Contribution ID: **2056** Type: **Oral**

Twisted States in Higgs Boson Decay into Fermion Antifermion Pair

Monday 27 October 2025 12:45 (15 minutes)

We analyze Higgs decay $H \to f\overline{f}$ allowing for final states with nonzero angular momentum ("twisted" states). We construct the two-particle wavefunction from the S-matrix element in momentum space and transform it to coordinates. In the Higgs rest frame the wavefunction depends solely on the relative coordinate r and the spin orientations, enabling a spherical-harmonic decomposition that isolates partial waves and their spin-orbit structure. We obtain compact angular factors controlled by the projections $\vec{\xi_1} \cdot \hat{r}, \vec{\xi_2} \cdot \hat{r}$ and $\vec{\xi_1} \cdot \vec{\xi_2}$. The results demonstrate how spin-orbit coupling manifests in scalar boson decays and provide a theoretical framework for analyzing twisted fermion states in high-energy processes.

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Session Classification: Theoretical Physics

Track Classification: Theoretical Physics