Phenomenology 2018 Symposium



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New Physics in Old Data? Localized 4-Sigma and 5-Sigma Dijet Mass Excesses in ALEPH LEP2 Four-Jet Events

Monday 7 May 2018 17:30 (15 minutes)

We investigate an excess observed in hadronic events in the archived LEP2 ALEPH data. The events are clustered into four jets and paired such that the mass difference between the two dijet systems is minimized. The excess occurs in the region $M_1 + M_2 \sim 110$ GeV; about half of the excess is concentrated in the region $M_1 \sim 80$ GeV, $M_2 \sim 25$ GeV, with a local significance between 4.7σ and 5.5σ , depending on assumptions about hadronization uncertainties. The other half of the events are in a broad excess near $M_1 \sim M_2 \sim 55$ GeV; these display a local significance of $4.1 - 4.5\sigma$. We investigate the effects of changing the SM QCD Monte Carlo sample, the jet-clustering algorithm, and the jet rescaling method, finding that the excess is remarkably robust under these changes, and we find no source of systematic uncertainty that can explain the excess. No analogue of the excess is seen at LEP1. We conclude that this excess should be investigated by the other LEP experiments and QCD experts.

Summary

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