Contribution ID: **128** Type: **not specified**

Phenomenological impact of anomaly-free axion in three Higgs doublet model

Tuesday 26 July 2022 14:36 (18 minutes)

Axion is one of the promising candidates for light dark matter (DM). Although the mass scale of axion is multifarious, the keV scale would be interesting. Because an excess has been reported in the XENON1T experiment and such a direct search experiment can probe the axion with a mass of keV scale. The crucial constraint for axion in this mass range is the X-ray bound. Due to this, for the usual axion, its decay constant should be GUT scale or more and this follows that the corresponding axion-electron coupling is far away from the sensitivity of the direct search experiments. On the other hand, anomaly-free axion can evade the severe X-ray bounds and at the same time, can simultaneously explain DM and the XENON1T excess at the intermediate scale of the decay constant. In this talk, we consider a three Higgs doublet model (3HDM) as a possible renormalizable model where the anomaly-free axion can be embedded. We discuss the effect of the mixing among the axion and CP-odd Higgs bosons predicted in 3HDM for the axion couplings. In addition, we clarify the relation between the axion and heavy Higgs bosons.

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Session Classification: Parallel Session B

Track Classification: Particle Physics