



What is the ultimate source of nuclear energy?

We were asked this by a student after we made a generalization that all forms of energy, including nuclear, derive eventually from the sun. That is not exactly accurate. Nuclear energy does derive from a star, but not the sun.

Stars use fusion reactions to turn matter into energy. Inside a star, hydrogen, atomic number 1, is squeezed and heated to make helium and heavier elements, step by step down the periodic table. This process stops around iron, atomic number 26. Iron is so stable that once a star has made enough of it, the iron starts to quench the fusion furnace, and the star starts to die.

As a star dies, it collapses, and this collapse sometimes causes the core of the star to become so hot, it explodes in a nova or supernova. During this explosion, nuclear reactions are powerful enough to populate the rest of the periodic table down to around uranium. The explosion also blasts the star-stuff into space, where some of it was once lucky enough to coalesce into planet Earth when our solar system formed.



The uranium on Earth, with its 92 protons and 146 neutrons, was formed in the explosion of a star that was somewhere near here before the formation of the sun. Nuclear power is not solar in the same way that wind, hydroelectric, photovoltaic, or even fossil fuels, which are derived ultimately from plant matter, are. Nuclear energy is perhaps more correctly called a form of stellar energy.

7/2017