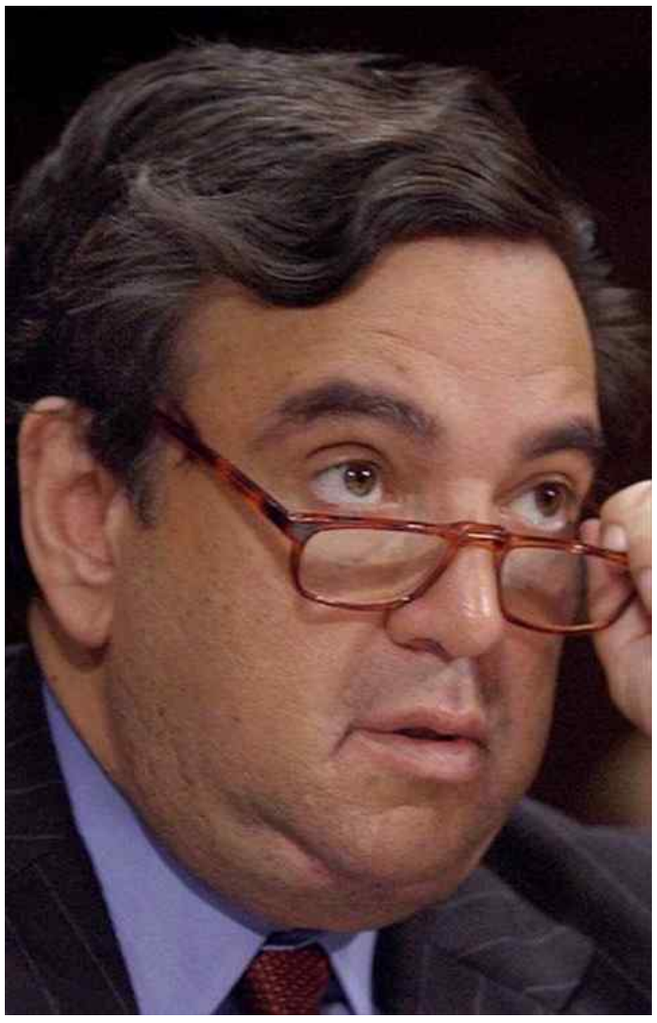
I've been told that I have a lot of energy. The secret is that I use renewable resources. Some days I'm solar powered. Some days I'm wind powered. And some people in this room might think I'm hybrid gas-powered. You'll just have to guess which it is today.

