

NPL recreates original fission experiment

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BBC presenter Jem Stansfield with NPL's David Thomas, who is holding the ion chamber used during filming

National Physical Laboratory helped a BBC/Open University production crew recreate Otto Frisch's famous fission experiment from the 1930s.

In 1939 Otto Frisch, and his aunt Lise Meitner, published a letter in [Nature](#) proposing an explanation for experiments by Fermi and collaborators where medium weight nuclei were produced on bombarding uranium with [neutrons](#). They suggested that the nucleus split apart releasing large quantities of energy, and they called this process 'nuclear fission'. Frisch quickly performed an experiment to confirm this

hypothesis by measuring the energy released.

Over 70 years later, in July 2010, the BBC approached NPL to help them recreate Frisch's experiment as part of their documentary [Explosions: How We Shook the World](#). Their proposal was to build and use a home made ion chamber similar to the device Frisch would have used. They approached NPL to do this because we have the facilities and expertise to perform the experiment safely and legally.

David Thomas (Head of NPL's Neutron Group) said: "When the BBC approached us I thought we wouldn't be able to recreate such an experiment with the equipment we were given, so I was genuinely astounded when, after a little tinkering, it worked like a dream."

Miniature fission

During filming, one sixth of a gram of natural (unenriched) uranium 238 was placed inside the ion chamber, and then bombarded with neutrons from a small radionuclide source - in this case a mixture of americium and [beryllium](#). Am-Be sources are commonly used in industry for oil well logging and moisture gauging, and are the basis for routine [neutron detector](#) calibration.

In contrast, Frisch used a radium/beryllium mixture which produces high-energy gamma rays. During NPL's recreation of the experiment Am-Be was used instead as it is much more 'hygienic', and only emits [alpha particles](#), and some low-energy gamma rays.

Several fission events were observed (i.e. a uranium nucleus splitting apart) via a piece of kit called a 'storage oscilloscope'. The oscilloscope also revealed background 'noise' due to uranium's natural radiation. The background noise was interspersed with much larger (~10 times larger) fission events showing up as peaks every ten seconds or so.

The experiment was perfectly safe at all times - the energy released during [fission](#) was tiny, about one millionth of one millionth of the energy you would need to boil a cup of water.

As the UK's national measurement institute, NPL is responsible for maintaining all the UK's primary measurement standards. This includes measurement of radiation, which is why we hold small neutron sources and small amounts of uranium of the kind used in this experiment.

Provided by National Physical Laboratory

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