19.7: Further Modes of Decay - Positron Emission and Electron Capture

Isotopes produced by nuclear reactions, which do not occur in nature (artificial isotopes) are invariably unstable and radioactive. They exhibit two kinds of decay not found among naturally occurring radioactive elements. The first is **positron emission** in which a fundamental particle we have not discussed is ejected from the nucleus. The **positron** is identical with the electron except that it has a positive rather than a negative charge. Its symbol is ${}^{0}_{+1}\mathrm{e}^{+}$ or ${}^{0}_{+1}\beta^{+}$. An example of a positron emission reaction is the decay of ${}^{11}_{6}\mathrm{C}$

$$ {}^{11}_{6}\mathrm{C} \longrightarrow {}^{11}_{5}\mathrm{B} + {}^{0}_{+1}\mathrm{e}^{+} $$

Positron emission is common among isotopes having a low neutron-to-proton ratio.

The second new method of decay is called **electron capture**. The nucleus absorbs one of the electrons from its own innermost core. An example is the following reaction:

$$ {}^{0}_{-1}e + {}^{7}_{4}\mathrm{Be} \overset{ec}{\longrightarrow} {}^{7}_{3}\mathrm{Li} $$

Again this results in an increased neutron/proton ratio.