

Spacetime Quasicrystals

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Self-similar quasicrystals — like the famous Penrose tilings — are exceptional geometric structures in which long-range order, quasi-periodicity, non-crystallographic orientational symmetry, and discrete scale-invariance are tightly interwoven in a beautiful way. In this talk, we discuss how such structures may be naturally generalized from Euclidean space to Minkowski spacetime, yielding the first ever examples of spacetime quasicrystals. We highlight key novel features that distinguish them from their Euclidean cousins, such as their now-infinite orientational and Lorentz-boost symmetries. We then turn to three applications in quantum gravity: first, as a new scheme to implement the most symmetric toroidal compactification of the superstring; second, as a novel class of ordered and highly symmetric causal sets; and finally, we close with ongoing work extending hyperuniformity to spacetime to characterize our quasi-crystalline causal sets.