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Aperiodic crystals and beyond

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Following Dan Shechtman's discovery of quasicrystals in 1982, the realm of crystallography has been extended to include structures that lack translational periodicity. While periodic crystals can be modelled as decorations of lattices, aperiodic crystals require more general discrete structures such as point sets or tilings in space for the description of their structure. For a mathematical introduction to the field of aperiodic order, we refer to the recent monograph [1]. Interesting examples are obtained by projections from higher-dimensional lattices, leading to model sets which have pure Bragg diffraction, though the Bragg peaks are, in general, dense in space. All symmetries that have been experimentally observed in quasicrystals can be reproduced in this way, and some of the resulting structures are standard examples of tilings that are frequently used in quasicrystal modelling, such as the famous Penrose tiling. But there exists a plethora of ordered structures beyond cut and project sets, some of which have even weirder properties. After a general introduction to aperiodically ordered structures, a couple of examples of such systems are briefly described, offering a glimpse at the largely unexplored world of order beyond (aperiodic) crystals.

[1] *M. Baake, U. Grimm, Aperiodic Order. Volume 1. A Mathematical Invitation, Cambridge University Press, Cambridge, 2013.*

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