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Conformal Realization of the Neutrino Option and its Gravitational Wave Signature

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It was recently proposed that the electroweak hierarchy problem is absent if the generation of the Higgs potential stems exclusively from quantum effects of heavy right-handed neutrinos which can also generate active neutrino masses via the type-I seesaw mechanism. Hence, in this framework dubbed the "neutrino option", the tree-level scalar potential is assumed to vanish at high energies. Such a scenario therefore lends itself particularly well to be embedded in a classically scale-invariant theory. In this talk we demonstrate that the minimal scale-invariant framework compatible with the "neutrino option" requires the Standard Model to be extended by two real scalar singlet fields in addition to right-handed neutrinos. We present the parameter space of the model for which a phenomenologically viable Higgs potential and neutrino masses are generated, and for which all coupling constants remain in the perturbative regime up to the Planck scale. In addition, we show that the phase transition connected with radiative scale symmetry breaking is of strong first order with a substantial amount of supercooling. This yields a sizable gravitational wave signal, so that the model can be fully tested by future gravitational wave observatories. In particular, most of the parameter space can already be probed by the upcoming LIGO science run starting in early 2019.

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