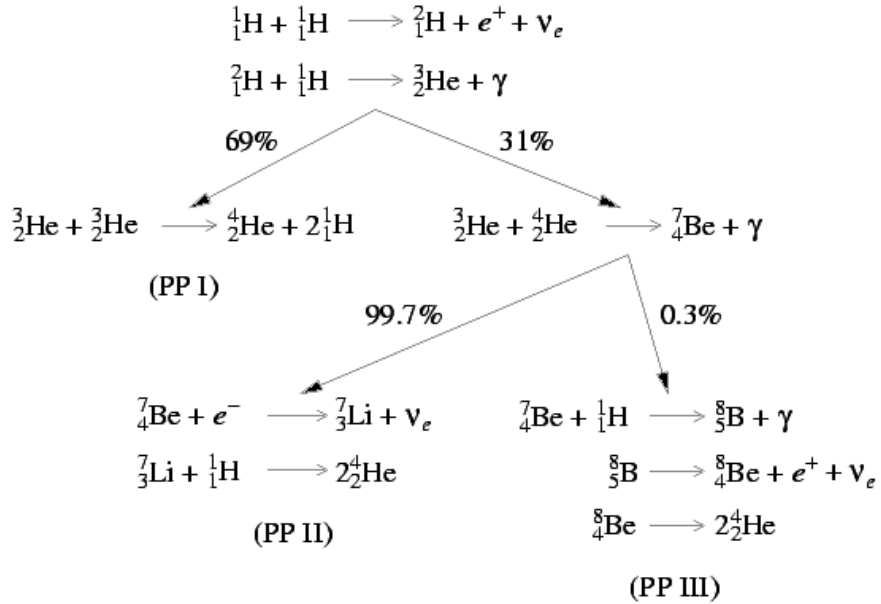


Proton-Proton Chain Activity

Helpful websites:

Wikipedia Proton-Proton Chain, http://en.wikipedia.org/wiki/Proton-proton_chain

The proton-proton chain is described by the reactions in the diagram below. At first this appears very complicated, it becomes much easier to follow if we understand the symbols that chemists and physicists utilize to describe these reactions.



Source: <http://burro.cwru.edu/Academics/Astr221/StarPhys/ppchain.gif>

${}^1_1\text{H}$ - hydrogen-1, 1 proton + 0 neutrons

${}^2_1\text{H}$ - hydrogen-2, 1 proton + 1 neutron

${}^3_2\text{He}$ - helium-3, 2 protons + 1 neutron

${}^4_2\text{He}$ - helium-4, 2 protons + 2 neutrons

${}^7_3\text{Li}$ - lithium-7, 3 protons + 4 neutrons

${}^7_4\text{Be}$ - beryllium-7, 4 protons + 3 neutrons

${}^8_4\text{Be}$ - beryllium-8, 4 protons + 4 neutrons

${}^8_5\text{B}$ - boron-8, 5 protons + 3 neutrons

e^+ - positron

e^- - electron

ν_e - electron neutrino

γ - gamma ray photon

1. Access and experiment with the Proton-Proton Chain Simulator (source: Astronomy Education at the University of Nebraska-Lincoln). Complete the following table.

Object	Symbol used in animation	Definition/description
proton		
neutron		
positron		
gamma ray		
neutrino		

2. What is the proton-proton chain?
3. The reaction can occur in several different ways, designated by PP I, PP II, and PP III. What percent of the reactions are PP I?
4. What percent of the reactions are PP II? Hint: you will need to convert both the percentages leading to PP II branch, multiply them, and convert the result to a percent.
5. What percent of the reactions are PP III? Hint: you will need to convert both the percentages leading to PP III branch, multiply them, and convert the result to a percent.
6. Each of the reactions also produces energy. How much energy is produced in the entire process? Where does that energy go?
7. How many tons of hydrogen are converted to how many tons of helium each second in the Sun?