

# Testing Grand Unified Theories with gravitational waves and proton decay

*Friday, 2 June 2023 11:45 (5 minutes)*

We consider a minimal non-supersymmetric  $SO(10)$  Grand Unified Theory (GUT) model that can reproduce the observed fermionic masses and mixing parameters of the Standard Model. We calculate the scales of spontaneous symmetry breaking from the GUT to the Standard Model gauge group using two-loop renormalisation group equations. This procedure determines the proton decay rate and the scale of  $U(1)_{B-L}$  breaking, which generates cosmic strings and the right-handed neutrino mass scales. Consequently, the regions of parameter space where thermal leptogenesis is viable are identified and correlated with the fermion masses and mixing, the neutrinoless double beta decay rate, the proton decay rate, and the gravitational wave signal resulting from the network of cosmic strings. We demonstrate that this framework, which can explain the Standard Model fermion masses and mixing and the observed baryon asymmetry, will be highly constrained by the next generation of gravitational wave detectors and neutrino oscillation experiments which will also constrain the proton lifetime.

**Would you be interested in presenting a poster? (this will not impact the decision on your talk)**

yes

**Primary authors:** FU, Bowen (University of Southampton); TURNER, JESSICA; MARSILI, LUCA (IPPP, University of Durham); PASCOLI, Silvia (Universita e INFN, Bologna (IT)); KING, Stephen Frederick (University of Southampton); Prof. ZHOU, Yeling (UCAS)

**Presenter:** MARSILI, LUCA (IPPP, University of Durham)

**Session Classification:** Gravitational Waves