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## Probing Axion-Nucleon Couplings with Supergiant Stars

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A finite axion-nucleon coupling enables the production of axions in stellar environments via the thermal excitation and subsequent de-excitation of  ${}^{57}$ Fe isotopes.

Given its low-lying excited state at 14.4 keV, <sup>57</sup>Fe can be efficiently excited in the hot cores of supergiant stars, leading to axion emission. If these axions convert into photons in the Galactic magnetic field, they would produce a characteristic 14.4 keV line detectable by hard X-ray telescopes such as NuSTAR.

We will present the first constraints on axion-nucleon couplings derived from NuSTAR observations of Betelgeuse and discuss the potential insights that could be gained from detecting this line on the characteristic properties of Betelgeuse and similar supergiant stars. Our results establish significantly more stringent bounds than those obtained from solar observations for axion masses of  $m_a$  $lesssim 10^{-10}$  eV.

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