

Scalars 2015

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Pseudoscalar fields in the Universe, novel ways of Majorana neutrino mass generation and Leptogenesis

Content :

I first discuss the role of pseudoscalar fields in potentially inducing Majorana neutrino mass in a way alternative to seesaw and then I proceed to study the role of cosmic backgrounds of such fields in the early Universe in inducing Leptogenesis. A particularly interesting realization of the above ideas, motivated from string theory, which I will concentrate upon in the talk, is that of an antisymmetric Kalb-Ramond (KR) tensor field arising in the gravitational multiplet of the string. In four space-time dimensions, the field strength of the KR field is dual to a pseudoscalar field, whose mixing with ordinary axions in the Universe can lead to the above mentioned Majorana mass generation via Yukawa couplings of the axions to neutrinos. On the other hand, a constant in time background of the KR field strength in the early Universe, playing the role of a torsion field, can lead to Leptogenesis via CP violating tree level decays of right-handed Majorana neutrinos. Phenomenological challenges and open issues in such scenarios are discussed.

Summary :

I first discuss the role of pseudoscalar fields in potentially inducing Majorana neutrino mass in a way alternative to seesaw and then I proceed to study the role of cosmic backgrounds of such fields in the early Universe in inducing Leptogenesis. A particularly interesting realization of the above ideas, motivated from string theory, which I will concentrate upon in the talk, is that of an antisymmetric Kalb-Ramond (KR) tensor field arising in the gravitational multiplet of the string. In four space-time dimensions, the field strength of the KR field is dual to a pseudoscalar field, whose mixing with ordinary axions in the Universe can lead to the above mentioned Majorana mass generation via Yukawa couplings of the axions to neutrinos. On the other hand, a constant in time background of the KR field strength in the early Universe, playing the role of a torsion field, can lead to Leptogenesis via CP violating tree level decays of right-handed Majorana neutrinos. Phenomenological challenges and open issues in such scenarios are discussed.

Referneces:

[1] N.-E.~Mavromatos and A.~Pilaftsis, ``Anomalous Majorana Neutrino Masses from

Torsionful Quantum Gravity," Phys.\ Rev.\ D {\bf 86}, 124038 (2012)
[arXiv:1209.6387 [hep-ph]].

[2] M.-de Cesare, N.-E.-Mavromatos and S.-Sarkar,
``Tree level Leptogenesis from Kalb-Ramond Torsion Background," EPJC in press
(2015) [arXiv:1412.7077 [hep-ph]].

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