

Tiling the Sphere with Regular Polygons

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We give a complete classification of edge-to-edge tilings of the sphere by regular polygons under a unified framework. Without assuming convexity of the tiles or polyhedrality of the underlying graph, our proof is independent of the Johnson-Zalgaller classification of solids with regular faces (1967) [?, ?], which took over 200 pages. We apply a blend of trigonometric, algebraic and combinatorial tools of independent interest. Our main theorem follows.

Theorem 1. *The edge-to-edge spherical tilings by regular polygons are*

- *the five Platonic tilings,*
- *the thirteen Archimedean tilings,*
- *the twenty-five tilings corresponding to circumscribable Johnson-Zalgaller solids:*

$$J_1, J_2, J_3, J_4, J_5, J_6, J_{11}, J_{19}, J_{27}, J_{34}, J_{37}, J_{62}, J_{63},$$

$$J_{72}, J_{73}, J_{74}, J_{75}, J_{76}, J_{77}, J_{78}, J_{79}, J_{80}, J_{81}, J_{82}, J_{83},$$

- *the infinite families of prisms and antiprisms,*
- *the infinite families of hosohedra and dihedra.*

References

- [1] V. A. Zalgaller, *Convex polyhedra with regular faces*, Zap. Nauch. Sem. Leningrad. Otdel. Mat. Inst. Steklov. (LOMI) 2, 220 (1967).
- [2] N. Johnson, Convex solids with regular faces. *Canadian Journal of Mathematics* **18** (1966) 169–200.