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Space vectors forming rational angles

We classify all sets of nonzero vectors in $\mathbb{R}^3$ such that the angle formed by each pair is a rational multiple of π. The special case of four–element subsets lets us classify all tetrahedra whose dihedral angles are multiples of π, solving a 1976 problem of Conway and Jones: there are 2 one–parameter families and 59 sporadic tetrahedra, all but three of which are related to either the icosidodecahedron or the B_3 root lattice. The proof requires the solution in roots of unity of a $W(D_6)$–symmetric polynomial equation with 105 monomials (the previous record was 12 monomials only). This is a joint work with Kiran S. Kedlaya (UCSD), Bjorn Poonen (MIT), and Michael Rubinstein (University of Waterloo).