How we did the experiment

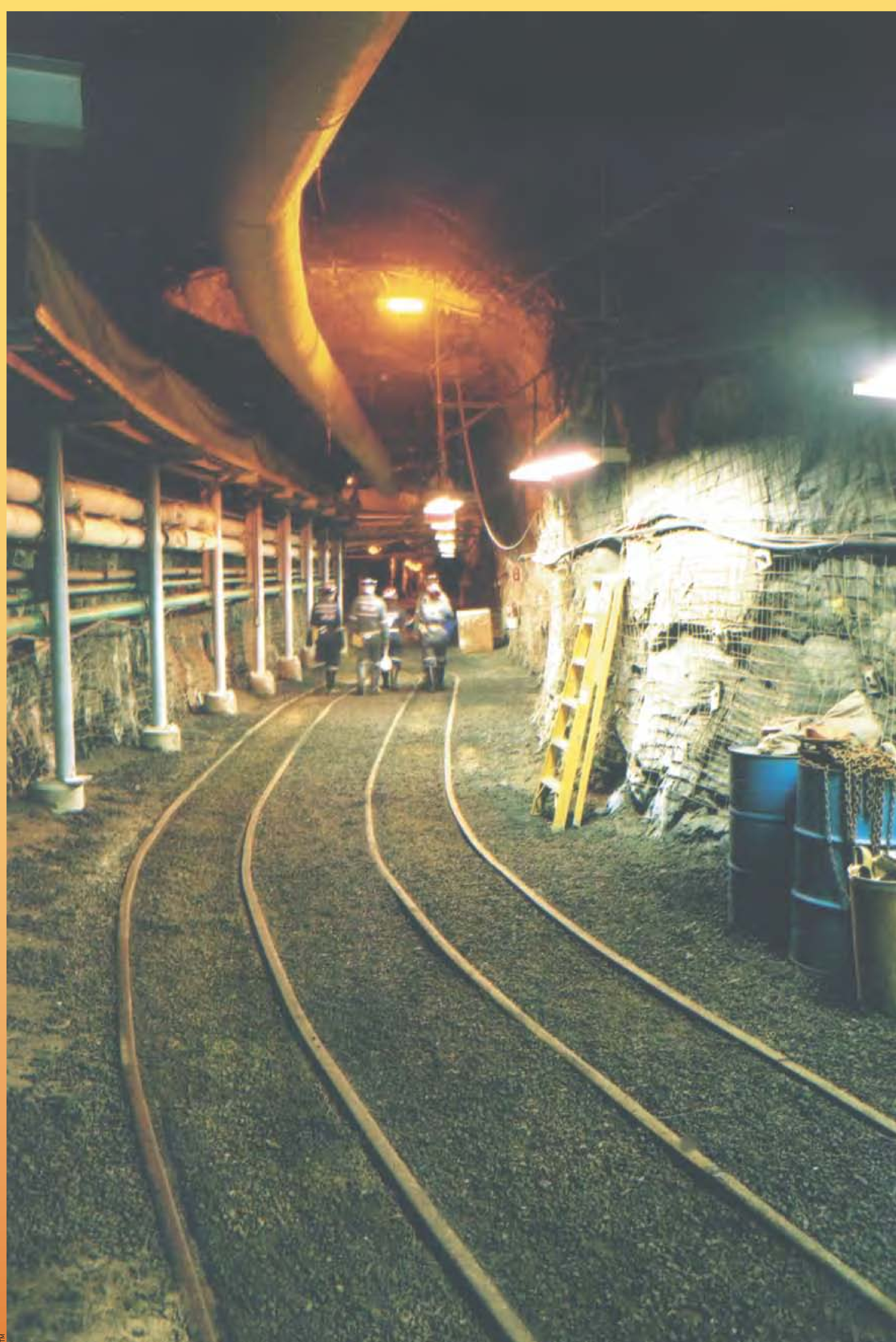
Cosmic Intruders

A Shield of Solid Rock

Particles from outer space, known as cosmic rays, constantly bombard the Earth, drowning out any neutrinos.

Because of this, the SNO detector is located in a mine, two kilometres underground. The rock shield reduces cosmic rays to a minimum.

But this protective rock has no effect on the neutrinos, which reach SNO in almost equal numbers day and night, as they continually pass through the Earth.

