

## Physics 220, Week 1 topics

(★ = more important.)

- Introduction to groups and applications in physics.
- ★ Examples of finite groups  $Z_N$  and  $S_N$ .
- ★ Multiplication tables for  $Z_3$  and  $S_3$ . General properties (e.g. each element appears once and only once in every row or column).
  - Subgroups  $H \subset G$ . Examples of  $Z_2$  and  $Z_3$  subgroups of  $S_3$ .
  - $G = H + g_1H + \dots + g_{m-1}H$ , shows that  $|H| = |G|/m$  with  $m$  an integer.
  - Normal or invariant subgroups  $H$ :  $gH = Hg$  for all  $g \in G$ .
  - Factor group  $G/H$  is a legit subgroup of  $G$  if (though perhaps not only if)  $H$  is normal.
- ★ Conjugacy classes, with  $Z_3$  and  $S_3$  examples. Normal subgroups contain complete conjugacy classes.
- ★ Definition of a representation. The trivial representation. Example: three 1d representations of  $Z_3$ .