainty.

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