Nuclear Fission in the Home Radiation Lab

By George Dowell

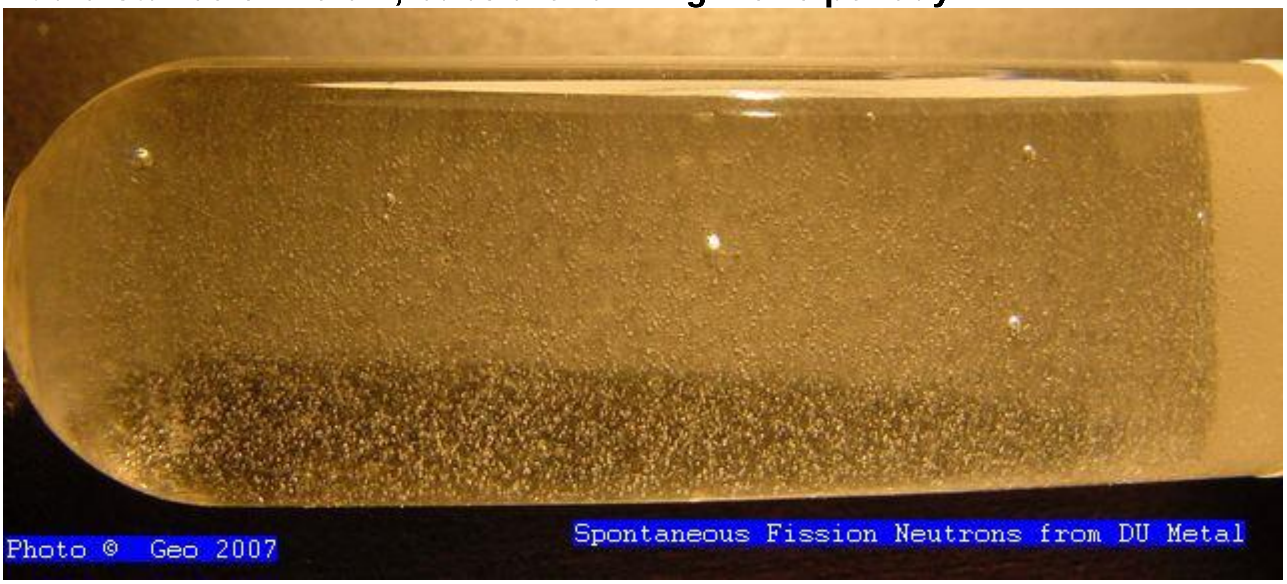
SF, Spontaneous Fission is a form of radioactive decay that is possible in very heavy atoms. Theoretically it can happen in all atoms above A=100, but in practice SF is only probable in atoms above A=230.

Elements U-235 (2.0 E10-7%), U-238 (5.4 E10-5%), Pu-239 (4.4x10-10 %), Pu-240 (5.0x10-6 %) and Cf-252 (3.09 %) are all candidates for SF, with Cf-252 far and away the most prodigious with fission probability of 3.09% per decay.

Neutron "background" baseline established over several days of monitoring with the Fast Neutron Bubble Detector.
At our altitude of 600 Ft., temperature of 73 F and 48 hours, no bubbles were noted.
Geology in this region, ne Missouri USA, is limestone, from the sediment of the ancient inland sea.

SF Source is a Depleted Uranium collimator weighing 1 pound 12 ounces, the detector being a BTI BD-PND bubble detector.
Calculated neutron yield for this mass is 11 n/s.

At a distance of 2.5 cm, bubs are running 4 or 5 per day.



INDUCED FISSION in the HOME RAD LAB
Subcritical Neutron Multiplication

Described is a lab procedure for splitting of U-235 atoms and recording the results in terms of fast neutrons
via BTI Bubble Detector Model BD PND. By experiment we have verified that the BD PND only responds to fast neutrons, nit slow neutrons, and also that there are zero "background" neutrons at this location. Spontaneous fission from the DU slab has been documented and is subtracted from the overall results, although the number of SF neutrons is quite small.
Fast initiator neutrons are provided by a home made Ra-Be generator, constructed for the project from 10,000 Radium
watch hands plus elemental Beryllium. Yield was about 240 CPM into a moderated and reflectored 20 atm.He3 detector.This source was temporary and has since been dismantled.

Fast neutrons are first thermalized (slowed down) by layers of high density polyethylene plastic, called HDPE from here on, a hydrogen rich material.

