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Axion dark matter echoes: a global analysis of astrophysical sources

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Axion dark matter produces echo images of bright radio sources due to stimulated decay. These echo images take the form of a faint radio line centered at half the axion mass with a width determined by the dark matter velocity dispersion. Due to the kinematics of the decay, the echo image can either be antipodal to the incoming source of stimulating radiation (gegenschein) or can be along the same line of sight as the source ("forwardschein"). We present an all-sky analysis of axion dark matter-induced echo images using extragalactic radio point sources (i.e. radio galaxies), supernova remnants (SNRs), and galactic synchrotron radiation as sources of stimulating radiation. Because galactic synchrotron radiation is diffuse and faint compared to point sources, we find that the forwardschein constitutes a large fraction of the signal, particularly in the direction of the Galactic center. We find that existing radio telescopes like the Canadian Hydrogen Intensity Mapping Experiment (CHIME) may already be sensitive to axion dark matter (DM) with just given archival data.

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