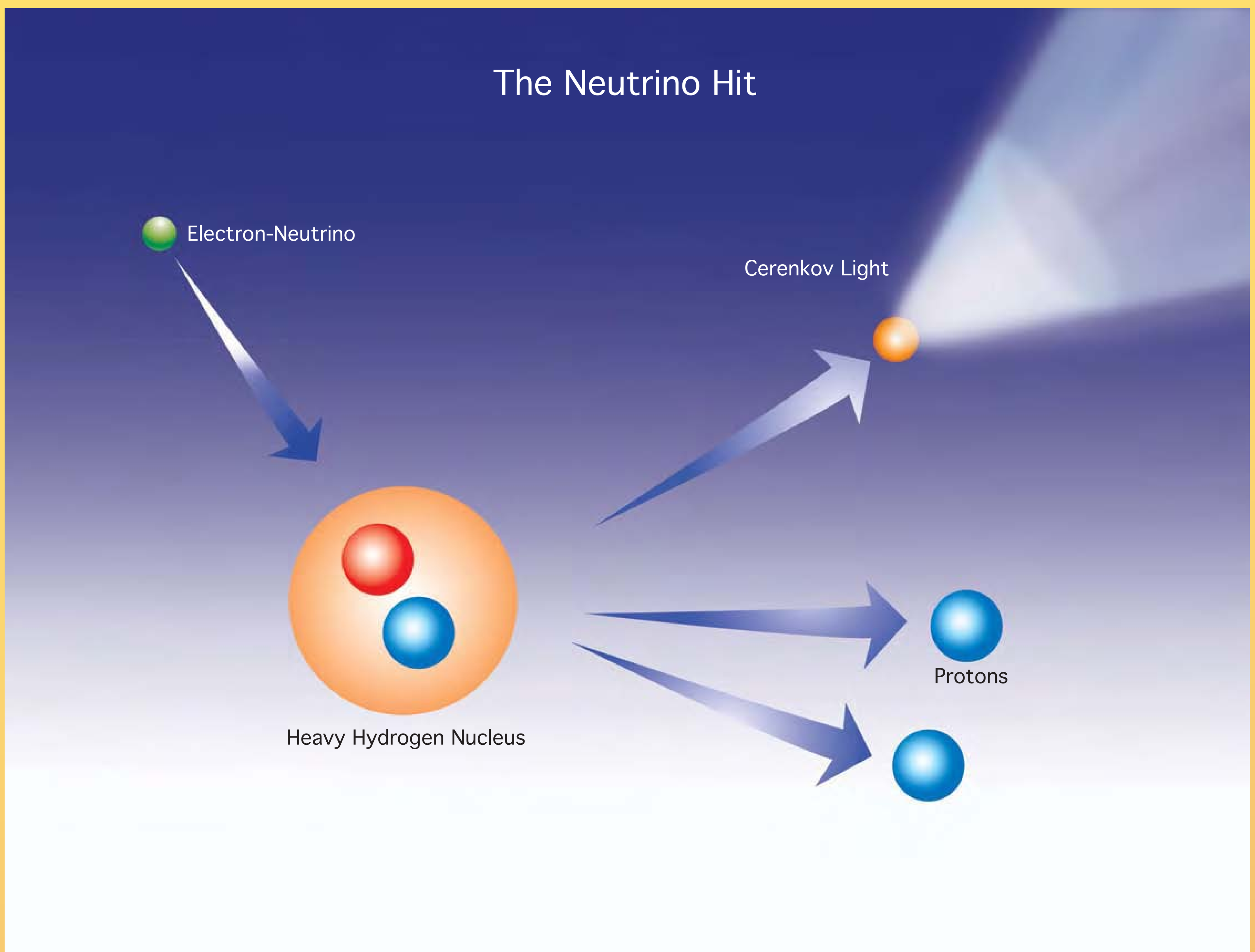


Setting the Bait

SNO Snares Neutrinos in Heavy Water

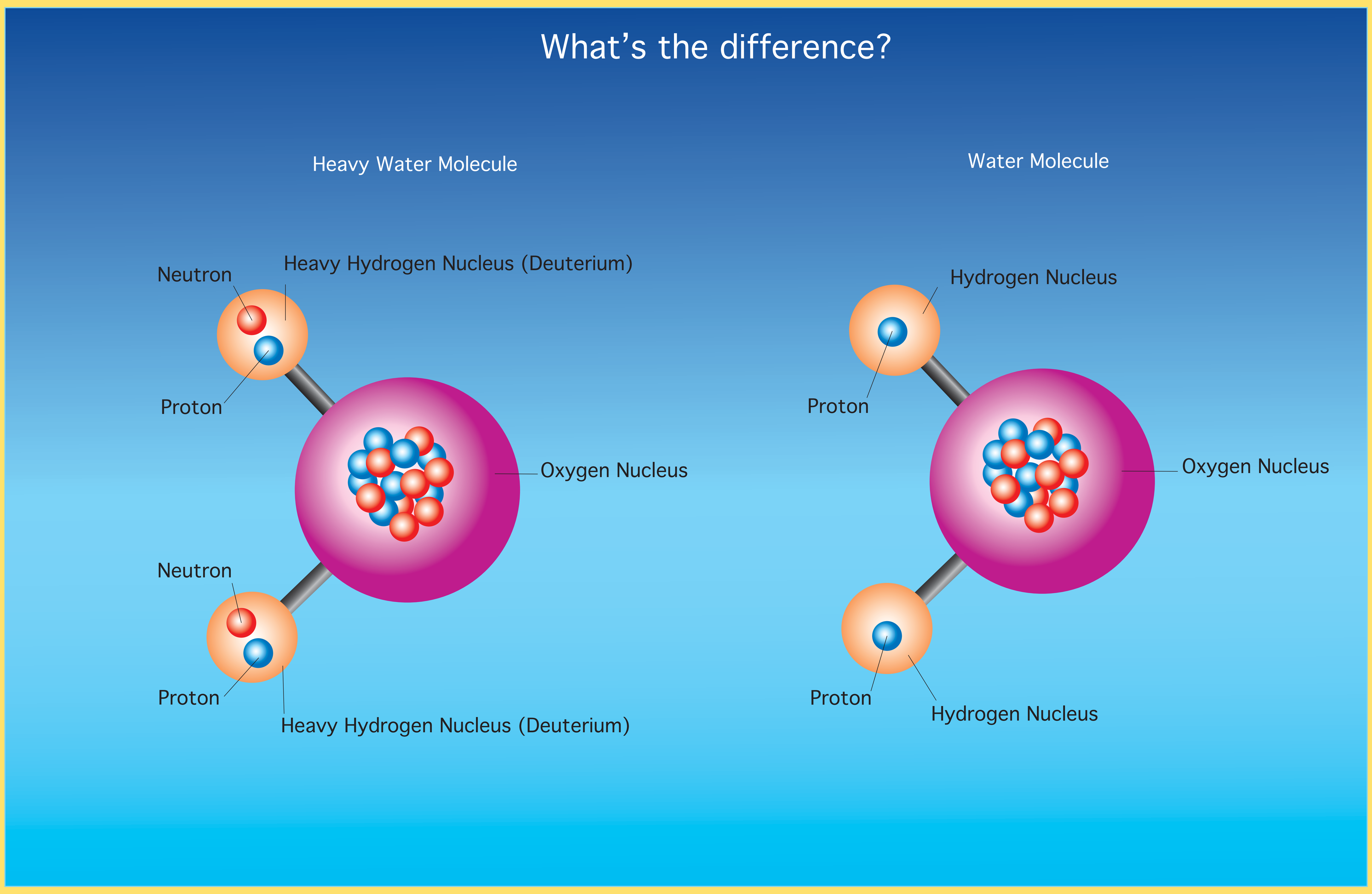
The secret of SNO's success is in the heavy water, which contains one more neutron in each hydrogen nucleus than in ordinary water. Any flavour of neutrino can break the nucleus up, freeing the proton and neutron. However, only an electron-neutrino, the "vanilla" neutrino, can change that neutron into a proton and an electron. And the SNO detector can tell the difference between the two reactions.

That's how SNO can tell the vanilla neutrinos, from the other two flavours.



The electron-neutrino collides with a heavy hydrogen nucleus, containing a neutron and proton, releasing two protons and an electron. The electron causes a small flash of cone-shaped light.

Heavy Water



In the molecule of heavy water, notice the neutron in the nucleus of the heavy hydrogen (deuterium).