A beam of slowed neutrons is presented to a DU metal slab (note 1) consisting of approximately 1.75 pounds of U-238 and about 1.2 grams of U-235.
When a neutron is absorbed by a U-235 atom, the atom becomes unstable U-236 and immediately fissions via one of several methods shown below. Each of the methods results in the release of either 2 or 3 fast neutrons, therefore we use the average figure of 2.5 released neutrons in the formula.
We have now multiplied the original fast neutron from the Ra-Be source to 2.5 neutrons. By judicious use of HDPE moderators and graphite reflector slabs, the extra
neutrons are slowed and reflected back to be themselves presented top the DU target. These new neutrons continue the subcritical multiplication process.

Ra+Be= 1n (fast)

Fast n + HDPE= 1n (thermal)

Thermal n + U-235 = U-236 = Kr-92+Ba-141 (note 2)+ 2.5 n (average, Fast)

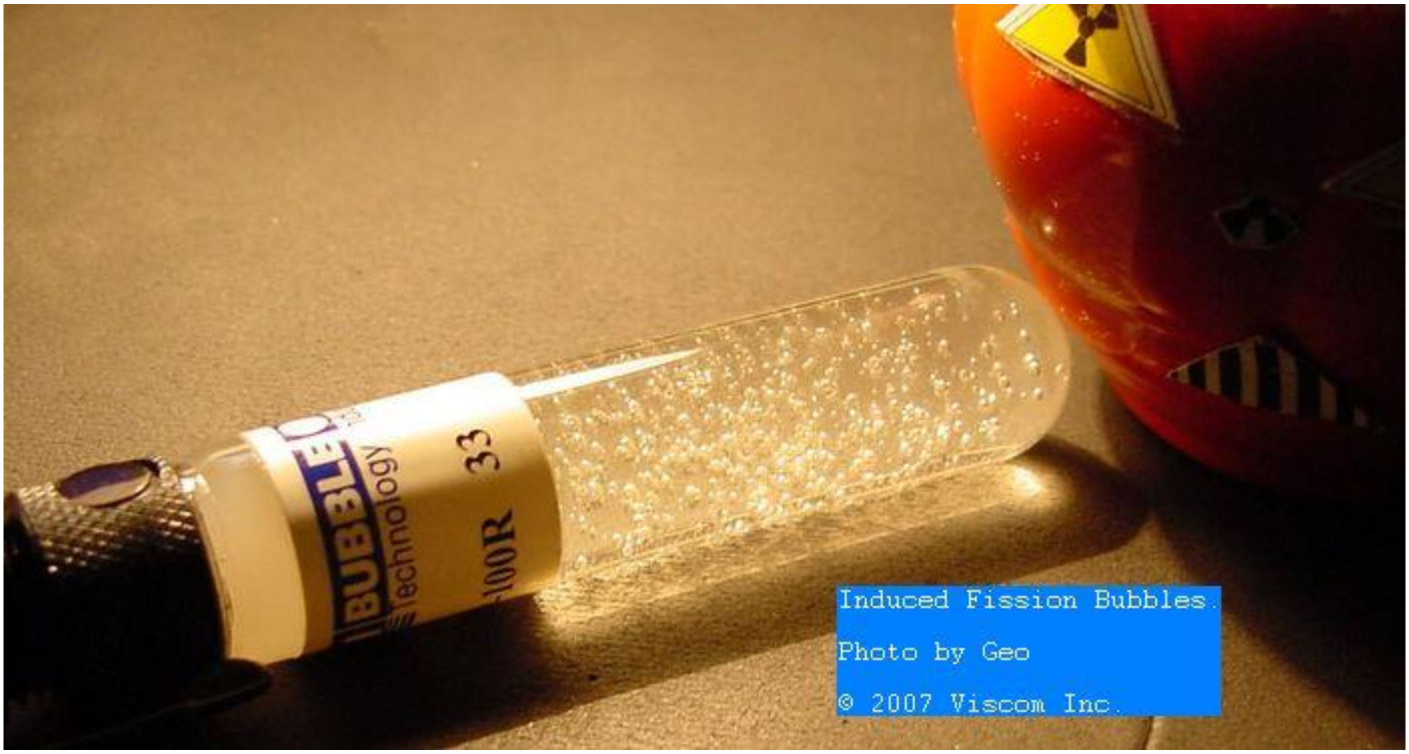
2.5 Fast n + HDPE+C (reflector) = 2.5 n (slow)

