Quasiperiodic Structures Constructed by Projection in Two Stages

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Pentagonal, octagonal; decagonal and dodecagonal structures have been observed in several alloy systems. These structures are quasi-periodic in a plane and periodic in its perpendicular direction. Crystals aperiodic in one direction have been known for decades. It is interesting to study intermediate structures in which the periodic and quasiperiodi directions are intrinsically connected. That may be done by projecting a a periodic structure in $D(>3)$ dimensions into three-dimensional space so that a second projection be quasiperiodic in a plane. We have achieved this earlier in the octagonal case [1] and partly in the dodecagonal case [2]. Here we present an improved dodecagonal version, as well as a new look at the pentagonal, or rather decagonal case. In the dodecagonal case we cut and project first the four-dimensional root lattice D_4 into $\mathbf{R}^3$ and then into a suitable irrational $\mathbf{R}^2$. In the pentagonal/decagonal case we start with the five-dimensional simple cubic lattice $\mathbf{Z}^5$.

[1] Ben-Abraham S.I., *Ferroelectrics*, 2004, **305**, 29-32. [2] Ben-Abraham S.I., Lerer Y., Snapir Y.,. *J. Non-Cryst. Solids,* 2003, **334-335**, 71-76.

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