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The undecakisicosahedral group and a 3-regular carbon network of genus 26. (English)

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Summary: Three projective special linear groups $\text{PSL}(2, p)$, those with $p = 5, 7$ and 11 , can be seen as p -multiples of tetrahedral, octahedral and icosahedral rotational point groups, respectively. The first two have already found applications in carbon chemistry and physics, as $\text{PSL}(2, 5) \cong I$ is the rotation group of the fullerene C_{60} and dodecahedrane $C_{20}H_{20}$, and $\text{PSL}(2, 7)$ is the rotation group of the 56-vertex all-heptagon Klein map, an idealisation of the hypothetical genus-3 “plumber’s nightmare” allotrope of carbon. We present an analysis of $\text{PSL}(2, 11)$ as the rotation group of a 220-vertex, all 11-gon, 3-regular map, which provides the basis for a more exotic hypothetical sp^2 framework of genus 26. The group structure and character table of $\text{PSL}(2, 11)$ are developed in chemical notation and a three-dimensional (3D) geometrical realisation of the 220-vertex map is derived in terms of a punctured polyhedron model where each of 12 pentagons of the truncated icosahedron is connected by a tunnel to an interior void and the 20 hexagons are connected tetrahedrally in sets of 4.

MSC:

92E10 Molecular structure (graph-theoretic methods, methods of differential topology, etc.)

Cited in 2 Documents

05C10 Planar graphs; geometric and topological aspects of graph theory

20B25 Finite automorphism groups of algebraic, geometric, or combinatorial structures

20G99 Linear algebraic groups and related topics

57M20 Two-dimensional complexes (manifolds) (MSC2010)

Keywords:

$\text{PSL}(2,11)$; topology; carbon allotrope

Full Text: DOI

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