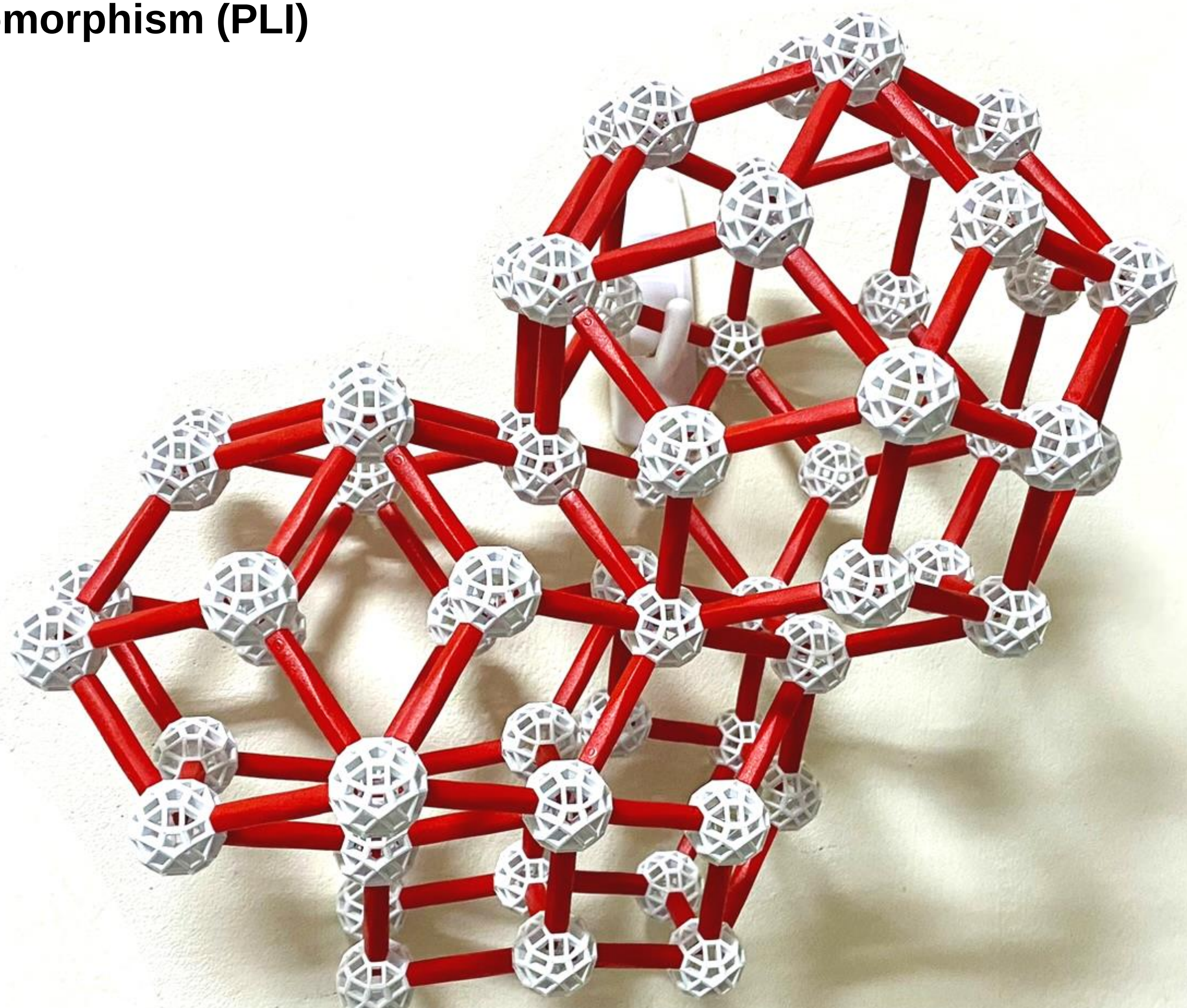
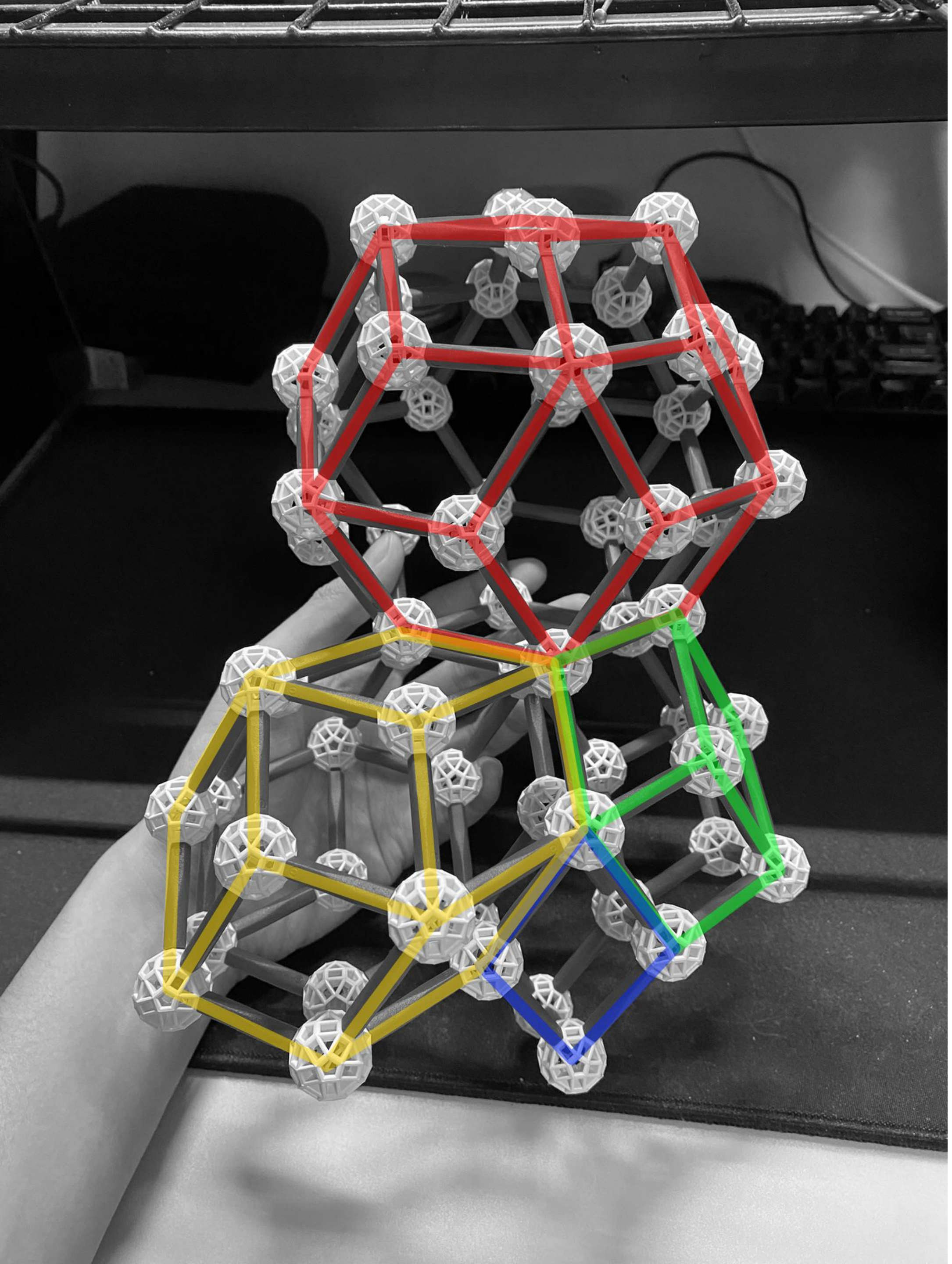
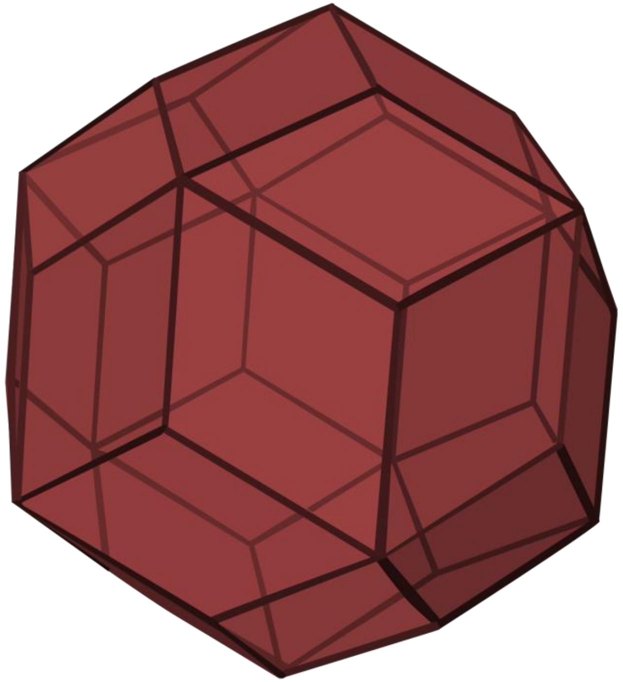
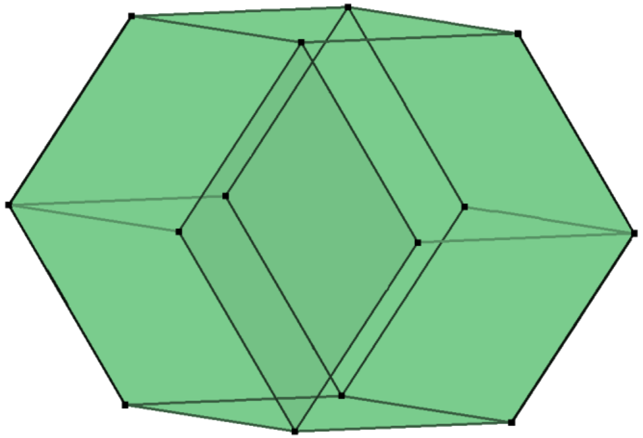
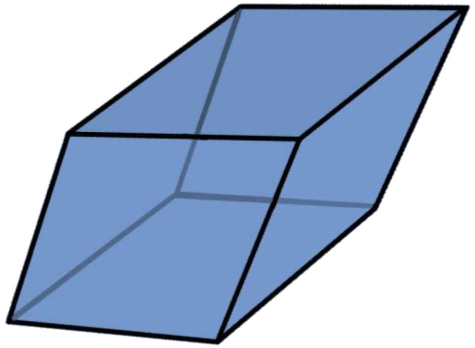
3D Penrose Local Isomorphism (PLI)

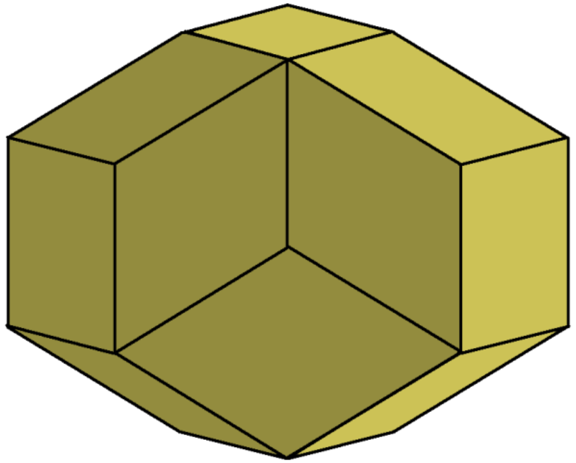










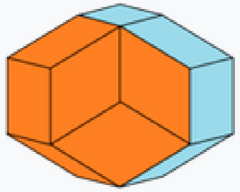
