

# Rutherford Scattering

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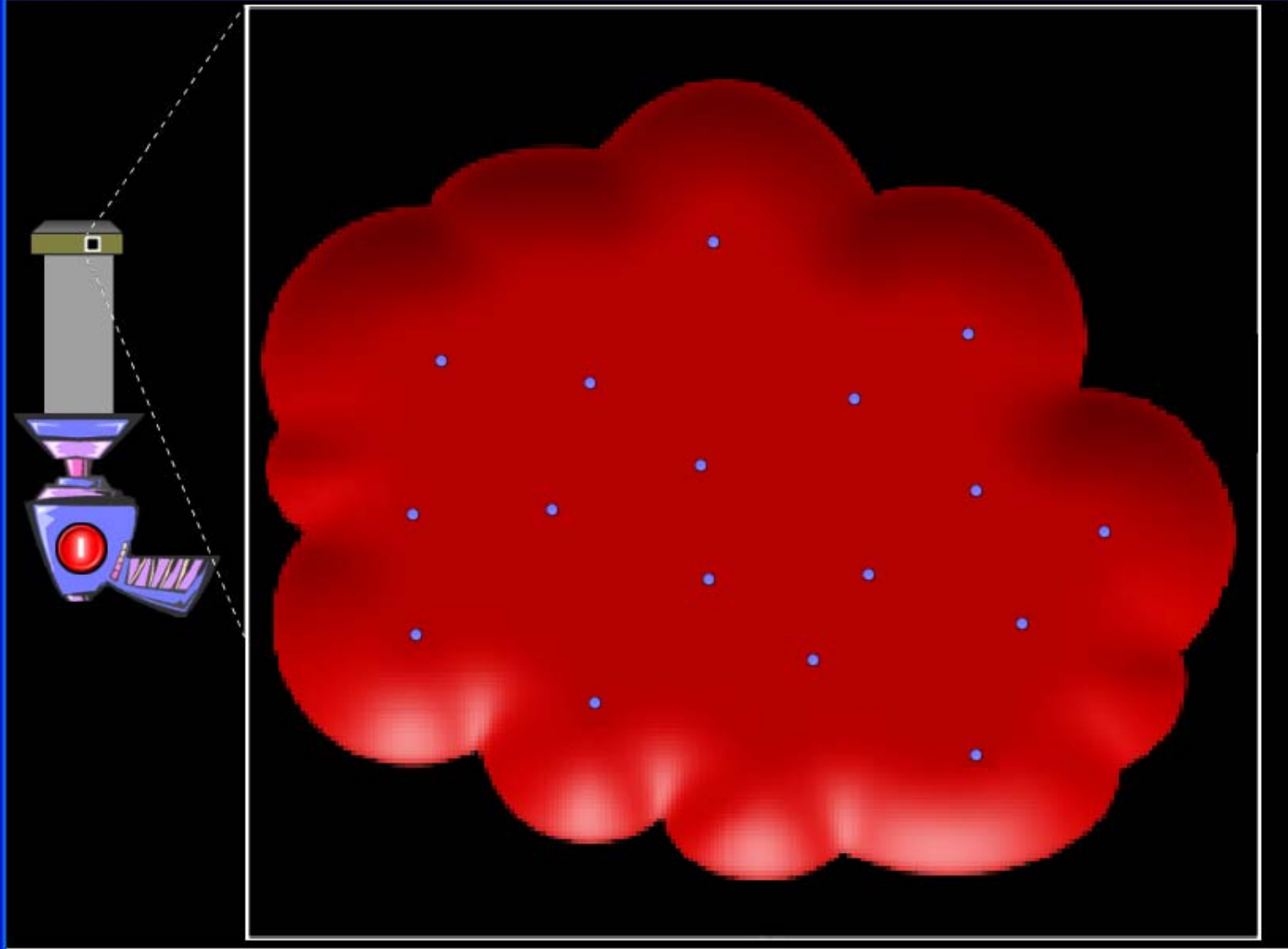
# Learning Goals

- Describe the qualitative difference between scattering off positively charged nucleus and electrically neutral plum pudding nucleus.
- For charged nucleus, describe qualitatively how angle of deflection depends on:
  - Energy of incoming particle
  - Impact parameter
  - Charge of target

# Outline of Sim

- Gun fires alpha particles at atoms like in H atom sim but box is bigger and “show traces” is always on.
- Can control speed of alpha particles with “energy” slider in control panel.
- “Plum Pudding Atom” Panel:
  - Looks like plum pudding in H atom, but fills the whole box, contains 79\* electrons, alpha particles just go straight through undeflected.
- “Rutherford Atom” Panel:
  - Nucleus in center contains number of protons and neutrons controlled by sliders in control panel.
  - Electrons pass through corners of box very unobtrusively.
  - Changing the number of neutrons does not change behavior, just picture of nucleus.
  - Changing the number of protons or energy of alpha particles changes the parameter D discussed in the Rutherford scattering document. I’ll write out the details if we decide to proceed.

