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Growing evidence of new bosons at the LHC

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Particle Physics today displays a growing number of anomalies that cannot be explained by the Standard Model. Some of these anomalies are related to New Physics via quantum corrections. Other anomalies may be connected with the decay of new particles. This is the case the multi-lepton (electrons and muons) anomalies at the LHC. These include the excess production of opposite sign leptons with and without b-quarks, including a corner of the phase-space with a full hadronic jet veto; same sign leptons with and without b-quarks; three leptons with and without b-quarks, including also the presence of a Z. The internal consistency of these anomalies and their interpretation in the framework of a simplified model are presented, where the inconsistency of the data with the SM is more than 8 sigma. This points towards the existence of a new scalar S with a mass in the range 130-170 GeV produced from the decay of a heavier new scalar H. Motivated by this, a search for narrow resonances with $S \rightarrow \gamma\gamma$, $Z\gamma$ in association with light jets, b-jets or missing transverse energy is performed. Using a simplified model, the maximum global significance of about 4 sigma is achieved for $m_S = 151.5$ GeV. Combined with the multi-lepton anomalies the significance far surpasses 5 sigma. The potential connection of these excesses with other anomalies will be discussed as well.

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

N/A

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