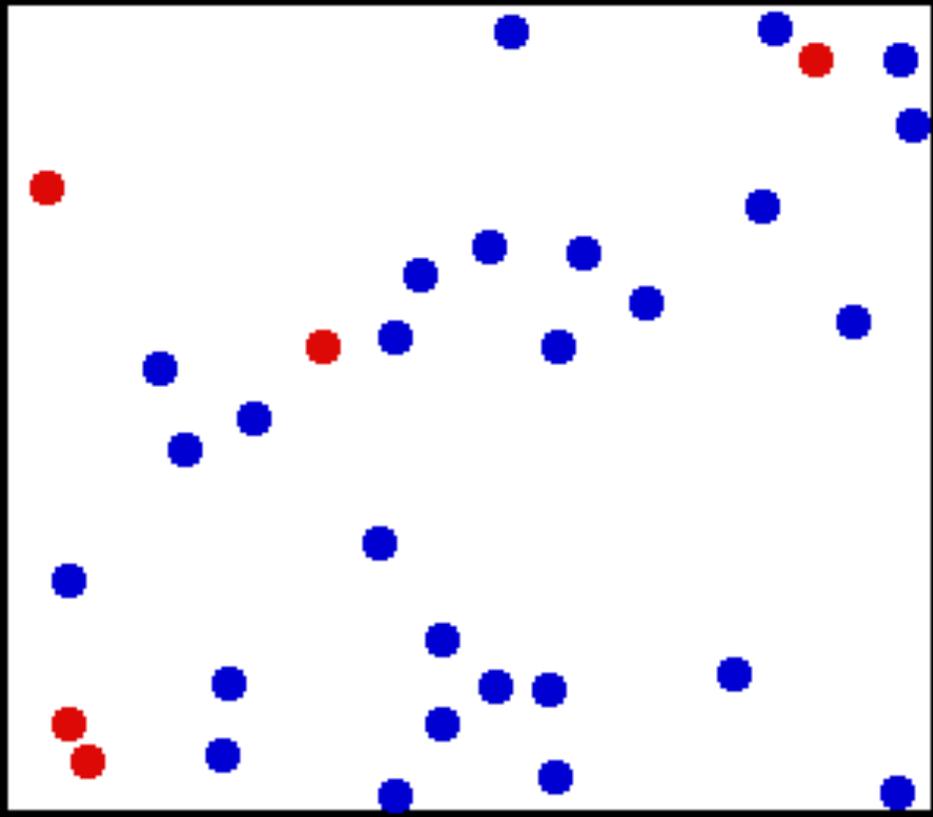
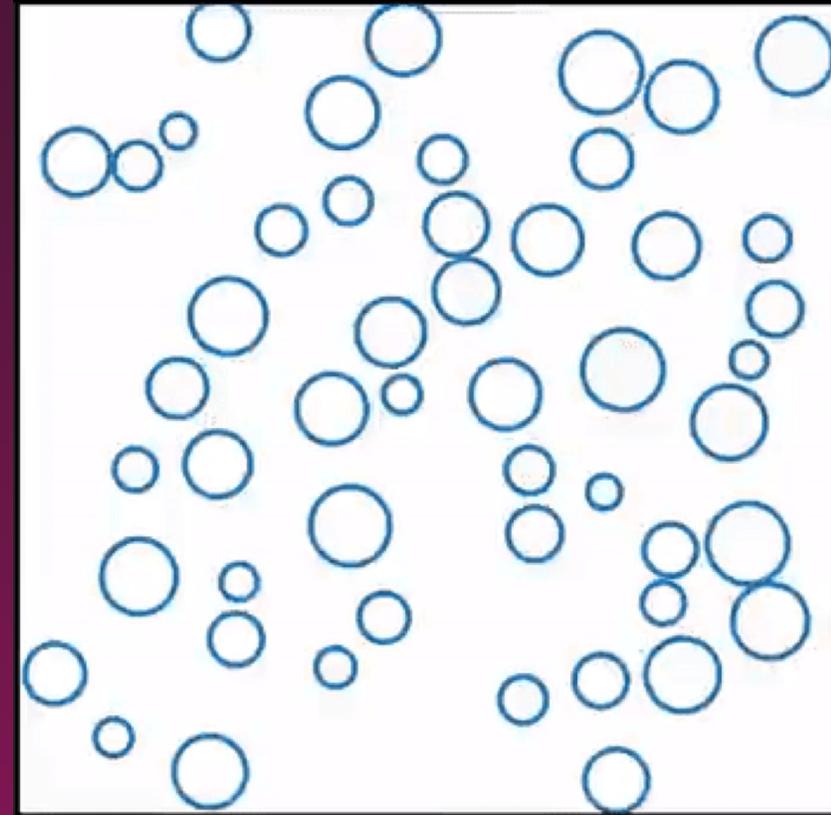


Collisions



Wikipedia



<https://scipython.com/blog/two-dimensional-collisions/>

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Effects of collisions

- Excitation/deexcitation of atomic (and ionic and molecular) states
 - Example, the collision between an electron and O III ion excites the O III to a higher energy level, which then decays and emits a photon
 - This is a key transition we will study in H II regions!
 - Because energy is transferred from kinetic to radiative, this is an *inelastic* collision
- Ionization
 - Example: The collision between an electron and an O V ion (O^{4+} ; 4 electrons removed) imparts enough energy to strip off an electron, leaving O VI (O^{5+})
 - Important in hot ionized media
- Recombination
 - Example: An ionized hydrogen particle (H II, or H^+) ‘captures’ a free electron.
 - The electron may recombine to a higher excited state then decay, emitting photons
- Chemical Reactions
 - Example: Formation of CO (key tracer of molecular hydrogen)

Types of collisions

Neutral – neutral

$$U \propto r^{-6}$$

Ion – neutral

$$U \propto r^{-4}$$

Ion – electron

$$U \propto r^{-1}$$

