The Fascinating World of Quasicrystals

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Abstract

The field came into existence with the pioneering realization by Shechtman in 1982 that the sharp diffraction intensities with $m \overline{3} \overline{5}$ symmetry came from a new kind of structural arrangement in solids- christened 'quasicrystals'. Quasicrystals have given life to the dodecahedron $\{5,3\}$ and its dual the icosahedron $\{3,5\}$- the dormant platonic solids in the crystalline world and hence have realized symmetries forbidden in the periodic world. The discovery physically realized the geometrical ideas of Roger Penrose and dream-vision of Alan Mackay. The existence of a sharp diffraction pattern was only associated with crystals before this discovery.

The talk aims at introducing the structure of quasicrystals via Fibonacci sequences, Penrose tilings and hyper-dimensional projections. Different types of quasicrystals and alloy systems forming these will also be described; along with related structures like rational approximants and vacancy ordered phases.

Keywords: Fibonacci Sequences Penrose Tilings, Quasi-periodicity, Quasicrystals

Brief CV

Anandh Subramaniam did his B.Tech from IIT Madras, followed by a M.E and Ph.D from I.I.Sc., Bangalore. Then he was a scientist in CSIR followed by the position of a Guest Scientist at Max Planck Institute for Metals Research at Stuttgart (as a Max Planck Fellow and as an Alexander von Humboldt Fellow). After being a faculty in the department of Applied Mechanics at IIT Delhi he joined IIT Kanpur in the department of Materials Science and Engineering. Selected awards received by him include: The Shri Ram Arora International Award for Materials Science and Engineering Education (TMS, USA) and Young Research Award (IUMRS). His areas of interest are: Physical Materials Science, Nanomaterials, Quasicrystals, Amorphous Materials, Metastable Materials, Epitaxial Systems, Defects & Interfaces in Materials, Symmetry, Crystallography, Transmission Electron Microscopy, Finite Element Method. Using theory, computational theory, computer simulation and experiments he has published papers on Metals, Semiconductors and Insulators (Ceramics). He is currently preparing two video courses and also writing two books for undergraduates.