

Geophysics

Going to extremes

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Mapping the Earth with neutrinos

TELESCOPES that point down instead of up sound like a weird idea but, if they are designed to detect subatomic particles called neutrinos, they can tell astronomers what is happening in the sky on the other side of the planet. That is because most of the neutrinos that reach the Earth pass right through it. The planet thus forms a useful screen against other sorts of particles that might confuse the telescope. Such devices could, however, also see what is happening deep inside the Earth. At least, that is the suggestion made this week by a team led by Maria Gonzalez-Garcia of Stony Brook University, in New York state.

At the moment, the only data on the Earth's interior are the paths of earthquake waves that are reflected and refracted by the various layers of the planet's interior. These, together with reasonable guesses about the Earth's overall composition, have been used to put together the familiar model of an iron core, a rocky mantle and a thin crust. But the evidence is indirect. If Dr Gonzalez-Garcia is correct, then physicists will have opened a direct window on the subterranean world—at a minimal extra cost.

Most of the neutrinos that travel through the Earth come either from the sun or from sources far beyond the solar system. Some, however, are the result of collisions between cosmic rays and the gases of the upper atmosphere. As luck would have it, these tend to have about the right level of energy to be absorbed by rock more often than their extraterrestrial counterparts. That means they can, according to Dr Gonzalez-Garcia, be used like X-rays passing through a human body, to pick out denser rocks from lighter ones.

Of course, you would need an appropriate neutrino telescope to do this. Luckily, one is being built at the South Pole at the moment. Called IceCube, it will work by detecting the flashes of light generated on those rare occasions when a neutrino hits one of the atoms in a molecule of water in the ice.

When IceCube is completed in 2011, it will be a boon to astronomy. But it will also be the first telescope capable of spotting enough neutrinos to make it worthwhile to take measurements of the interior of the Earth. If Dr Gonzalez-Garcia is right, it will thus be the world's first geoscope as well.

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