Abstract Submitted
for the 4CS20 Meeting of
The American Physical Society

Order to Disorder in Quasiperiodic Systems[1] DAVID MORISON, BEN MURPHY, ELENA CHERKAEV, KEN GOLDEN, university of utah — Four decades since the discovery of quasicrystals, the material properties arising from quasiperiodic microgeometry remain an active topic of theoretical intrigue and engineering utili ty. Here we introduce a class of Moir type quasiperiodic media with novel macroscopic behavior. As the microgeometry of a Moir system is tuned, the transport properties switch from those of ordered to randomly disordered materials in a fashion which parallels the Anderson localization transition, even though there are no scattering or interference effects at play. This transition is evident within an integral representation that applies broadly to the effective electrical, thermal, elastic and optical properties of two-phase composite media. This representation distills the relationship between microgeometry and bulk transport into the spectral characteristics of an operator, which is analogous to the Hamiltonian in quantum transport phenomena. Periodic media display sharp resonances, band gaps, and spatially extended eigenstates separated by "mobility edges" of localized states. As we tune system parameters to aperiodicity and disorder, eigenstates become more uniformly extended, and level repulsion increases as the spectral properties transition toward obeying universal Wigner-Dyson statistics.

[1]NSF award 1715680 "Random Matrix Theory for Homogenization of Composites"

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Date submitted: 24 Sep 2020

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