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Local growth rules and kinetics for ordered icosahedral quasicrystals JOSHUA SOCOLAR, Duke Univerity, CONNOR HANN, Duke University, PAUL STEINHARDT, Princeton University — Icosahedral quasicrystals (IQCs) with extremely high degrees of translational order have been produced in the lab and found in naturally occurring minerals. While the existence of IQCs is well established, questions remain about how IQCs form. We address the question of whether it is possible in principle for nucleation and growth dominated by local growth rules and kinetics to produce a *perfectly* ordered IQC. We find that it is possible to produce an IQC with a vanishing density of defects through a local growth algorithm for sequential, face-to-face addition of tiles of two different shapes to a growing cluster. The choice of how to add a tile at any selected vertex on the surface is based only on short-range information about tiles that share the vertex. The process is analogous to the Onoda growth rule for 2D Penrose tilings [Onoda et al., PRL 60, 2653 (1988)], but new subtleties emerge in three dimensions. The geometric features underlying this algorithm can inform analyses of experimental systems and numerical models that generate highly ordered quasicrystals.

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