Contribution ID: **66** Type: **Talk**

Axion constraints from white dwarf cooling in 47 Tucanae

Friday, 20 September 2024 10:20 (20 minutes)

Astrophysical objects such as white dwarfs, the remnants left by most stars after nuclear burning in the core has finished, are increasingly popular targets to search for evidence of axions. If axions interact with electrons, then axions could be produced at an appreciable rate in the dense, electron-degenerate core of a white dwarf via axion bremsstrahlung from electrons. The emission of these axions would provide an additional mechanism by which white dwarfs can lose energy and thus affect the rate of white dwarf cooling. Hints of axions have been suggested based on observations of the cooling of white dwarfs in the Galactic disc and halo, but the statistical analysis of these populations of white dwarfs is complicated by the variability of some key parameters important for comparing models of white dwarf cooling with observations, such as the white dwarf birthrate and distance. Conversely, globular clusters like 47 Tucanae provide populations of white dwarfs for which many of these key parameters are well controlled. In this talk, I will present the results of a detailed statistical analysis of the cooling of white dwarfs in 47 Tucanae to look for indirect evidence of axions. White dwarf cooling models were created by performing stellar evolution simulations that incorporated energy loss due to axion bremsstrahlung, and these cooling models were compared to observations from the Hubble Space Telescope. This analysis provides a new constraint on the axion-electron coupling that improves upon previous bounds by nearly a factor of two and excludes the range of values favoured by the axion hints from the cooling of Galactic white dwarfs.

Primary author: FLEURY, Leesa (University of British Columbia)

Co-author: HEYL, Jeremy (University of British Columbia)

Presenter: FLEURY, Leesa (University of British Columbia)

Session Classification: Morning 5