Contribution ID: **271** Type: **not specified**

Gauge and fermion preheating and the end of axion inflation

Thursday, August 6, 2015 3:12 PM (18 minutes)

Axions are attractive candidates for theories of large-field inflation that are capable of generating observable primordial gravitational wave backgrounds. These fields enjoy shift-symmetries that protect their role as inflatons from being spoiled by coupling to unknown UV physics. This symmetry also restricts the couplings of these axion fields to other matter fields. At lowest order, the only allowed interactions are derivative couplings to gauge fields and fermions. These derivative couplings lead to the biased production of fermion and gauge-boson helicity states during and after inflation. I will describe some recent work on preheating in axion-inflation models that are derivatively coupled to Abelian gauge-fields and fermion axial-currents.

For an axion coupled to U(1) gauge fields it is found –analytically and numerically- that preheating is efficient for a wide range of parameters. In certain cases the inflaton is seen to transfer all its energy to the gauge fields within a few oscillations. In most cases, three-dimensional lattice simulations showed that the gauge fields on sub-horizon scales end preheating in an unpolarized state due to the existence of strong rescattering between the inflaton and gauge-field modes. The conclusions are qualitatively similar for quadratic and monodromy axion potential, with the additional formation of oscillons for the latter.

Coupling an axion to Majorana fermions leads to biased production of fermion helicity-states which can have interesting phenomenological implications for leptogenesis.

Oral or Poster Presentation

Oral

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Session Classification: AstroParticle, Cosmology, Dark Matter Searches, and CMB

Track Classification: Cosmology and Dark Matter Theory