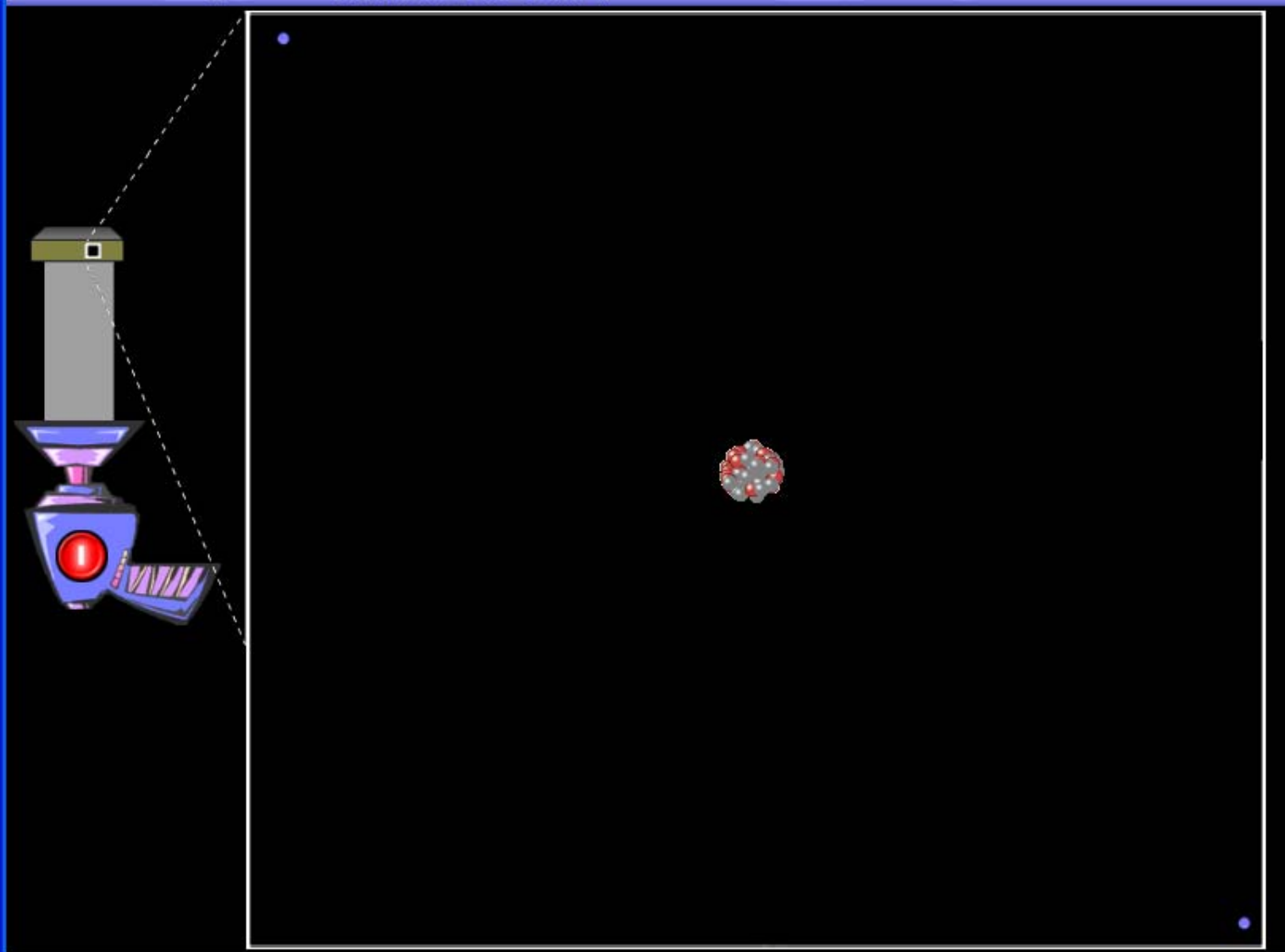
\*79 is the atomic number of Gold, for which Rutherford did original experiment. Default number of protons in Rutherford panel should also be 79.



Alpha Particle Properties:

Energy

Play Pause Step



Alpha Particle Properties:

Energy

Atom Properties:

Number of protons

Number of neutrons

# Ranges and Defaults

- Currently in alpha particle algorithm there is a parameter  $D$  which is set to  $L/16$ .
- Now set  $D = (L/16) * (p/p_d) * (v_d^2/v^2)$ , where  $p$  is number of protons, and  $v$  is the velocity in units of  $dt$ .
- # of protons  $p$ : range : 1-100, default = 79
- # of neutrons  $n$ : range: 1-150, default = 118
- Velocity  $v$ : range:  $0.5dt - 3dt$ , default =  $2dt$

$v_d$  = default speed,  $p_d$  = default number of protons