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Neutron star heating by dark matter in an ALP mediated lepton-flavor-violating model

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We investigate the capture of fermionic dark matter by neutron stars in scenarios where the dark matter interacts with leptons via a pseudoscalar mediator that violates lepton flavor in the μ–e sector. We demonstrate that such interactions can lead to significant heating of the star, potentially raising its surface temperature to $\sim!2000\,\mathrm{K}$. This level of heating may be detectable in the near future with upcoming infrared telescopes, including the James Webb Space Telescope (JWST), the Thirty Meter Telescope (TMT), and the European Extremely Large Telescope (E-ELT). Our analysis accounts for both kinetic energy deposition from dark matter capture and heating from annihilation in the stellar core. We also address the subtleties involved in inelastic capture processes, with particular attention to the implications of lepton-flavor-violating interactions.

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