

Resolving the QCD Axion Domain Wall Problem with a Light Axion

Monday 10 November 2025 15:30 (20 minutes)

We propose two novel solutions to the domain wall problem of the QCD axion by introducing a massless or light axion that also couples to gluons. The first solution applies when the new axion forms strings after inflation. Due to its mixing with the QCD axion, domain walls of the QCD axion are bounded by these strings and confined into cosmologically safe string bundles. This scenario predicts the existence of such string bundles, which may survive until today and leave observable signatures, such as gravitational waves, cosmic birefringence, and CMB anisotropies. The simultaneous detection of the QCD axion and any of these cosmological signatures would serve as a smoking-gun signal. The second solution assumes a homogeneous initial condition for the new axion. If it is sufficiently light, its potential temporarily induces a bias in the QCD axion potential before the onset of oscillations, rendering the domain walls unstable. In both scenarios, the Peccei-Quinn mechanism remains effective, and the strong CP problem is not reintroduced. We identify the viable parameter regions and discuss the resulting dark matter abundance.

Presenter: MURAI, Kai

Session Classification: Parallel session - Theory I