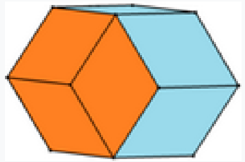
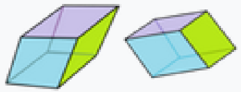
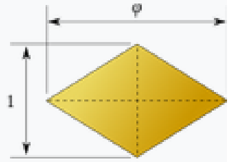


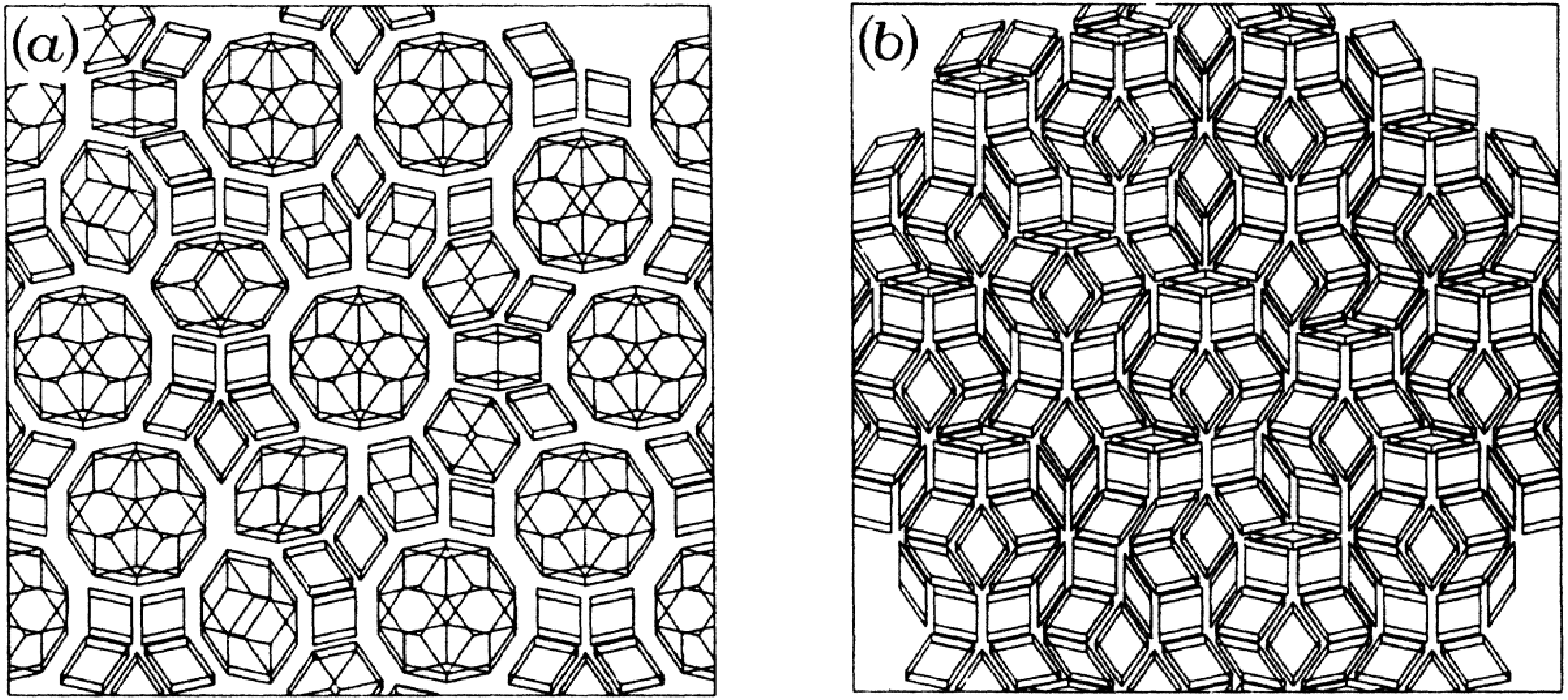
Quasicrystals. I. Definition and structure

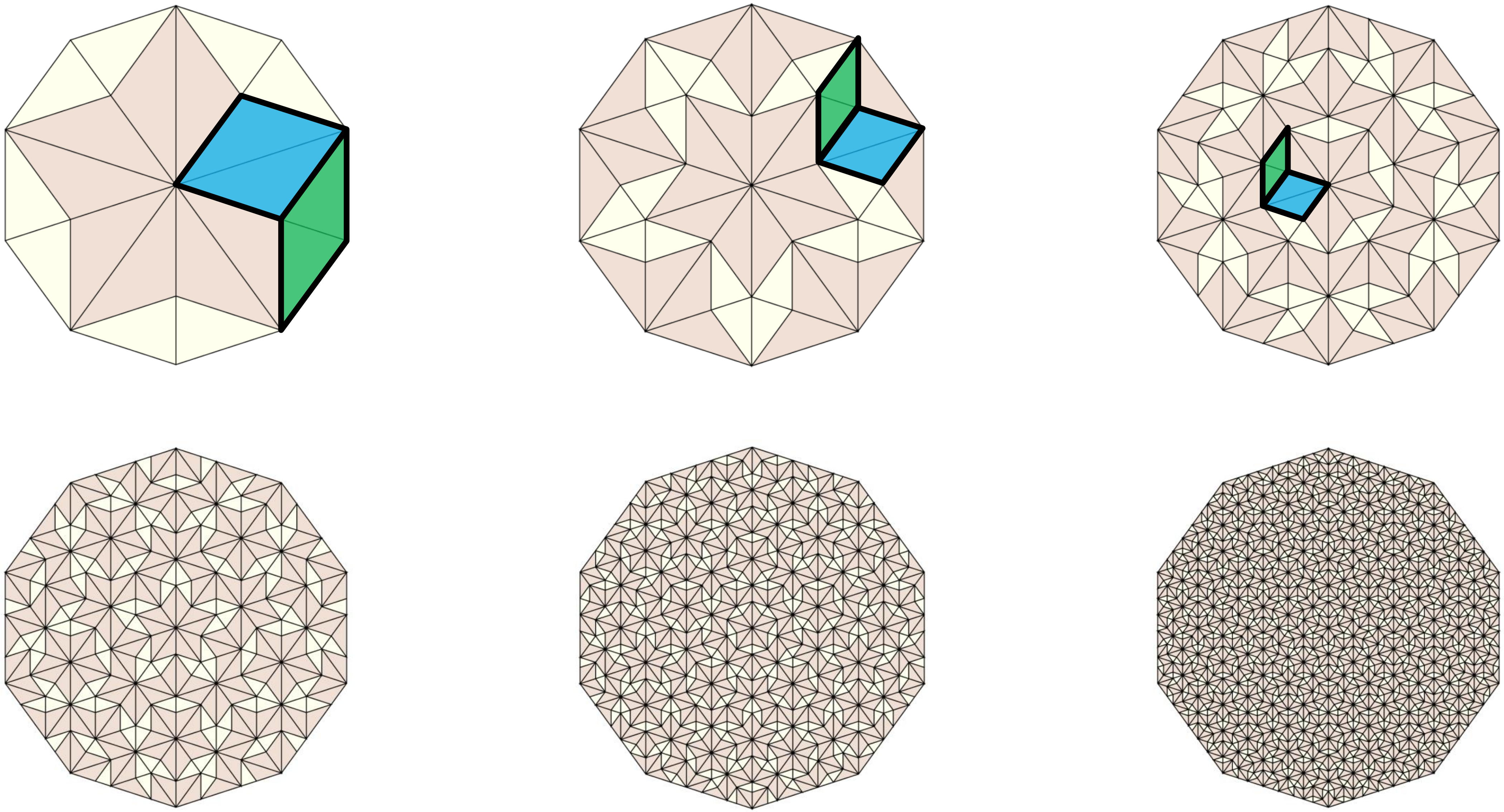
Dov Levine and Paul J. Steinhardt
Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396
(Received 3 September 1985)

that cell. An alternative and much more useful construction makes use of four types of unit cells, each of which is a zonohedron that can be formed from the oblate and prolate rhombohedral bricks: (a) a rhombic triacontahedron formed from ten oblate and ten prolate bricks; (b) a rhombic icosahedron formed from five oblate and five prolate bricks; (c) a rhombic dodecahedron formed from two oblate and two prolate bricks; and (d) a single prolate rhombohedron. Associated with these four units is a set of

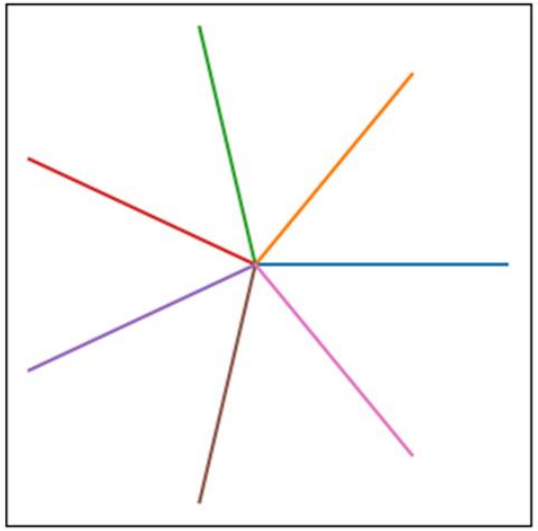
