



# Neutrons and Neutron Interactions

# Sources of Neutrons

## ◆ Fission

- More in next section

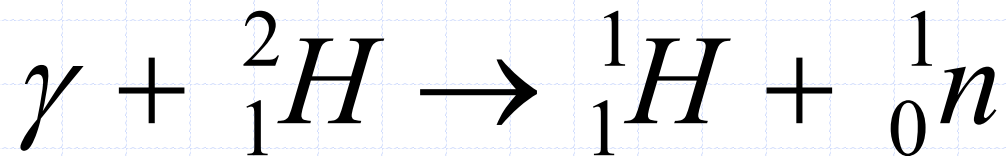
## ◆ Photoneutrons

## ◆ Spontaneous fission

- A rare decay mode of Uranium and some other heavy elements

# Photoneutrons

- ◆ A few nuclides have a loosely bound neutron
- ◆ Neutron can be freed with a gamma of sufficient energy



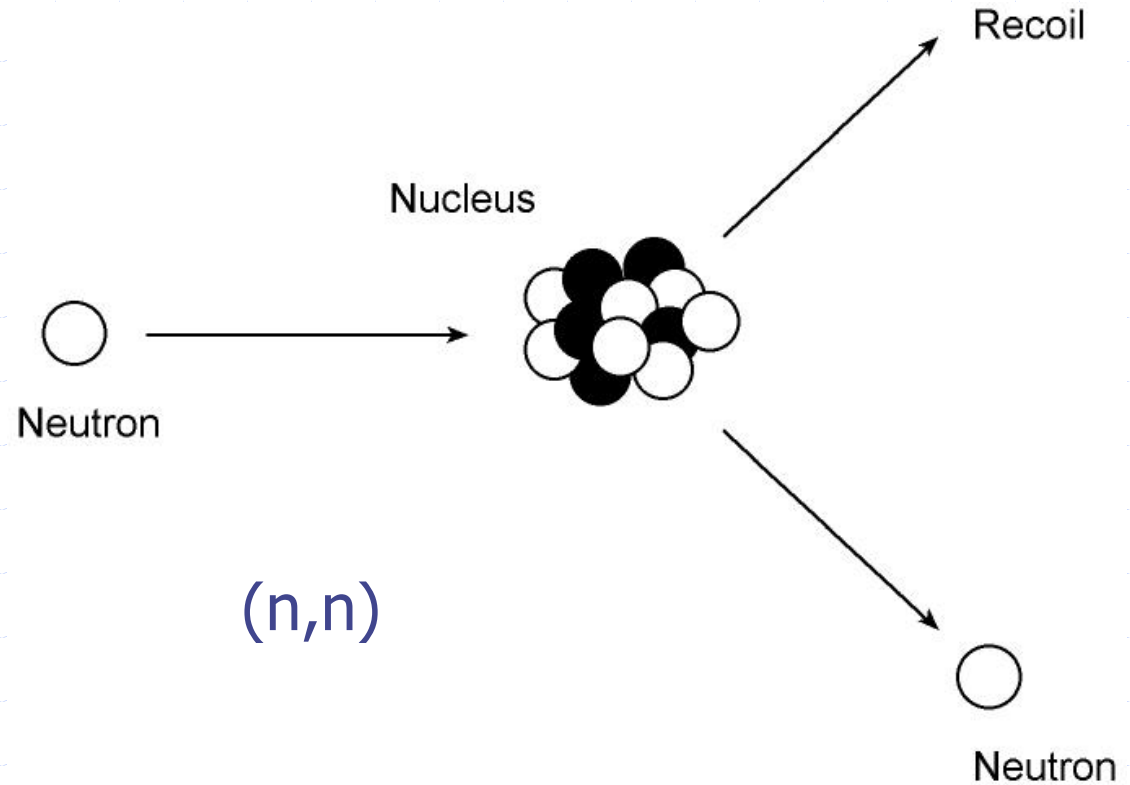
- ◆ Gamma > 2.2 MeV



# Neutron Interactions

# Elastic Scattering

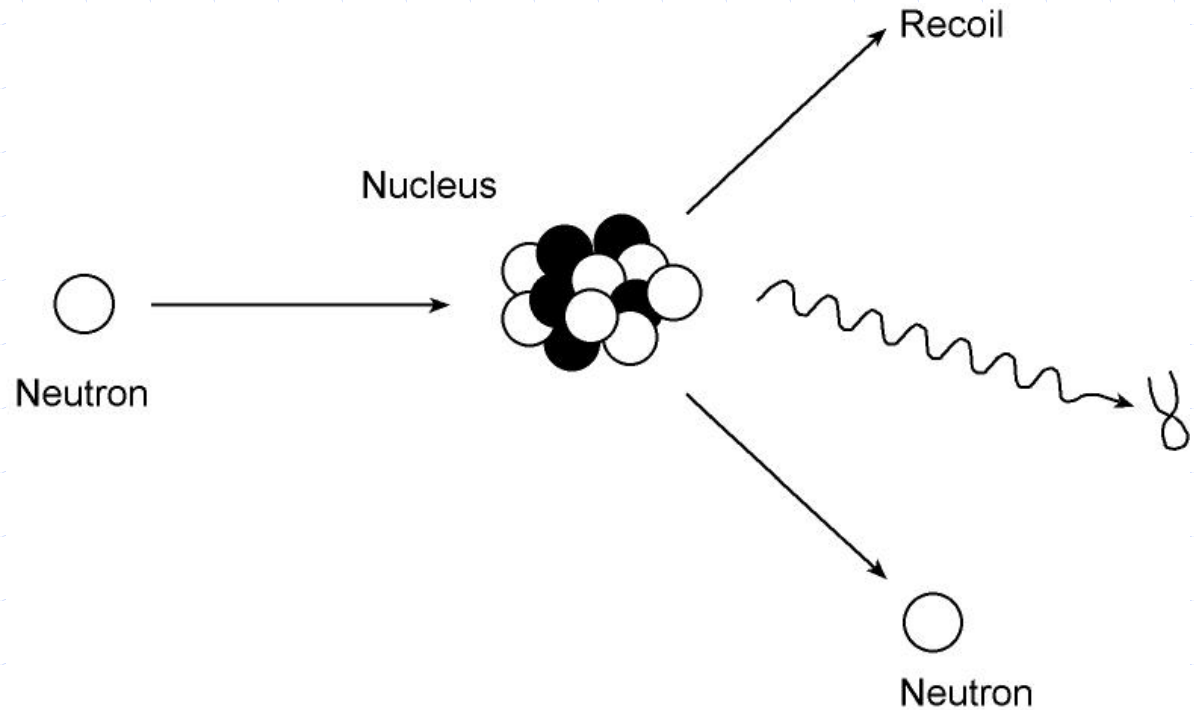
Billiard balls



Kinetic Energy of the particles is conserved

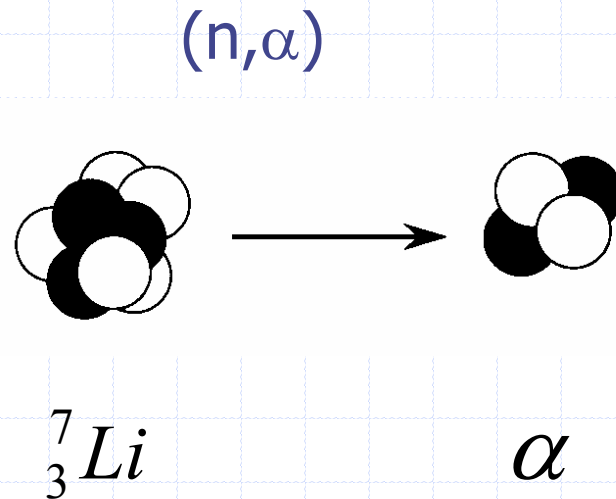
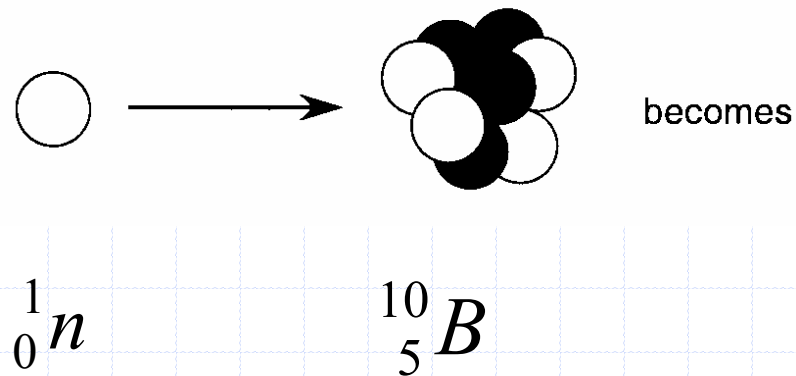
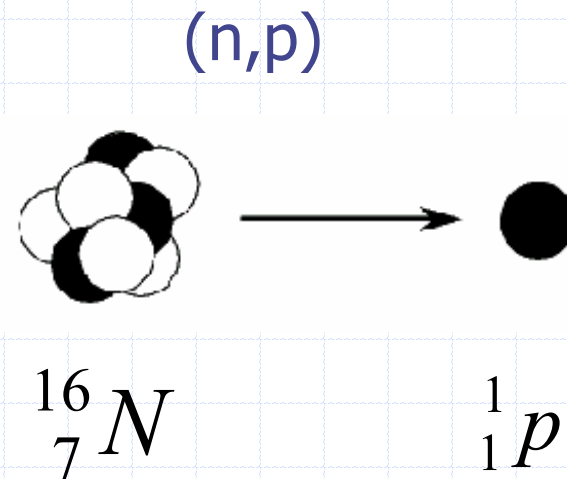
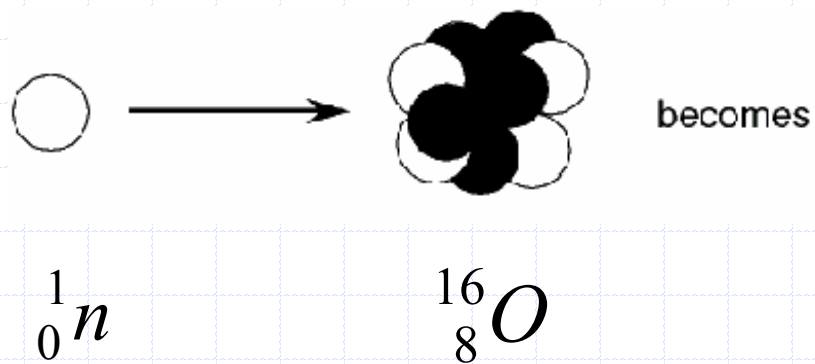
# Inelastic Scattering

