
Mathematical Colloquia

Monday, 06 December 2021

17:15 h, **lecture room B6** (ExWi)

Prof. Dr. Gabor Domokos, Budapest University of Technology

Plato's cube and the natural geometry of fragmentation

Abstract: If we approximate natural fragments by convex polyhedra and count the respective numbers for faces, vertices and edges then, in most cases, we find averages remarkably close to 6,8,12, the values corresponding to the cube. Not only can this observation be translated into a simple Lemma about hyperplane convex mosaics, we also find that general convex mosaics may serve as particularly fitting models for natural fragmentation patterns. In 2D, this approach offers a complete, global view while in 3D we support an analogous theory by offering a related geometric conjecture.

To verify our geophysical claims, we vetted field data from over 4000 natural fragments against computer simulations and found not only good agreement for the aforementioned cuboid averages, but we could also reproduce full distributions for many geophysical shape descriptors with remarkable accuracy.

The appearance of the cube (albeit in an averaged sense) in this context may remind one of Plato's theory of the Element Earth. I will briefly comment some purely geometric aspects of this connection.

[1] <https://www.pnas.org/content/117/31/18178>

This is joint work with Doug Jerolmack (U. Pennsylvania), Ferenc Kun (U. Debrecen) and János Török (Budapest U. of Technology and Economics).

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