

Proposed contribution for the European Strategy Discussion

Areas of exploration complementary to colliders: Gravitational Waves

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In accordance with point 4) of the ECFA guidelines, my goal with this contribution is to highlight that with current and future gravitational wave experiments, which jointly cover a multi-frequency band from the nHz to the kHz, it is possible to obtain information about i) the scale where new physics phenomena might exist, ii) the size of theory couplings (e.g. scalar self-interactions, gauge and Yukawa couplings), iii) as well as connection to neutrino physics. This class of observables, if not too decoupled from the Standard Model, can also be directly tested at current and future colliders. Effective articulation among communities can potentially provide valuable insights in relation to question 3a) of the ECFA guidelines. This discussion is intended to be brief and will be supported by a few physics examples drawn from the literature (see e.g. [1]) and my own recent research (see e.g. [2] and [3]).

[1] *HHH Whitepaper*, Hamza Abouabid *et al.*, *Eur.Phys.J.C* 84 (2024) 1183, [2407.03015](#) [hep-ph].

[2] *Gravitational waves from supercooled phase transitions in conformal Majoron models of neutrino mass*, João Gonçalves *et al.*, [2412.02645](#) [hep-ph].

[3] *Gravitational waves from color restoration in a leptokuark model of radiative neutrino masses*, Mårten Bertenstam *et al.*, [2501.01286](#) [hep-ph].