

## **Tonight's topic: Finite Rotation Groups in $\mathbb{R}^3$**

Notation:  $SO(d)$  is the group of rotations in  $\mathbb{R}^d$  fixing the origin.

**We will describe all finite subgroups of  $SO(3)$ .**

Some related facts to be discussed only next week:

- A finite group of isometries in  $\mathbb{R}^d$  must fix a point.
- An isometry fixing the origin is a linear operator (transformation) corresponding to an orthogonal matrix – the group  $O(d)$ .
- The precise definition of direct isometries fixing the origin (the matrix has determinant 1) – the group  $SO(d)$ .
- The only direct isometries of  $\mathbb{R}^3$  fixing the origin are rotations (trivial in  $\mathbb{R}^2$ ).
- In particular: the composition of two rotations is a single rotation. (This is the only statement we will use on faith tonight.)
- Corollary: Rotations of  $\mathbb{R}^3$  fixing the origin form a group — the group  $SO(3)$ .
- The proof of many of these statements use linear algebra: orthogonal matrices and eigenvalues.