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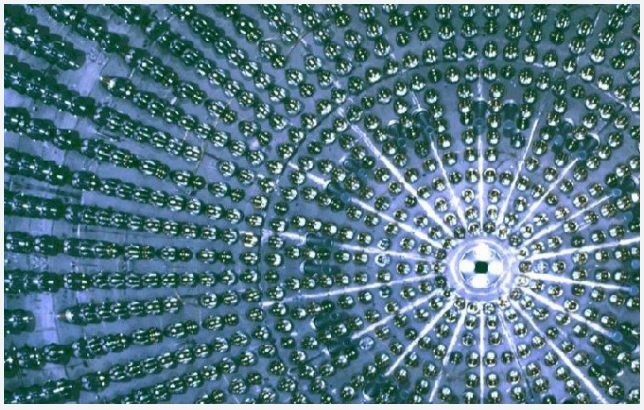

BOREXINO: OVER 10 YEARS OF SCIENTIFIC SUCCESSES

After more than ten years from the beginning of its scientific activity focused on the internal structure of the Sun, which gave an understanding of the power mechanism of our star with unprecedented detail, the Borexino experiment at the INFN Gran Sasso National Laboratories, on October 25th, published on Nature the compendium of its results on solar neutrinos. With this publication, Borexino crowns a long history of measurements and experimental investigations, which led the experiment, on the one hand, to investigate in detail the mechanism of energy production in the Sun and, on the other, to study in the region of low energy (from a few MeV down to less than 1 MeV) the so-called neutrinos oscillation phenomenon, i.e. the transformation of neutrinos from one type (flavor) into another.

Borexino is a large liquid scintillator detector, featuring about 1,300 tons of scintillator, 2,400 tons of water and 2,200 photomultipliers. The success of Borexino comes as a result of a 15 year long R&D study carried out by the collaboration to develop the best techniques of scintillator purification, allowing to reach and exceed the required levels of radiopurity. Immersed in the cosmic silence of the underground Gran Sasso Laboratories, from the moment of the data taking start-up, in May 2007, Borexino has been so radiopure that it conquered straightaway a unique and unmatched position within the many existing low background experiments. This peculiarity is the basis of the multiple results accumulated in more than a decade of operation, which go far beyond the initially set objectives, when the experiment was devised. In fact, designed to measure only the flow of neutrinos from ^{7}Be (beryllium 7) among those produced along the proton-proton chain (pp chain, i.e. the sequence of nuclear reactions in the solar nucleus initiated by the fusion of two protons), Borexino has gradually widened its experimental sensitivity, to cover the entire range of neutrinos from the whole sequence.

The unique characteristics of the measures carried out by Borexino, namely the real-time and low-threshold

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spectroscopic detection of the neutrino flux from the Sun, are all reported in the publication of Nature, with in addition a novelty: in this last result, the different neutrino components were measured simultaneously, and not separately as it happened for the previous analyses, and with considerably greater precisions. The precise and concurrent measurement in a single experiment of the neutrinos fluxes pp (^{7}Be, pep and ^{8}B - boron 8), as well as the limit on the minuscule flow of higher energy neutrinos (hep), altogether coming from the pp chain, allows Borexino to depict with absolute clarity on the experimental side the framework of the operation of our star, putting a definitive end to the secular question about the mechanism that makes it shine for the billions of years of its life.

At the same time, through the comparison of these experimental data of very high quality and accuracy with the forecasts of the Standard Solar Model, Borexino demonstrates incontrovertibly the existence in the low energy region of the oscillation between neutrinos of different flavor by the MSW (Mikheyev-Smirnov-Wolfenstein) effect. In particular, Borexino emphasizes in a completely autonomous way, using only its own data and without having to resort to results of other experiments, the peculiar transition between the two regimes of "vacuum" and "matter", that represents the signature of the MSW effect.

Borexino, stemmed from the intense cooperation among Italy, Germany, France, Poland, the United States and Russia, has been built exploiting cutting-edge techniques internationally recognized of absolute and unmatched excellence, especially in the field of materials radiopurity and low background. ■