Bill Richardson



Arizona State University
SES 194

Energy in Everyday Life

Fission

Frank Timmes

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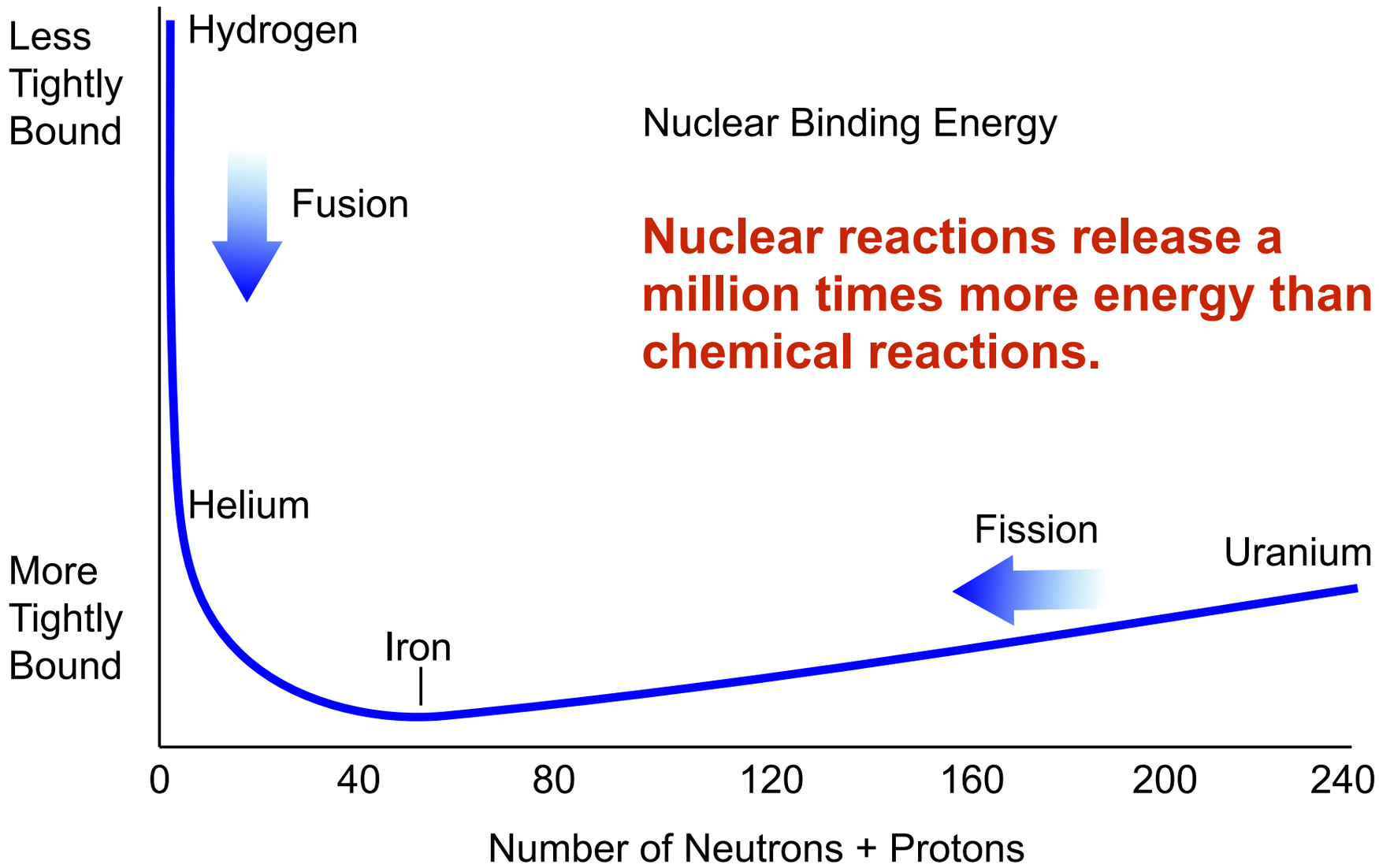
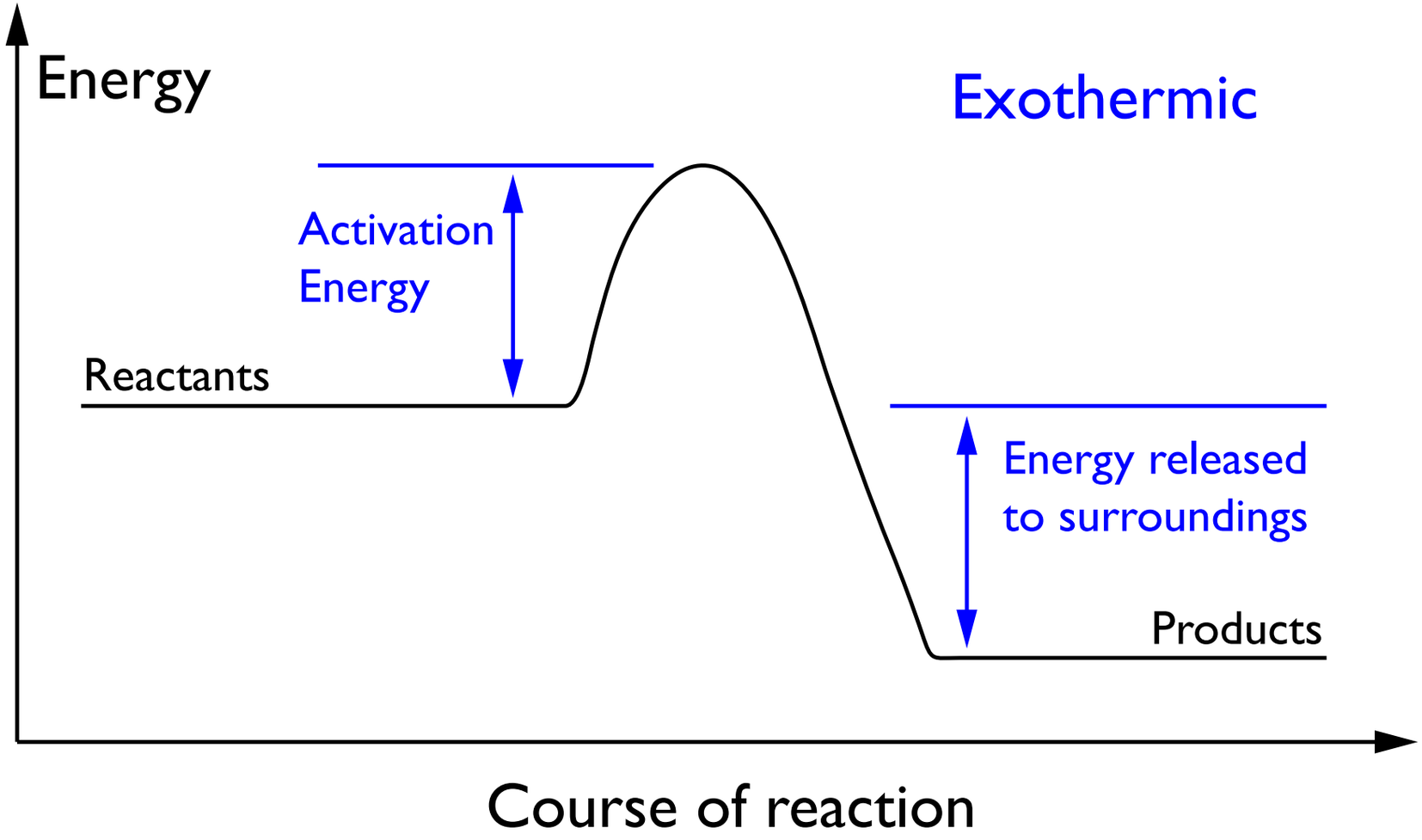
Fission is the breakup of something into two or more pieces.