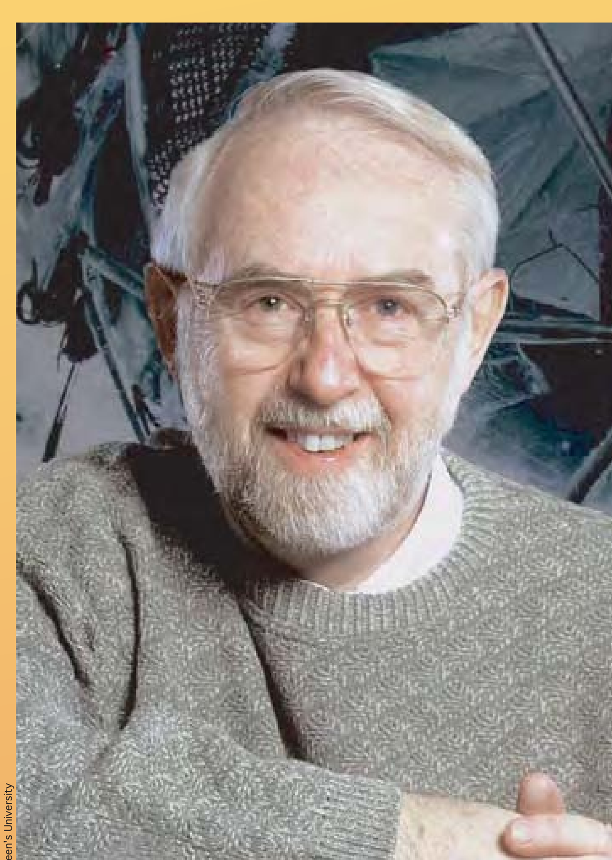
Why build this in Canada?

In the Canadian Shield, we already have a deep mine in Sudbury: Inco's Creighton mine. Nickel production is the primary function of this hard rock mine, but trapping neutrinos has made the mine famous around the world.

Our CANDU heavy water reactor technology and expertise means that there is an abundance of heavy water available for the SNO experiment.

We have qualified scientists, and institutions that support basic research.

Dr. Walter Davidson (left), National Research Council, one of the founding members of the project, with John MacDougall, former Member of Parliament for Temiskaming, an early advocate for SNO



Dr. Arthur McDonald, Queen's University, Kingston, Ontario, Director of the SNO Institute

Dr. Doug Hallman, Laurentian University, Sudbury, Ontario SNO Communications Director

