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Naturalness of a brane-localized electroweak Higgs boson

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In the Standard Model (SM) of Particle Physics, the electroweak (EW) symmetry breaking pattern is the less known and understood. With the discovery of a Higgs-like boson by the Large Hadron Collider (LHC) experiment in 2012, the Brout-Englert-Higgs (BEH) mechanism, which involves a new scalar field to break the EW gauge symmetry, seems to be at work in Nature. Nevertheless, the origin of the BEH field remains a mystery and it suffers from a technical naturalness puzzle: why the Higgs boson is so light compared to the quantum gravity scale? The Higgs sector can also play an important role to understand the open questions of the SM, like the flavour landscape, the masses of the neutrinos, the dark components of the Universe, the inflation... My PhD subject involves studying models with spatial extra dimensions, which could solve some of these questions. My starting point is the first Randall-Sundrum (RS1) model, where the Universe is a slice of AdS5 with the BEH field localized on a 3-brane at a boundary, and the fermions and gauge bosons propagating in the bulk. This scenario naturally produces a huge hierarchy between the EW and quantum gravity scales, and gives a solution to the flavor puzzle by a geographical mechanism in the extra dimension. In practice, I develop models from which I dig out the first phenomenological consequences.

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