For the fission of nuclei, energy can be extracted to do work from this breakup.

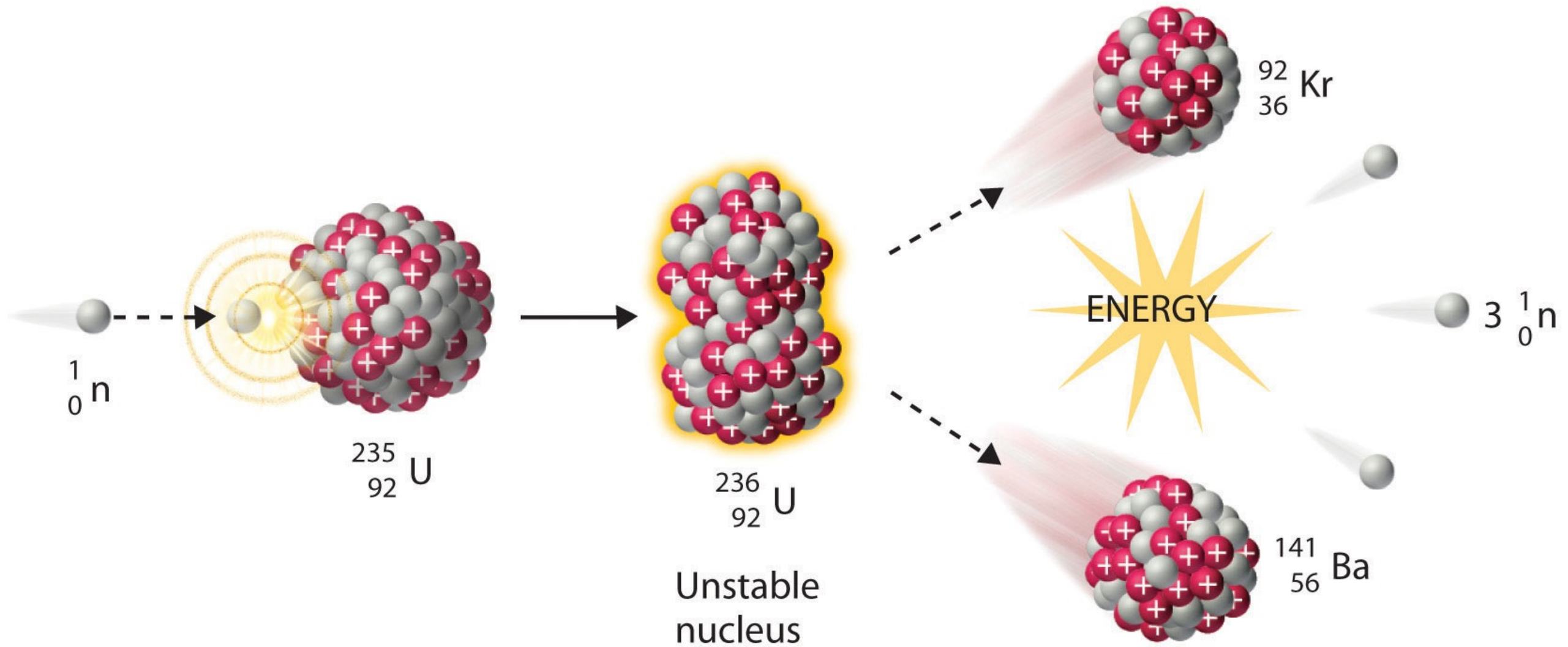


Nuclei that can fission are generally stable until they get a little extra energy (e.g., when they absorb another neutron) that destabilizes them and leads to breakup.

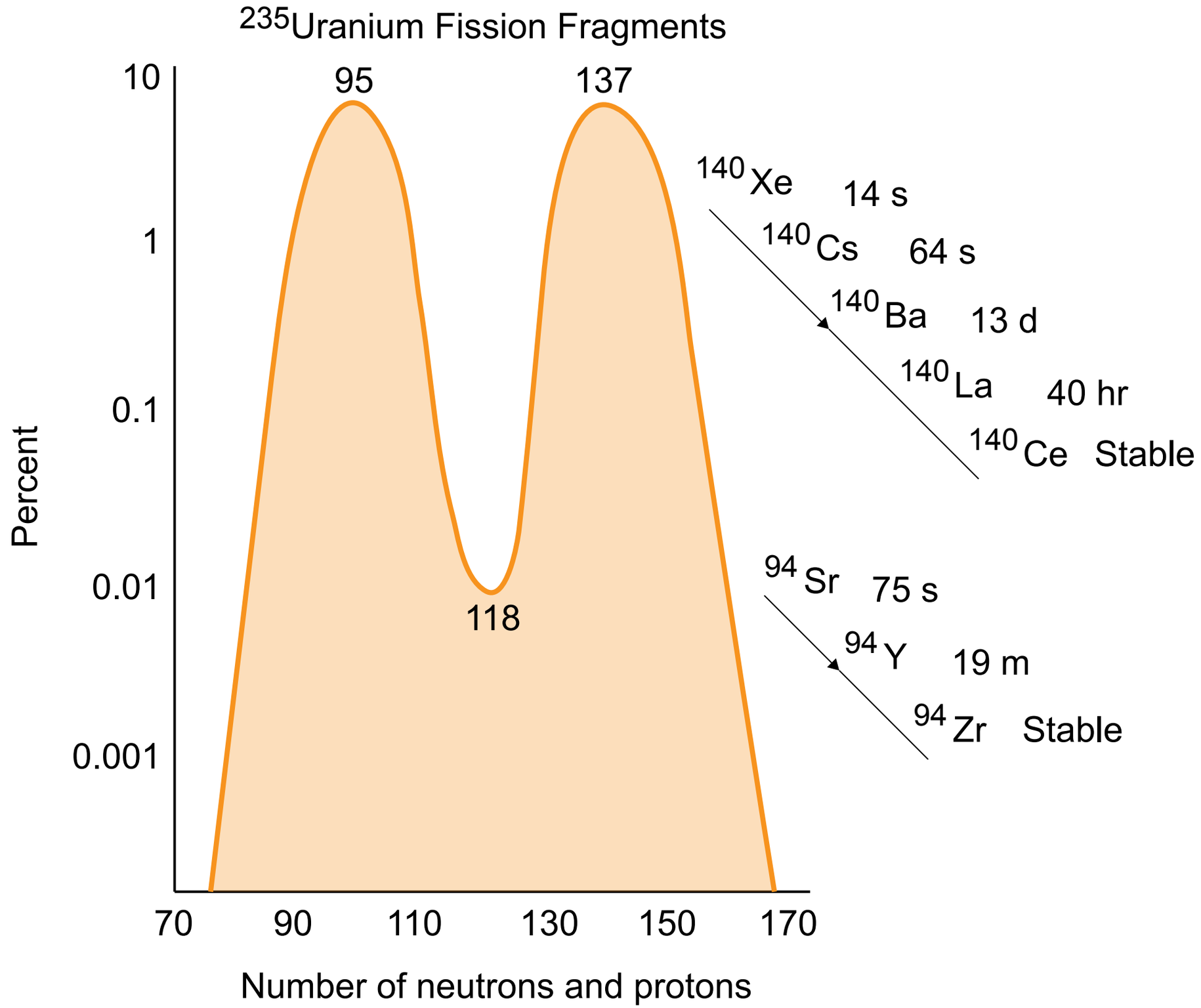
This nuclear activation energy is the analogous to the chemical activation energy.



