

# Constraints on the Species Scale and the Spectrum of States in Quantum Gravity

*Monday 3 June 2024 10:50 (30 minutes)*

The species scale serves as a UV cutoff in the gravitational sector of an EFT which generically depends on the scalar fields in the theory. In this talk, I will show that the field-dependence of the species scale is determined by higher-derivative corrections to the Einstein-Hilbert action. I will further argue that the slope of the species scale as a function of scalar fields is bounded from above everywhere in moduli space. The emergent string conjecture, which gives a constraint on the possible spectrum of light states in gravitational weak-coupling limits, predicts an exact value for this upper bound which is indeed satisfied in all known examples. Using properties of black hole thermodynamics and gravitational scattering amplitudes I will further show that in gravitational weak-coupling limits the density of one-particle states has a universal behavior as a function of energy. Based on this, I will then provide bottom-up evidence for the emergent string conjecture by showing that any tower of weakly coupled, light states is either a KK-tower or features a spectrum of states with degeneracy growing exponentially in energy which resembles excitations of a perturbative string.

**Presenter:** WIESNER, Max (Harvard University, USA)