$(n, n\gamma)$

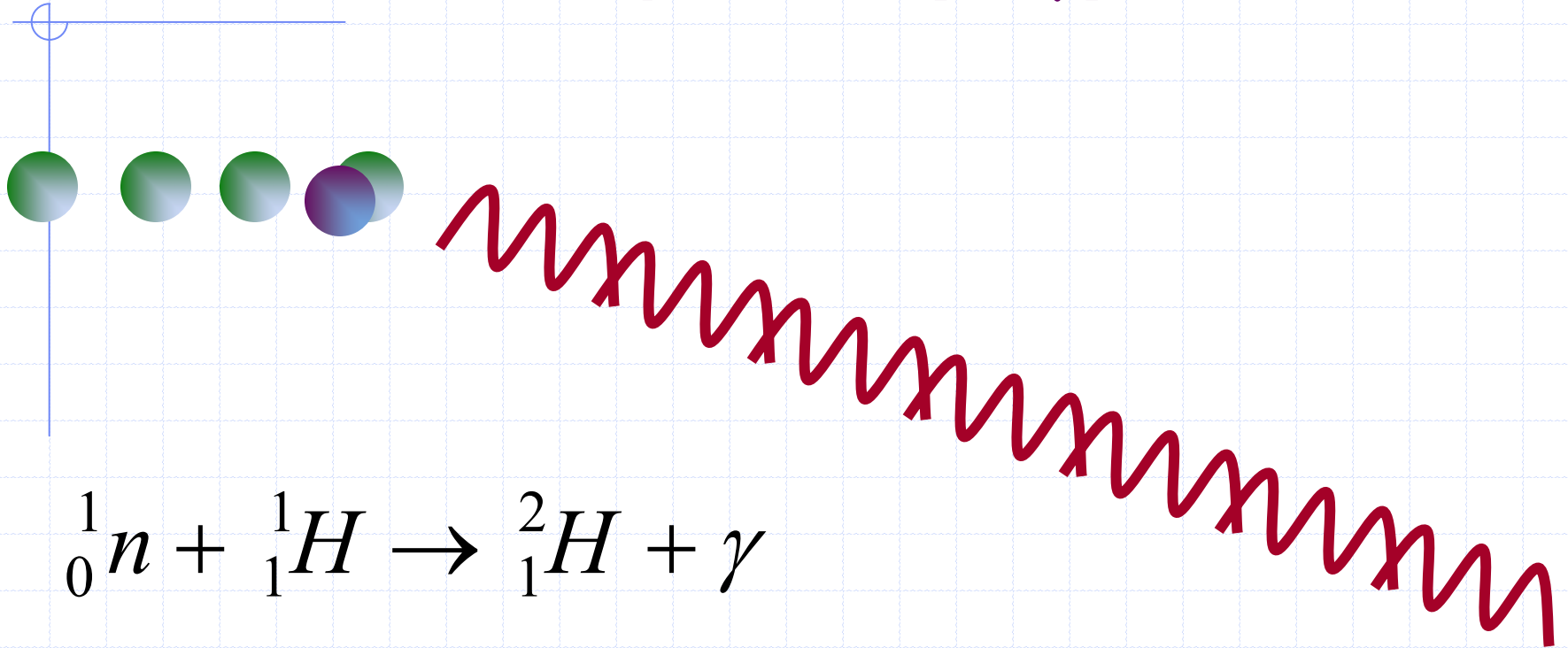


Bouncing play-dough balls off a wall.  
Kinetic energy is transformed

# Transmutation

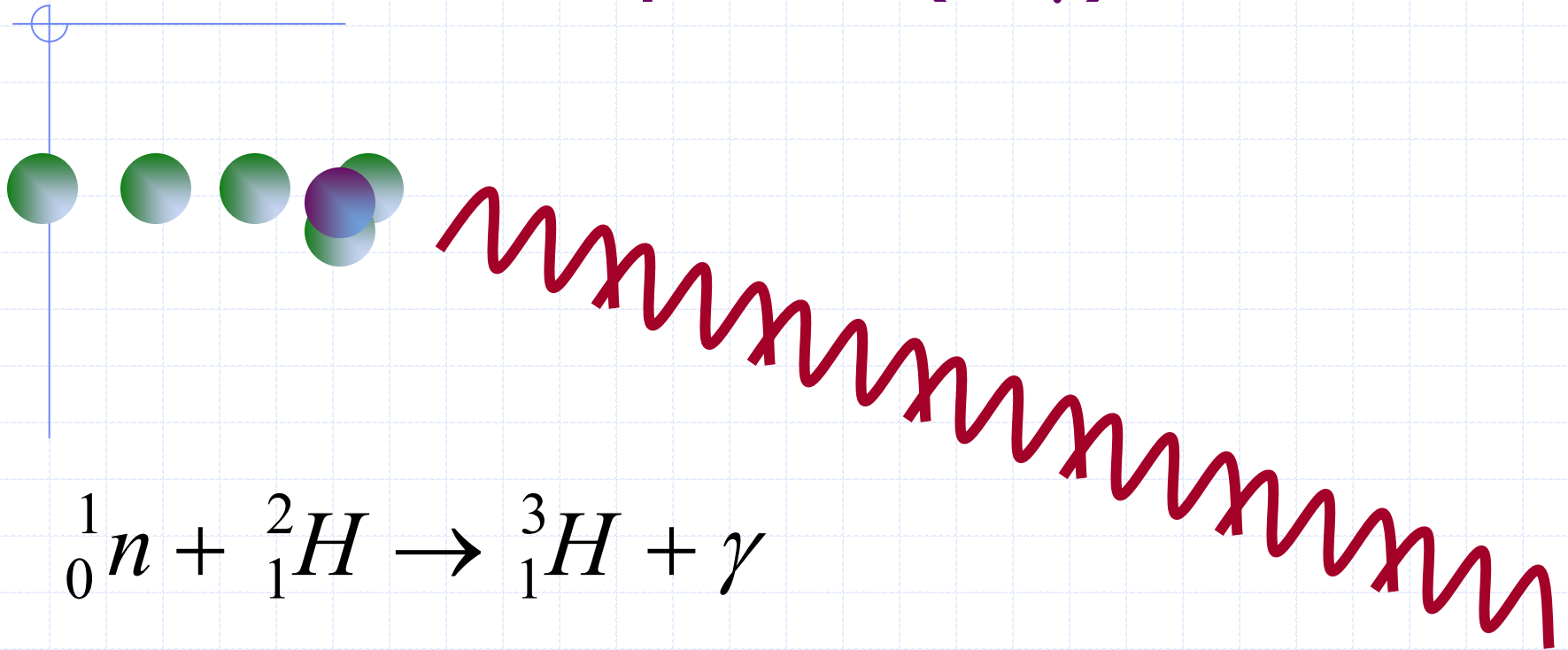


# Radiative Capture ( $n,\gamma$ )





# Radiative Capture ( $n,\gamma$ )



# Art's Generalizations

- ◆ Everything (almost) absorbs neutrons
  - Some easily
  - Some with difficulty
- ◆ Everything that absorbs neutrons will eventually become radioactive
- ◆ Reactors are full of neutrons
- ◆ Eventually everything is a reactor becomes radioactive