

# Whispers from the Dark Universe - Particles & Fields in the Gravitational Wave Era

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## WHISPERS FROM THE DARK UNIVERSE – PARTICLES & FIELDS IN THE GRAVITATIONAL WAVE ERA

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## Constraining light QCD axions with NS cooling

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Lighter than expected QCD axions can get sourced in neutron stars, which can lead to a new ground state of nuclear matter, reminiscent of strange quark matter. The presence of such a new ground state drastically changes the stellar composition of neutron stars; in particular, in the limit where axion gradient effects can be neglected, the star ends with an extremely large energy density. This prevents the existence of heat-blanketing envelopes; a low-density phase in which the isothermal core temperature drops towards the surface by several orders of magnitude and dictates the cooling behavior. In the absence of such envelopes, the surface temperature would hence be orders of magnitude larger, resulting in the same increase in the cooling rate. Confrontation with data allows to probe large regions of previously unexplored axion parameter space.

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