Metallic-mean quasicrystals: Sequences of quasicrystals that approach crystals

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Ever since the discovery of quasicrystals, crystalline approximants of these aperiodic structures constitute a very useful experimental and theoretical device. Characterized by packing motifs typical for quasicrystals but arranged in large unit cells, approximants are often seen in similar conditions as quasicrystals and they bridge the conceptual gap between periodic and aperiodic translational order.

In this talk, we propose a class of sequences of 2D quasicrystals that consist of increasingly larger crystalline domains and are marked by an ever more pronounced periodicity, thereby representing aperiodic approximants of a crystal lattice. The sequences are based on metallic means of multiples of 3, have a 6-fold rotational symmetry, and can be viewed as extensions of the bronze-mean quasicrystal [1].

These k-th metallic-mean QCs can be regarded as *aperiodic approximants* of crystals formed by increasing the size of their domains that consist of triangles as shown in Fig.1, much like crystalline approximants approach QCs as the size of their unit cells grows. The aperiodic approximants introduce a complementary device that unifies aperiodic and periodic patterns, complementing the well-established notion of crystalline approximants.

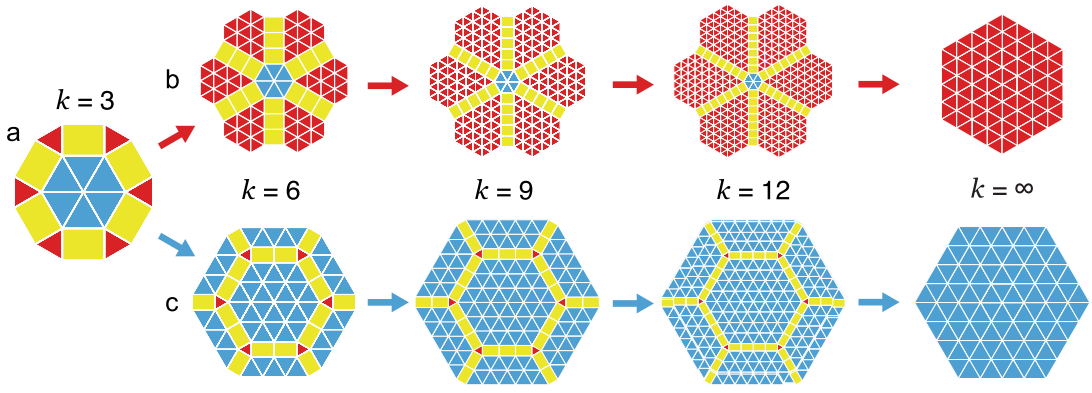

Fig.1 Metallic-mean aperiodic approximants. **a**. Bronze-mean quasicrystal ($k = 3$), **b**. First-generation type IA k-th metallic-mean quasicrystals with $k = 6$, $k = 9$, $k = 12$, and $k \to \infty$, respectively. **c**, First-generation type IB k-th metallic-mean quasicrystals with $k = 6$, $k = 9$, $k = 12$, and $k \to \infty$, respectively.

[1] T. Dotera, S. Bekku, P. Ziherl, Nat. Mater. **16**, (2017) 987.