

Searching for axion dark matter with MeerKAT

Abstract

Attempts to understand the nature of dark matter have long been at the forefront of modern science. A particularly compelling dark matter candidate, of increasing scientific interest in recent years, lies in a class of particles known as axions, which were originally postulated to solve the Strong CP problem in particle physics. By virtue of the expected conversion of axions into monochromatic radio photons in neutron star magnetospheres, there is a convenient and sensitive way to probe axions with radio telescopes. We propose the UHF-band MeerKAT observations of the isolated neutron star RX J0806.4-4123 and the near galactic centre magnetar SGR J1745-2900, with the specific target of discovering or ruling out axion dark matter in the $2.5 - 5 \mu\text{eV}$ mass range (544 – 1088 MHz frequencies). This range is of particular interest due to its complementarity with laboratory-based axion dark matter searches, and especially the thus-far unexplored 810 – 1090 MHz gap between the ADMX and RBF experiments.