2.5 Thermal n + U-235...etc.etc.= many n (fast) for detection via BTI Bubble detector.

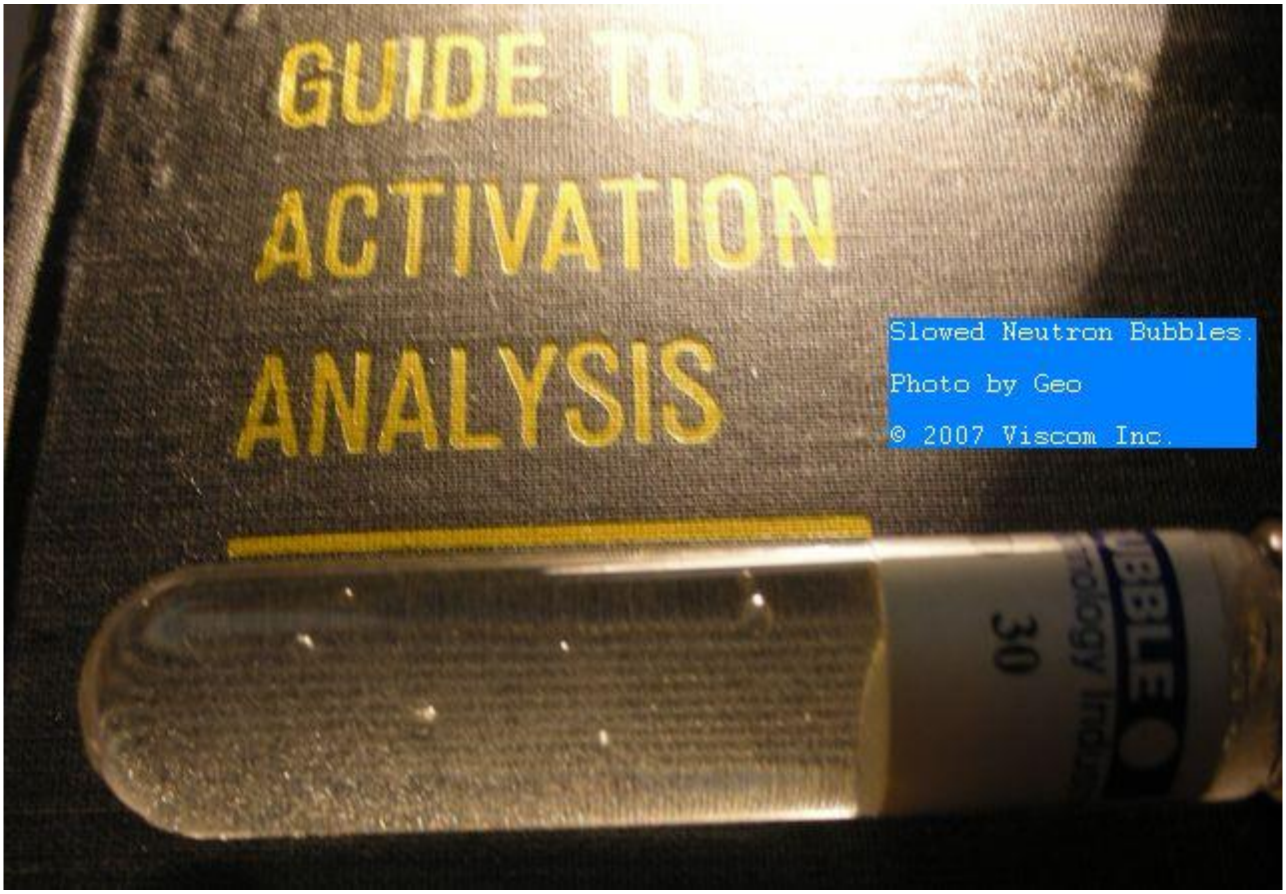
Regular U metal (non-DU) impossible to find today. DU easy to find, various forms. DU contains about .2% U-235.

HDPE is 6" x 6" x .5" slabs so is the graphite. Making adjustable piles and taking measurements eventually yields a standard configuration. Neutron generator was 10,000 radium watch hands + Be.

