Neutrino To Be Lucky Catch

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Neutrinos released in Switzerland are due to be caught in Italy under the international project OPERA. The system of detectors for identifying these mysterious particles is developed by a joint effort of Russian and Ukrainian scientists.
Specialists from the Joint Institute for Nuclear Research (Dubna, Russia) and Institute of Scintillator Materials NASU (Kharkov, Ukraine) have joined the Project OPERA that is a biggest and most expensive international experiment in the field of physics. (*read also about MINOS neutrino experiment at* www.physorg.com/news3267.html)

Under this project, neutrino beam will be generated by proton accelerator in the CERN (Geneva, Switzerland). At a speed close to that of light, the beam will instantly cover the distance of 730 km under ground and reach the laboratory Gran Sasso (Italy) situated at a depth of 1.5 km in the side halls of an automobile tunnel. There, the beam will go through the detectors and leave its traces.

A large and dense net is needed for catching neutrinos that can easily go throughout the Earth. To achieve this goal, scientists have designed a huge complex target having dimensions of 10x10x100 m and several systems of particle detection. Its walls are made of bricks that consist of nuclear emulsions and lead sheets. Plastic scintillators, placed between the bricks, are needed to produce a flash of light upon absorption of an ionizing particle, specifically, neutrino. There are also electronic devices to register the flash and identify the actual brick, where the neutrino interaction took place.

However, that is only the beginning of detection process. Then, scientists need to take the brick out of the wall and study particle tracks left on each of the emulsion sheets, which will finally allow for neutrino identification.

One can imagine the scale of work looking at these figures: the target is built of 62 walls containing in total 206336 bricks; each brick is made of 57 nuclear emulsions and 56 lead sheets. The analysis of one brick with the use of latest computer technologies and special equipment will take tens of hours. The Ukrainian scientists are involved into the OPERA project as the designers of new scintillator making technique. They have built the world's largest furnace for raw material processing and produced 33 thousands of 7-meter-long strips with a total weight of 70 tons.

Why the scientists have launched this difficult, expensive, and labour-consuming project? Because discovering the properties of neutrino will in the long run help to understand certain cosmic processes, e.g., the expansion of the universe. Apparently, the mechanism of mass formation in neutrino is somewhat different from that in other particles. It is not excluded that neutrino is the key to future physics.

Source: Informnauka (Informscience) Agency