Zonohedra with golden rhombic faces

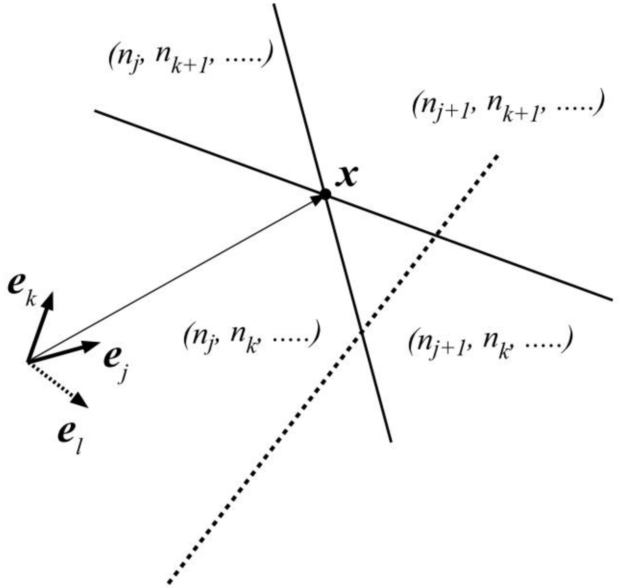
Solid name	Triacontahedron	Icosahedron	Dodecahedron	Hexahedron (acute/obtuse)	Rhombus (2-faced)
Full symmetry	I_h (order 120)	D_{5d} (order 20)	D_{2h} (order 8)	D_{3d} (order 12)	D_{2h} (order 8)
