

Limit on the Axion Decay Constant from the Cooling Neutron Star in Cassiopeia A

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The observed rapid cooling of the neutron star (NS) located at the center of the supernova remnant Cassiopeia A (Cas A) can be explained in the minimal NS cooling scenario. This consequence may be changed if there exists an extra cooling source, such as axion emission. In this work, we study the Cas A NS cooling in the presence of axion emission, taking account of the temperature evolution in the whole life of the Cas A NS. We obtain a lower limit on the axion decay constant, $f_a > (5 - 7) \times 10^8$ GeV, if the star has an envelope with a thin carbon layer. This is as strong as existing limits imposed by other astrophysical observations such as SN1987A.

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