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Quasi-crystalline order in vibrated granular matter

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The last two decades have seen growing interest in soft-matter quasi-crystals: they have been observed in a wide range of systems, from the nanoscale to the micrometer scale, and are considered to be promising bandgap materials for next-generation photonic devices. In this context, two fundamental problems are: i) understanding up to which length scale quasi-crystalline order may form spontaneously, and ii) identifying the key dynamical properties needed for a soft-matter system to form a quasi-crystal.
In this talk, I will provide numerical and experimental evidence of quasi-crystalline order in a binary mixture of millimeter-size spherical grains vibrated on a substrate. The presence of frictional forces (unavoidable for macroscopic objects) and external driving make this system intrinsically off equilibrium. Our findings demonstrate that quasi-crystals can be formed also by macroscopic particles (i.e. far beyond the micron scale where thermal motion can still occur), as well as in systems whose dynamics are far out of thermodynamic equilibrium.

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