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## Inflation, Origin of Matter Asymmetry, and GW Background

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Modern cosmology has been remarkably successful in describing the Universe from a second after the Big Bang until today. However, our current understanding of the cosmos before that time is less precise. Moreover, cosmology profoundly involves particle theory beyond the Standard Model to explain its long-standing puzzles: the origin of the observed matter asymmetry, particle nature of dark matter, and cosmic inflation. In this talk, I will explain that relic axion-gauge fields in fractions of a second after the Big Bang can relate and explain these seemingly unrelated puzzles in early and late cosmology. This new particle physics for inflation breaks matter-antimatter symmetry in inflation and does not require CP violation in the neutrino sector. As a smoking gun, such relics would provide a new window into the early Universe through primordial gravitational waves. Therefore, they are testable by future probes of GWs across 21 decades in frequency.

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