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Detecting Axion Dark Matter through the Radio Signal from Omega Centauri

As a well-motivated dark matter candidate, axions can be detected through the axion-photon resonant conversion in the magnetospheres of magnetic white dwarf stars or neutron stars. In this work, we utilize Omega Centauri, which is the largest globular cluster in the Milky Way and is suggested to be the remnant core of a dwarf galaxy, to probe the axion dark matter through radio signals that originate from all the neutron stars and magnetic white dwarf stars in it. With 100 hours of observation, the combination of SKA phase 1 and LOFAR can effectively probe the parameter space of the axion-photon coupling $g_{a\gamma}$ up to $10^{-14} \sim 10^{-15}$ GeV^{-1} for the axion mass range of $0.1 \sim 30$ μeV. Depending on the choice of neutron star evolution model, this limitation is two or three and a half orders of magnitude higher than that of the single neutron star or magnetic white dwarf.

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