

# Condensed Matter Physics Homework Assignment 4

Due date Friday, October 1

1. Evaluate the Madelung constants  $\alpha$  for ionic crystals NaCl and CsCl. There is more than one way of summing the electrostatic energy. Here are two examples to get you started. Ashcroft and Mermin divide the crystal into cells containing no net charge and no dipole or quadrupole moments (the figure below offers yet another way to achieve that). The cells interact via an octupole–octupole potential decaying as  $1/r^7$  at large distances. In class, we sliced NaCl into planes and strips. Their interaction decays even faster—exponentially. Feel free to choose any method—numerical or analytical—as long as it produces a convergent result. Include numerical code (if any) in your submission.

**Assigned reading:** Chapters 19 and 20 in *Ashcroft and Mermin*.

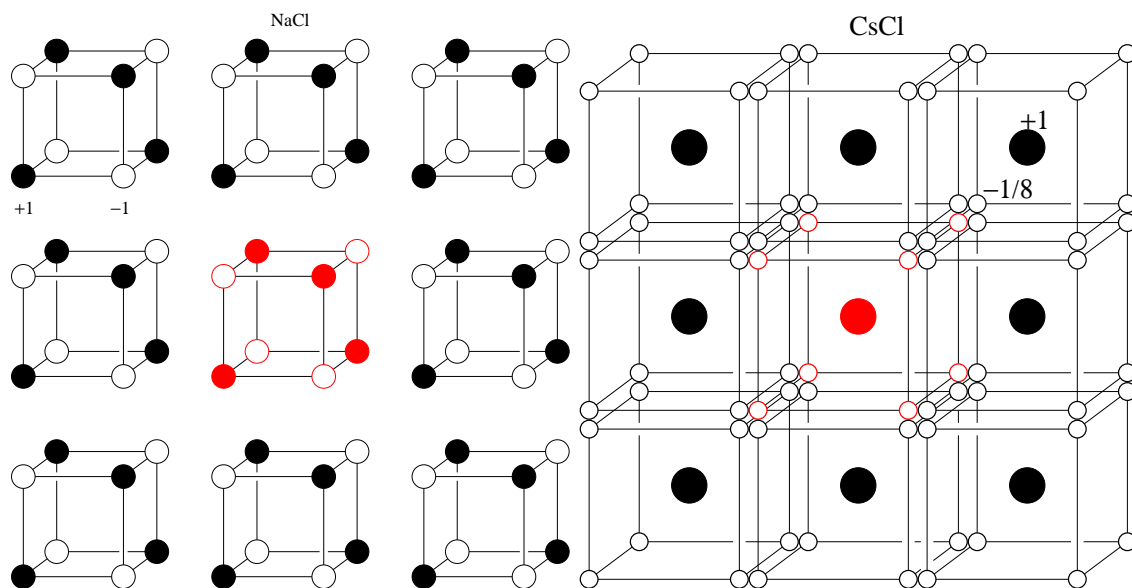


FIG. 1: NaCl and CsCl lattices split into blocks with vanishing electric charge, dipole, and quadrupole moments.