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# Unveiling the engine of the Sun: measurements of the pp-chain solar neutrinos with Borexino

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About 99 percent of solar energy is produced through sequences of nuclear processes that convert hydrogen into helium in the so-called pp-chain. The neutrinos emitted in five of these reactions represent a unique probe of the Sun's internal working and, at the same time, offer an intense natural neutrino beam for fundamental physics research.
The Borexino experiment consists of a large-volume liquid-scintillator detector designed and constructed for real-time detection of low energy solar neutrinos. It is installed at the underground INFN Laboratori Nazionali del Gran Sasso (L'Aquila, Italy) and started taking data in May 2007.
Borexino has been the only experiment so far capable of performing a complete study of the pp-chain by directly measuring the neutrino-electron elastic scattering rates for the neutrinos produced in four of its reactions: the initial proton–proton (pp) fusion, the electron capture of beryllium-7, the proton–electron–proton (pep) fusion, and the boron-8 beta+ decay. A limit on the neutrino flux produced in the helium-proton fusion (hep) was also set. This set of measurements further probes the solar fusion mechanism via the direct determination of the relative intensity of the two primary terminations of the pp-chain, and the computation of the solar neutrino luminosity. Moreover, the beryllium-7 and boron-8 fluxes are indicative of the Sun's core temperature, and their measurement shows a mild preference for the higher temperature expected from the high-metallicity Standard Solar Model scenario.
Finally, the experimental survival probability of these solar electron neutrinos allows to simultaneously probe the MSW neutrino flavor conversion paradigm, both in vacuum and in matter-dominated regimes, at different energies.
The details of the strategy adopted by the Borexino collaboration for successfully isolating the spectral components of the pp-chain neutrinos signal from residual backgrounds in the total energy spectrum will be presented.

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