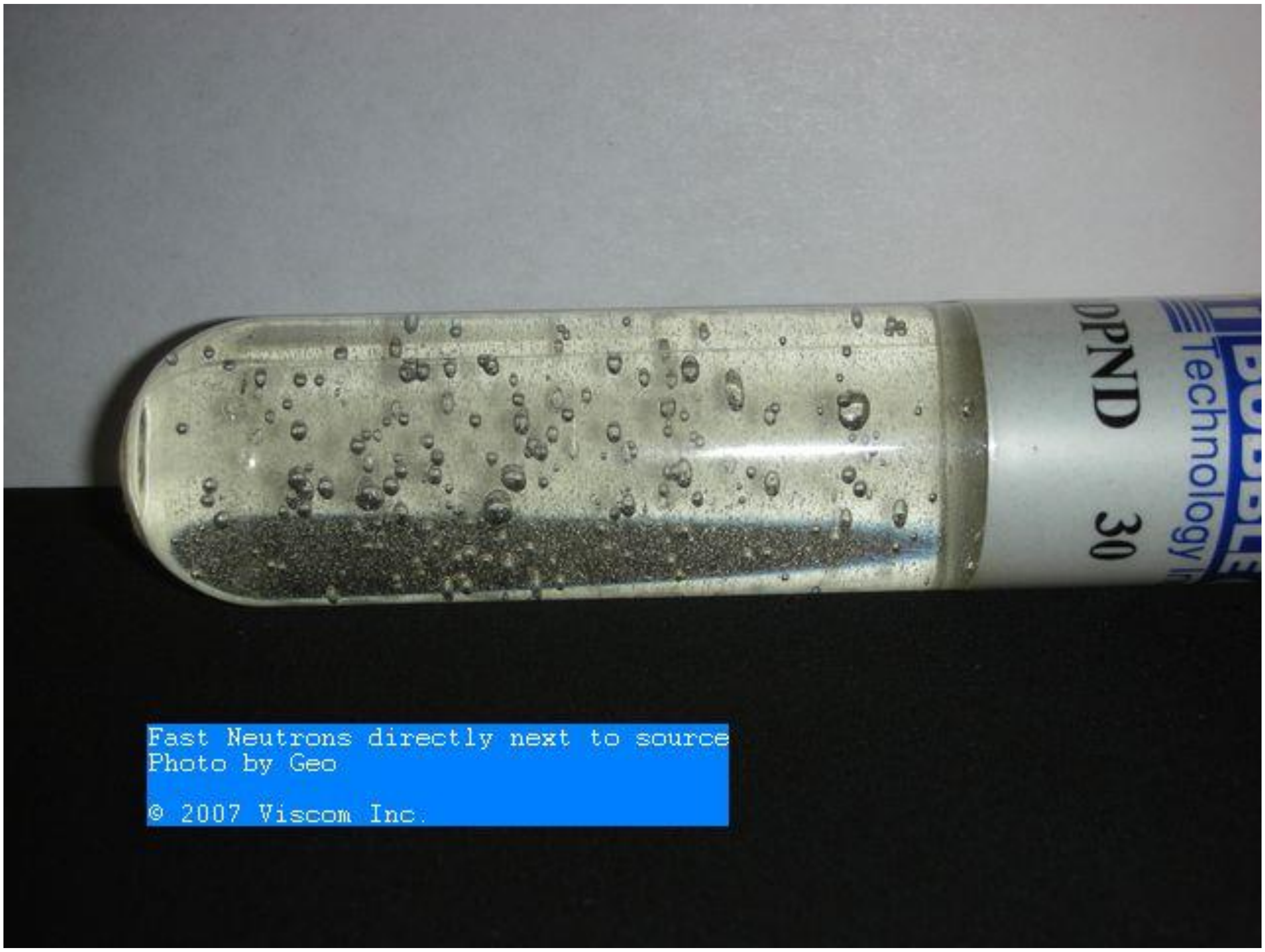
Only a bubble detector can be used in this scheme because of long count times, and the absolute zero false bubbs.



Bubbles captured from exposure to the DU target while it was being bombarded with slow neutrons.



Bubble detector test using only the slowed neutrons, without the DU slab shows 5 or 6 small bubbles
during a similar measured time period.
Note that the two larger bubbles in this picture were there before the test was run and must be disregarded.



Above is a test showing fast neutrons captured right next to the bare source, that is no

modereator. There were 8 bubbles left in the BTI from previous tests, and they should be

disregarded in the total count here. These include those two large bubbles.

<u>Bubble detector test without any source, without ant DU, yields no bubbles (zero background).</u>

note 1- USA laws and rules allow for up to 15 pounds of DU metal without a license, nor is there any restriction on the number of Radium Watch hands that can be owned.
note 2:
other possible fission products-
U-235 + n = Ba-144 + Kr-90 + 2n + energy

U-235 + n = Ba-141 + Kr-92 + 3n + 170 MeV

U-235 + n = Zr-94 + Te-139 + 3n + 197 MeV

Have Fun

George Dowell, “Geo”

NLNL/ New London Nucleonics Laboratory

Comments, criticism and questions will be appreciated and may be directed to the author by email to GEOelectronics@netscape.com