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Role of QCD axion in an inflationary universe with non-Abelian gauge fields

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In this talk I will consider an inflationary universe with non-Abelian gauge fields and axion fields that are in part identified with the standard model of particle physics.

In particular I consider possibilities of an enlarged color group with extra heavy quarks that solves the strong CP problem. When the heavy quarks are integrated out below the Peccei-Quinn symmetry breaking scale, they generate an axion coupling which makes the non-Abelian gauge field develop slowly during inflation and solves the strong CP problem of QCD after inflation.

In this class of models, the axion mass receives a new non-perturbative contribution from the new confinement scale, which is larger than the inflationary scale.

I then discuss the running of the gauge coupling constants that realizes the observable signal as chiral gravitational waves from inflation.

Finally, I constrain the number of extra heavy quarks in this scenario by future CMB observations.

Primary authors: Prof. KOMATSU, Eiichiro (Max Planck Institute for Astrophysics); Dr MALEKNEJAD, Azadeh (Max Planck Institute for Astrophysics); Dr LOZANOV, Kaloian (Max Planck Institute for Astrophysics)

Presenter: WATANABE, Yuki

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