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NON-EUCLIDEAN CRYSTALLOGRAPHY

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Non-Euclidean crystallography seems to be a new direction in modelling new phenomena as fullerenes, nanotubes, quasi crystals. The existence of such materials gives us the feeling [1], [2] that our experience space in small size can be non-Euclidean, for instance hyperbolic (H3) in the sense of János Bolyai and Nikolai I. Lobachevsky. Polyhedral models as for nanotube in Figure, and the unified projective metric geometry with the newer linear algebraic description provide us with these methods. The mathematical tools have also been overviewed in our conference papers [3], [4] with my colleagues, we are working on this topic. Author's hyperbolic football manifolds on some Archimedean solids are described in [1], in particular the classical football on {5, 6, 6} had already been published in 1988 (in a Dubrovnik Proceedings) without any fullerene reference. Extremal ball packing (with density 0.77147) and covering (with density 1.36893), realized at the football tiling, are better than those of the Euclidean cases. These are our recent results in [5]. These latter investigations led us also to a polyhedral scheme in Figure from [6], as fundamental domain (asymmetric unit under a symmetry group) for so-called cobweb (or tube) manifold Cw(6, 6, 6), where identifying (as with topological glue) the base faces s-1 and s by 1/3 screw motion s, and repeating this process, we get a tube structure. At some vertices four polyhedra Cw can meet, imitating carbon (C) atoms with four bonds. We can extend this construction for polyhedra Cw(2z, 2z, 2z) ($3 \leq z$ odd natural number). So we get an infinite series of compact hyperbolic manifolds (i.e. every point has a ball-like neighborhood) as new topological structures. With these we also get new models for possible nanotube structures realized in the hyperbolic space (H3), maybe also in our experience space (Euclidean, E3) in small size (?).

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