

Proposal Abstract:

The axion is a well-motivated candidate for dark matter. It solves the strong CP problem, but its interaction with electromagnetism had been expected but never detected experimentally. Such particles may convert to radio frequency photons in the magnetosphere of compact stars. The radio signature of such a process is a narrow spectral line at a frequency determined by the mass of axion. Based on the Goldreich-Julian model for the magnetosphere and the Navarro-Frank-White (NFW) model for dark matter density, we obtain the axion-induced pulse profile of such process with the help of the up-to-date plasma ray tracing method. We propose to observe PSRs J1841-0456 and J0250+5854 to search for the signature of axion conversion. If succeed, we detect the axion for the first time, although the chance is very low. Otherwise, we can deliver the most robust upper limit for the axion-photon coupling constants in mass range of (4.2,4.5) micro eV (around 1GHz), such parameter space had never been probed before.