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A rare glimpse into the solar core

Researchers have detected elusive neutrinos emitted during the first in a chain of reactions that generates more than 99% of the Sun's energy.

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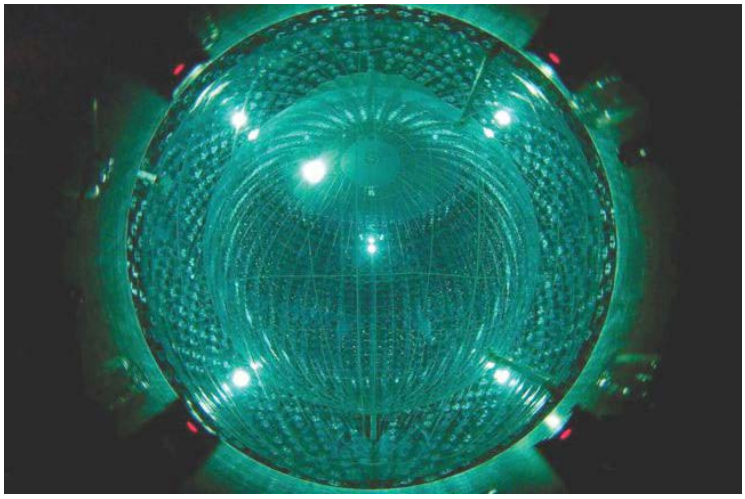
Almost everything we know about the Sun has been gleaned from the light it emits: Images collected at various wavelengths provide clues to the Sun's surface temperature, magnetic field dynamics, subsurface flows, and more. (See *Physics Today*, June 2000, page 26; April 2012, page 56.)To glimpse directly into the Sun's opaque core, however, one needs to look not for photons but for neutrinos. Byproducts of the fusion that gives the Sun its glow, solar neutrinos carry in their flux and energy a record of the reactions taking place in the solar interior. Now an international collaboration at the subterranean Borexino detector in Italy has measured the spectral flux of the most abundant of those neutrinos—so-called pp neutrinos emitted when two protons combine to form deuterium. The least energetic of the solar neutrino breeds, pp neutrinos are notoriously difficult to detect above the background noise of naturally occurring radioactive elements. At the Borexino detector, pictured here, the neutrinos are identified by the faint bursts of light generated as they scatter with electrons in a 100-m^3 volume of liquid scintillator. To rid the scintillator of trace radionuclides that would have spoiled the experiment, the researchers used purification techniques borrowed from petroleum engineering. Their reported neutrino flux, $(6.6 \pm 0.7) \times 10^{10}$ $cm^{-2}s^{-1}$, agrees with predictions of the standard solar model, but forthcoming higher-precision measurements could provide a more stringent test of the theory. (G. Bellini et al., Borexino collaboration, *Nature* **512**, 383, 2014.)



Credit: Borexino collaboration

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