When nuclei, such as uranium, fission they decompose into a number of pieces.

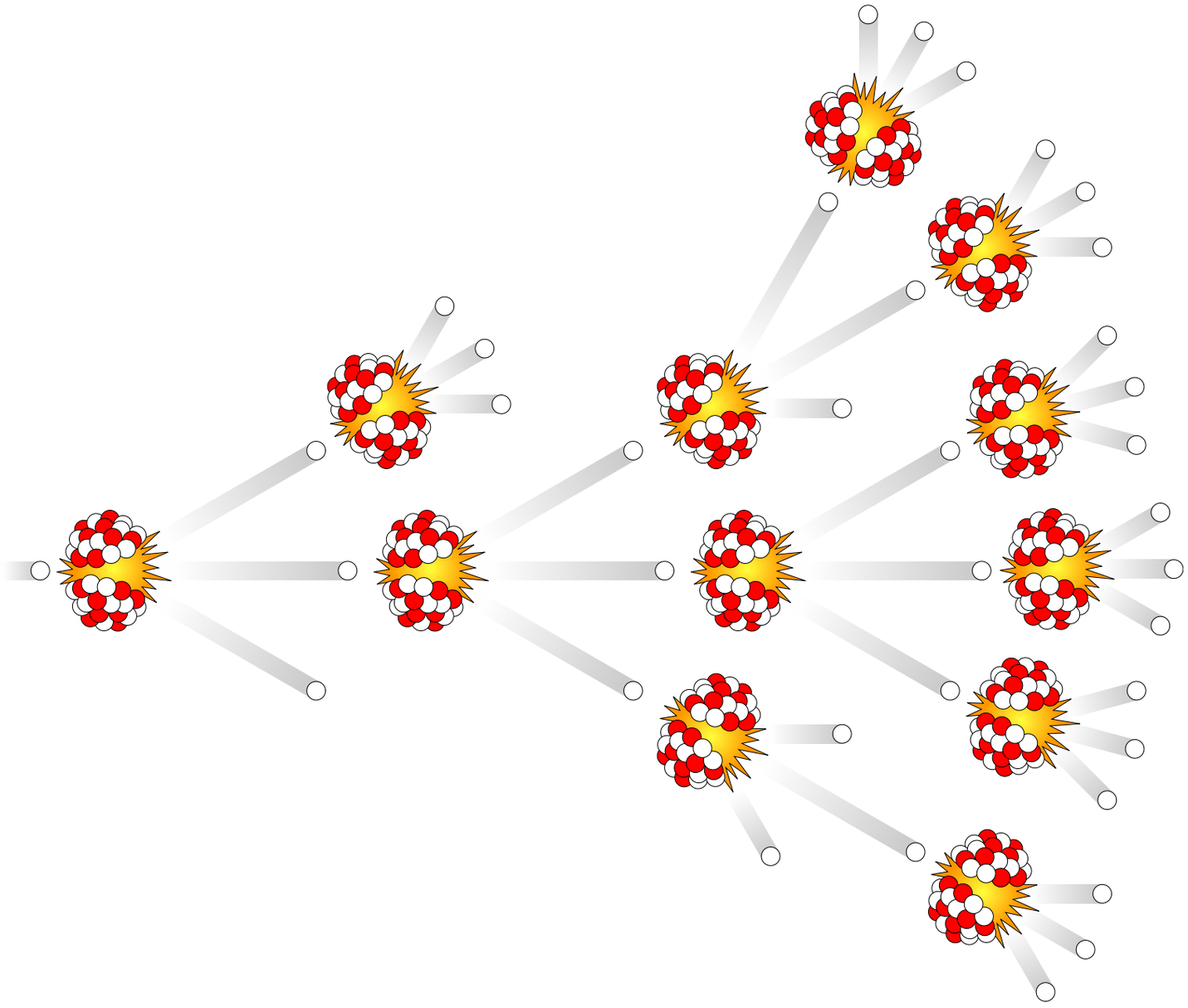


Those pieces may undergo further radioactive decay, producing additional energy.



