The Energy Released by Fission

I wanted to show you an "order of magnitude" argument for the energy released in a fission event. This is the kind of "back of the envelope" calculation that Otto Frisch could have performed on the ski trail with his aunt Lise.

The energy of two charged particles brought next to one another is something like $\alpha Q_1 Q_2 / r$, where Q is the charge, r is the distance between them, and α is a constant to make all the units work out. For a hydrogen atom, then, the energy is something like

$$E_{Hydrogen} = \alpha\ (1)(1)/10^{-10}$$

If the Uranium nucleus split into 2 equal pieces, the energy would be

$$E_{fission} = \alpha\ (46)(46)/10^{-14} = \alpha\ 2116/10^{-14} = 2.116 \times 10^{7}\ (\alpha\ /10^{-10}) \approx 2 \times 10^{7}\ E_{Hydrogen}$$

But as we discussed earlier, the energy of the hydrogen atom is on the order of 10 eV. So, the energy involved in the fission process is on the order of

$$E_{fission} \approx 20 \times 10^{6}\ (10\ eV) = 200 \times 10^{6}\ eV = 200\ MeV$$

The next question, of course, is "Where did this energy come from?".