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Gravitational Wave Probes of Axion Rotations Responsible for Dark Matter and Baryon Asymmetry

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We established a paradigm where the (QCD) axion's novel cosmological evolution, a rotation in the field space, gives rise to dark matter and the baryon asymmetry. The axion rotations also provide a natural origin for a kination era, where the total energy density is dominated by the kinetic term of the axion field, preceded by an early era of matter domination. We investigate the effects of this cosmological scenario on the spectrum of possible primordial gravitational waves from inflation or cosmic strings and find that the spectrum features a triangular peak. As a result, future gravitational wave observations can probe the viable parameter space of kination, including regions that produce axion dark matter by the kinetic misalignment mechanism or the baryon asymmetry by axiogenesis.

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