Dr. David Sinclair, Carleton University, Ottawa, Ontario, SNO Associate Director

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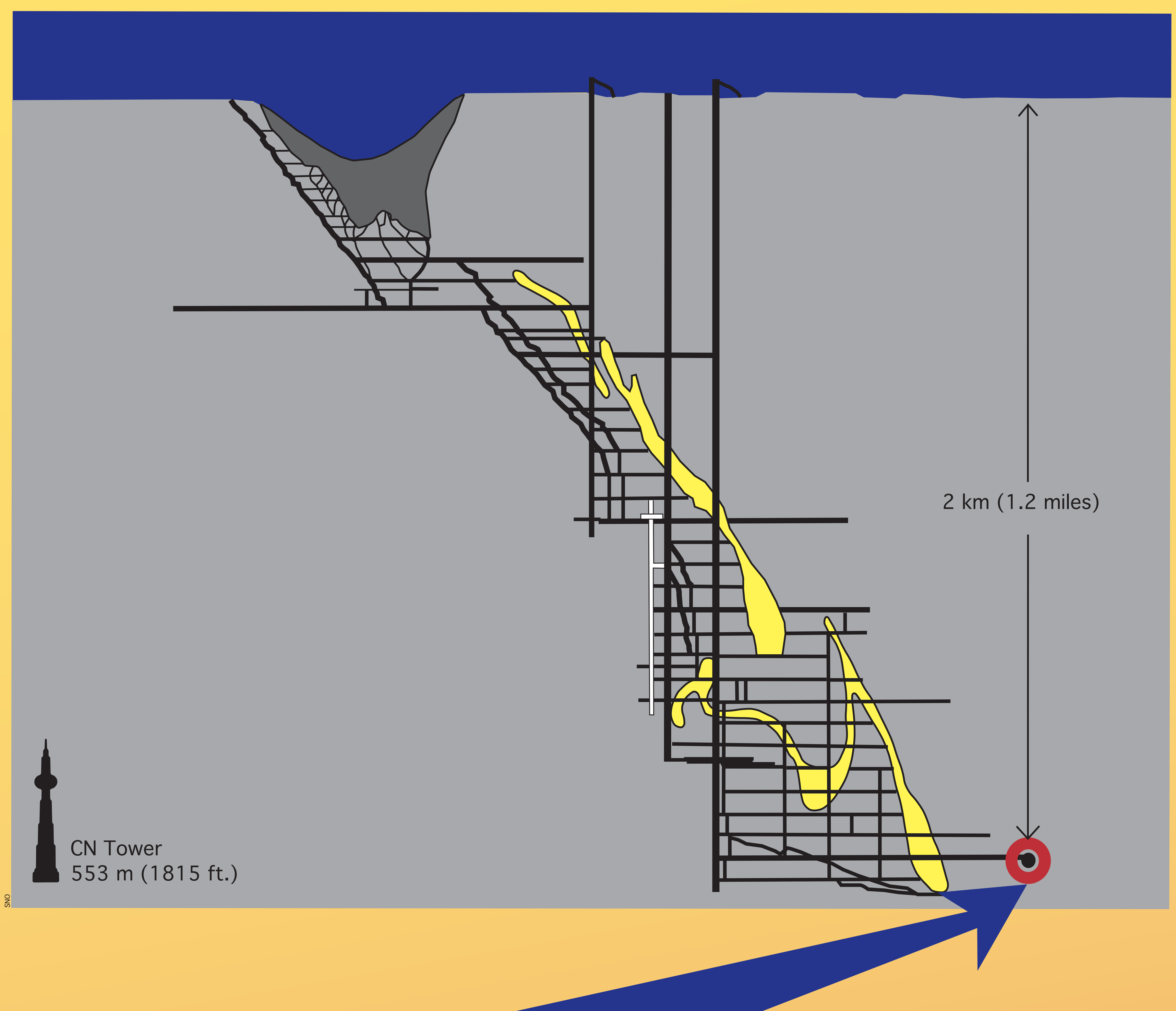
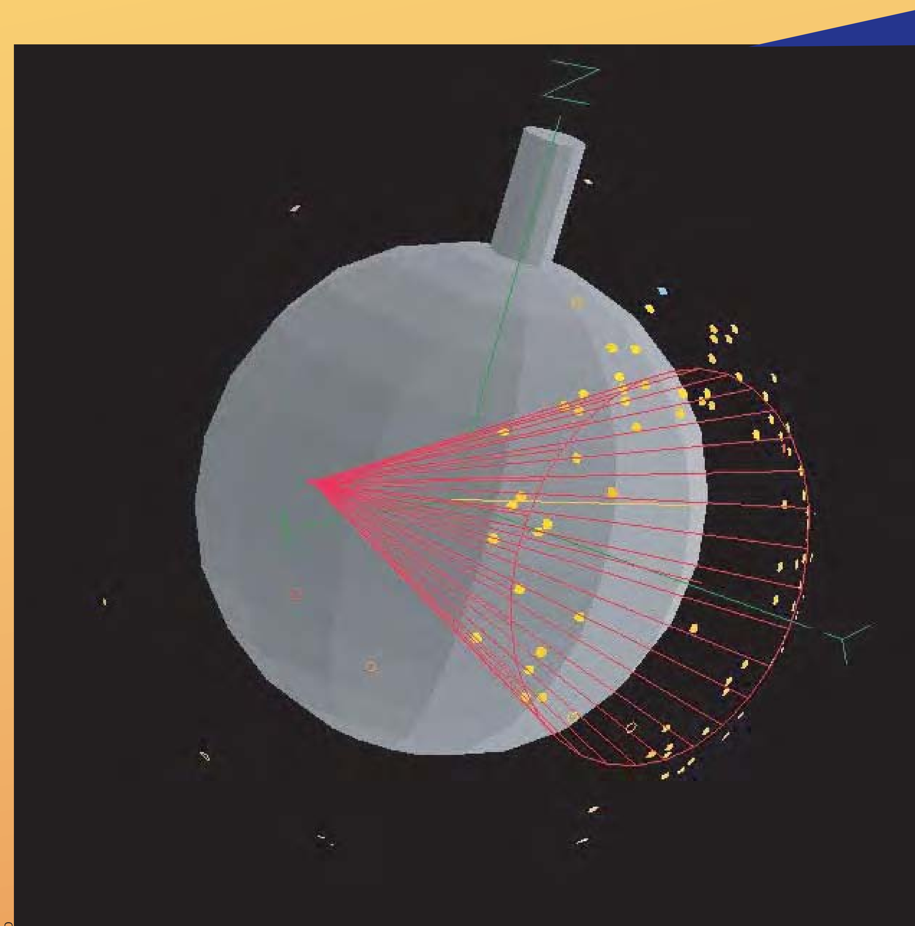
The Great Solar Neutrino Ambush

Hiding, Watching and Waiting

To trap the solar neutrinos, an enormous volume of heavy water was placed deep underground in a cavity ten storeys high. The heavy water was suspended in a colossal transparent sphere so that electronic "eyes" called photomultiplier tubes could watch from all sides for telltale flashes of light.

All the detector materials and the surroundings were purified to new standards. Then the experiment was sealed off to await one of nature's most unlikely occurrences: the interaction of a neutrino.





A solar neutrino is "captured" when it hits a molecule of heavy water. This results in a tiny flash of light that is detected by light-sensitive tubes. This collision happens once every two hours or so.

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