

# 1 Radioactivity

## 1.1 Radioatoms or Radionuclides

### 1.1.1 Types of instability

Typical  $\alpha$  particle emission energies are  $< 10 \text{ MeV}$ , meaning that relativistic effects can be ignored. The decay energy is expressed by (Shultis, 95):

$$E_D = Q_\alpha \left[ \frac{M_\alpha}{M_D + M_\alpha} \right] \approx Q_\alpha \left[ \frac{A_\alpha}{A_D + A_\alpha} \right]$$

### 1.1.2 Neutron-rich radionuclides

Because there are three particles emitted in  $\beta^-$  decay (daughter nucleus, electron, and electron-antineutrino), there is no unique solution to the energies of the resultant particles. The results are bound at the high end by the antineutrino having zero kinetic energy (Shultis, 97).