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Massive neutrino self-interactions and the Hubble tension

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Based predominantly on arXiv: 2012.07519 (JCAP 03 (2021) 084) and also on arXiv: 2207.07142 (JCAP 10 (2022) 018).
We have updated the constraints on flavour universal (and also flavour specific) neutrino self-interactions mediated by a heavy scalar, in the effective 4-fermion interaction limit. We use the relaxation time approximation to modify the collisional neutrino Boltzmann equations, which is known to be very accurate for this particular scenario. Based on the latest CMB data from the Planck 2018 data release as well as auxiliary data we confirm the presence of a region in parameter space with relatively strong self-interactions which provides a better than naively expected fit. However, we also find that the most recent data, in particular high-ℓ polarisation data from the Planck 2018 release, disfavours this solution even though it cannot yet be excluded. Our analysis takes into account finite neutrino masses (parameterised in terms of $\sum m_\nu$) and allows for a varying neutrino energy density (parameterised in terms of $N_{\rm eff}$), and we find that in all cases the neutrino mass bound inferred from cosmological data is robust against the presence of neutrino self-interactions. Finally, we also find that the strong neutrino self-interactions do not lead to a high value of H_0 being preferred, i.e. this model is not a viable solution to the current H_0 discrepancy.

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Leptons

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