Abstract Submitted
for the NMC16 Meeting of
The American Physical Society

Collapse of Axion Stars[1] MADELYN LEEMBRUGGEN, JOSHUA EBY, PETER SURANYI, ROHANA WIJEWARDHANA, University of Cincinnati — Axion stars, gravitationally bound states of low-energy axion particles, have a maximum mass allowed by gravitational stability. Weakly bound states obtaining this maximum mass have large radii, and as a result, they are dilute and are well described by a leading-order expansion of the axion potential. Heavier states are susceptible to gravitational collapse. Higher-order interactions, present in the full potential, can give qualitatively different results in the analysis of collapsing heavy states, as compared to the leading-order expansion. In this work, we find that collapsing axion stars are stabilized by repulsive interactions present in the full potential, and thus collapsing axion stars do not form black holes. These dense configurations, which are the endpoints of collapse, have extremely high binding energy, and as a result, decay through number changing $3\,a \to a$ interactions with an extremely short lifetime.

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Date submitted: 17 Aug 2016 Electronic form version 1.4