

Non-obvious controls:

- Be sure to try all the different tabs at the top of the simulation.
- You can **Pause** the sim and then use **Step** to incrementally analyze.
- Check **Show traces** to view the paths of the α particles.
- If you are doing a lecture demonstration, set your screen resolution to 1024x768 so the simulation will fill the screen and be seen easily.

Important modeling notes / simplifications:

- The default number of protons and neutrons is set to match those of gold.
- In the **Rutherford atom**, the sim shows only a small fraction of the area of an atom. Therefore, the fraction of α particles deflected by large angles in the area shown in the sim is much higher than the fraction in the sample as a whole.
- In the **Rutherford atom**, the electron moving around the outside edge of the box should actually be much further away, but it is there to remind students how the nucleus relates to the rest of the atom.
- In the **plum pudding atom**, since the electrons are distributed evenly throughout the positive goo, most parts of the atom are electrically neutral and therefore do not deflect α particles. For computational simplicity, we choose not to show the small deflections due to the slight inhomogeneity of the charge distribution.

Insights into student use / thinking:

- Instructors may wonder why the simulation allows the user to vary the **number of neutrons**, since this does not affect the scattering angle. However, students may think it does, and having the control allows them to see that it does not.

Suggestions for sim use:

- For tips on using PhET sims with your students see: [Guidelines for Inquiry Contributions](#) and [Using PhET Sims](#)
- The simulations have been used successfully with homework, lectures, in-class activities, or lab activities. Use them for introduction to concepts, learning new concepts, reinforcement of concepts, as visual aids for interactive demonstrations, or with in-class clicker questions. To read more, see [Teaching Physics using PhET Simulations](#)
- For activities and lesson plans written by the PhET team and other teachers, see: [Teacher Ideas & Activities](#)
- Ask students to use this sim in conjunction with the *Models of the Hydrogen Atom* sim to explain the experimental reasons for rejecting earlier models of atoms in favor of later ones.
- Ask students to calculate the ratio of deflection angles for α particles that approach at different angles and check that it matches the Rutherford scattering formula: