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SO(10) Grand Unification from M-theory on a G2-manifold

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We consider Grand Unified Theories based on $SO(10)$ which originate from M-theory on G_2-manifolds. In this framework we are naturally led to a novel solution of the doublet-triplet splitting problem involving an extra $\mathbf{16}_X, \overline{\mathbf{16}}_X$ vector-like pair by considering discrete symmetries of the extra dimensions and preserving unification. Since Wilson line breaking preserves the rank of the gauge group, the necessary $U(1)$ gauge breaking is generated from extra multiplets. The main prediction of the approach is the existence of light states with the quantum numbers of a $\mathbf{16}_X, \overline{\mathbf{16}}_X$ vector-like pair which could show up in future LHC searches.

Primary author: CRISPIM ROMAO, Miguel (University of Southampton)

Presenter: CRISPIM ROMAO, Miguel (University of Southampton)

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