n Belts of $(2(n-1))_n$ // edges[10]	6 belts of 10_6 // edges	5 belts of 8_5 // edges	4 belts of 6_4 // edges	3 belts of 4_3 // edges	2 belts of 2_2 // edges
$n(n-1)$ Faces[11]	30	20 (−10)	12 (−8)	6 (−6)	2 (−4)
$2n(n-1)$ Edges[12]	60	40 (−20)	24 (−16)	12 (−12)	4 (−8)
$n(n-1)+2$ Vertices[13]	32	22 (−10)	14 (−8)	8 (−6)	4 (−4)
Solid image					

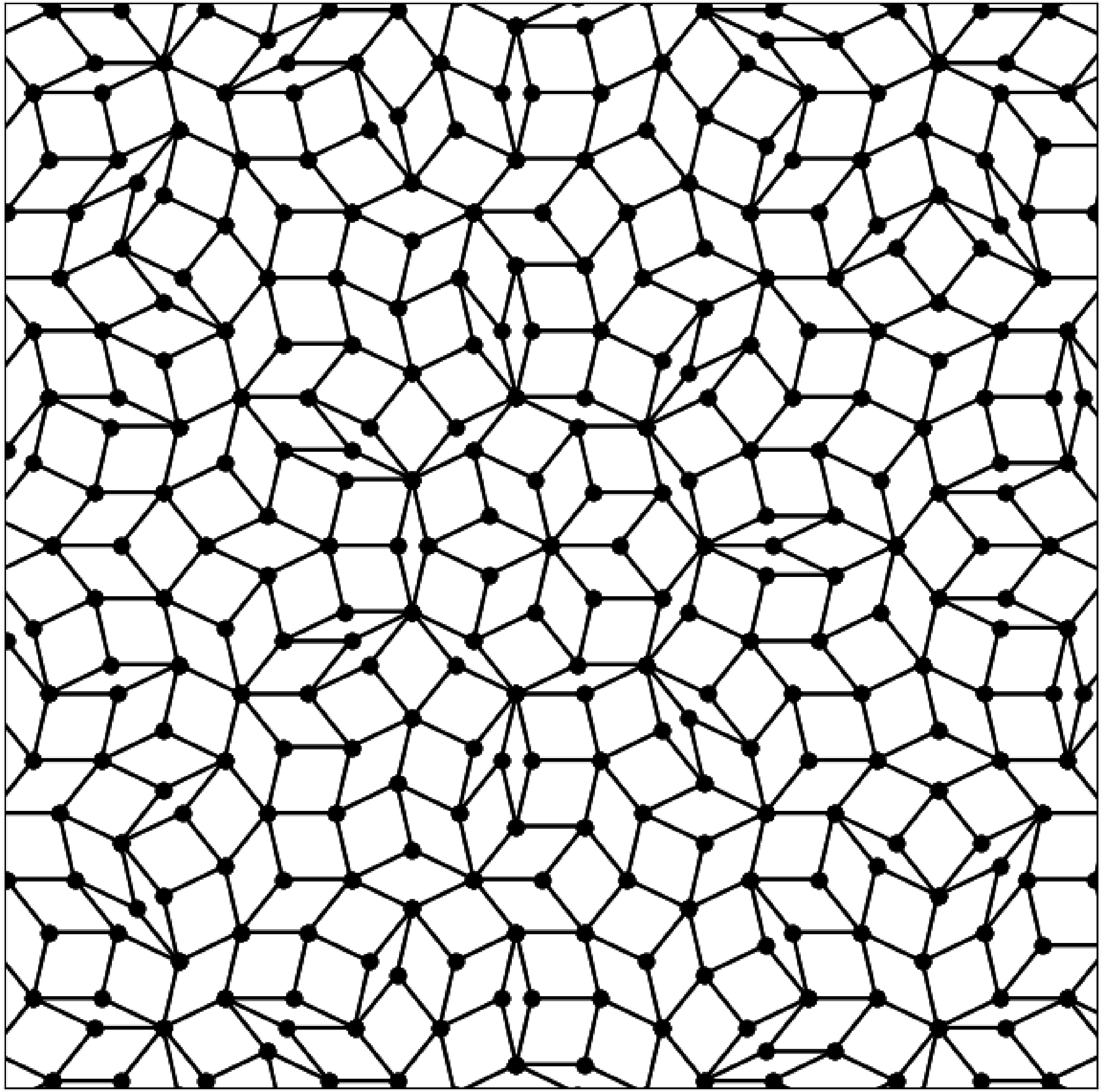

(a)
(b)



Generalized dual method (GDM)







$$\boldsymbol{t}^0_{n_j,n_k} = n_j\boldsymbol{e}_j + n_k\boldsymbol{e}_k + \sum_{l\neq j\neq k}\left(\lfloor(x_{n_j}\boldsymbol{u}_{jk} + x_{n_k}\boldsymbol{u}_{kj})\cdot\boldsymbol{e}_l - \alpha_l\rfloor + 1\right)\boldsymbol{e}_l\,.$$