Nucleosynthesis

- Before there were nuclei, there were only protons, neutrons, electrons, neutrinos
- Protons are combined into He instead
  - He\(^4\) has a large binding energy, but a four-particle collision is very unlikely
  - \(p+p \rightarrow d + e^+ + \nu_e\)
  - Binding energy \(\approx 2\) MeV

  2 d collisions are unlikely because the fraction of d is small in a star, but
  - \(p+d \rightarrow ^3\text{He} + \gamma\)
    - \(^3\text{He} + ^3\text{He} \rightarrow ^4\text{He} + p + p\)

  - 4 protons are converted into a \(^4\text{He}\) nucleus
    - This releases 26 MeV of energy

  This reaction is known as the PPI chain