Group actions applied to virus architecture

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It has been known for a long time that most viruses exhibit icosahedral symmetry. In 1962 Caspar and Klug[1] developed a theory describing the structure of the protein containers that encapsulate and hence protect the viral genome. The theory’s main ingredients are triangulations of the faces of an icosahedron. The location of (centres of mass of) structural proteins is deduced from such triangulations.

More recently Keef and Twarock[2] extended the Caspar–Klug theory using more general tilings of the icosahedron and superpositions of several tilings. Now more structural details can be explained as well as the organisation of the viral genome inside the icosahedral capsid. In this theory many mathematical objects like quasicrystals, groups, lattices, etc. interact to provide more insight.

We clarify these interactions and provide a more uniform mathematical framework based on group actions.

References