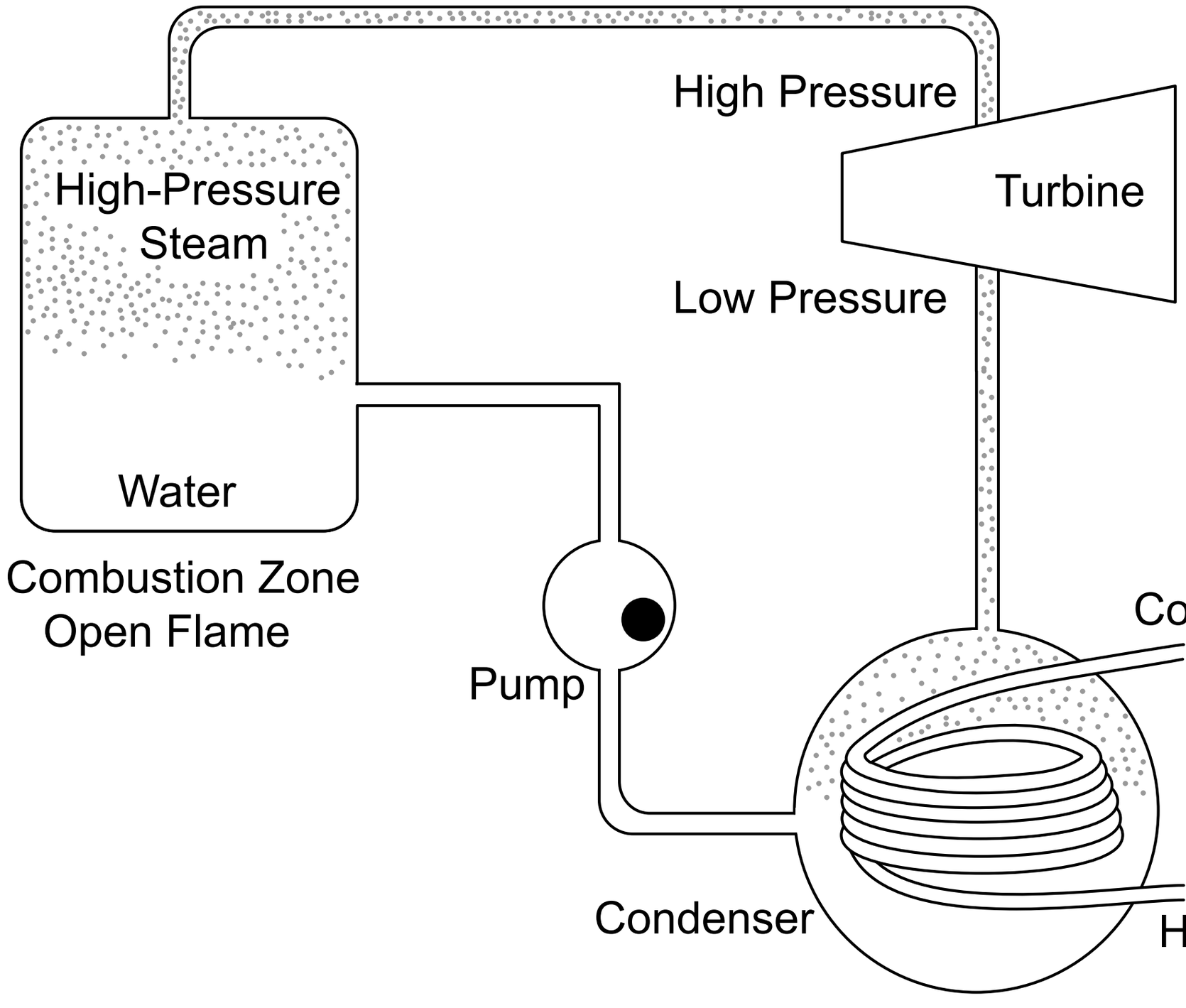
Among the fragments are usually 2-3 neutrons, which can interact with other fissile nuclei, causing additional reactions.

This is the essence of a chain reaction.



The extra neutrons produced in a fission chain reaction can be controlled, for reactors in nuclear power plants, or uncontrolled, for a bomb.

For controlled situations, the energy extracted is used to run a heat engine, where the hot reservoir can be kept hot for periods longer than a year.



$$\text{efficiency}_{max} = \frac{T_{high} - T_{low}}{T_{high}}$$