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Probing Light Fermiophobic Higgs in Type-I 2HDM with CNN-Based Diphoton Jet Substructure Analysis

Tuesday, 25 February 2025 16:00 (30 minutes)

In the Two-Higgs-Doublet Model (2HDM) Type-I, setting the coupling between a light CP-even Higgs boson and fermions to zero introduces a fermiophobic Higgs h, which dominantly decays as $h \rightarrow \gamma\gamma$. Searching for h with a mass below 10 GeV presents a challenge, as conventional isolated diphoton methods become ineffective. This is due to the $h \rightarrow \gamma\gamma$ decay producing highly collimated diphotons that merge into a single jet, making traditional photon-based searches impractical. To address this, we develop a machine learning model that leverages CNNs to analyze jet substructure, enabling the identification of diphoton jets and distinguishing them from QCD backgrounds. In this talk, I will introduce the 2HDM Type-I fermiophobic Higgs, discuss the unique challenges associated with detecting diphoton jets, and compare the effectiveness of cut-based and machine learning analyses in enhancing signal discrimination.

Presenter: LEE, Soojin (Konkuk University)

Session Classification: Afternoon Talks