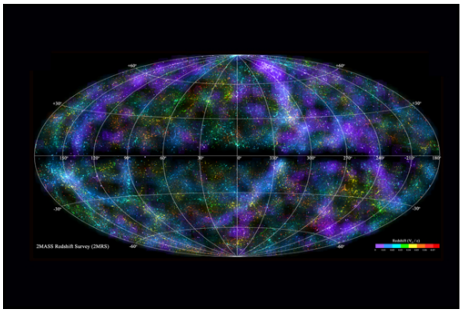
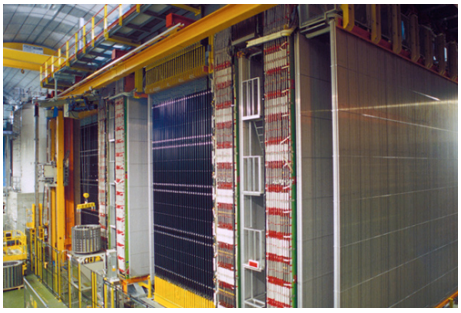


RESEARCH
DARK MATTER: POSSIBLE TRACES IN EXTRAGALACTIC RADIATION

Despite its name, dark matter might not be so dark, but associated with electromagnetic radiation. This is the hypothesis of a team of scientists of the INFN Turin, Roma Tre and Trieste sections, of the INAF and of the Chinese Academy of Science. The study, published in Physical Review Letters (PRL), describes a possiblecorrelation between the extragalactic gamma emission captured by the Fermi space telescope, in which INFN and INAF collaborate, and the distribution of cosmic dark matter rebuilt from the catalogue of 2MASS (Two Micron All Sky Survey) galaxies. According to the authors, this could be an indirect imprint of dark matter: its first possible non-gravitational trace.
The study shows, in fact, that the signal is compatible with the hypothesis that dark matter could be constituted by so-called Weakly Interacting Massive Particles (WIMP). WIMPs interact weakly and, so, they should go through a possible mutual annihilation or decay process. The goal of the reaserch is looking outside the group of galaxies which is part of our Milky Way, the so-called Local Group, for a gamma signal which can be associated with these processes. To do this, the gamma radiation map measured by the Fermi satellite was correlated with the distribution of 2MASS galaxies and it was possible to demonstrate that the signal that was found in this way is compatible with WIMPs". ■



RESEARCH
FIFTH TAU NEUTRINO DETECTED BY OPERA

The OPERA (Oscillation Project with Emulsion-tRacking Apparatus) international experiment at the INFN Gran Sasso National Laboratories has detected the fifth interaction of the tau neutrino. The neutrino started its "flight" at CERN as a muon neutrino and, after travelling through the Earth crust for 730 km, reached the Gran Sasso Laboratories, manifesting itself as a tau neutrino. The detection of tau neutrinos from the oscillation of muon neutrinos is very difficult because of two conflicting requirements: a huge and very heavy detector and micrometer accuracy. The challenge was to reach the scale of thousands of tons with a detector based on nuclear emulsion technology, a unique photographic technique in ensuring the required accuracy.
In 1998 it was demonstrated that the number of muon neutrinos produced in cosmic ray interactions with the atmosphere arriving on Earth was less than expected. The results of OPERA now conclusively confirm that muon neutrinos can oscillate into tau neutrinos. Detection of the fifth tau neutrino is very important: direct observation of the transition from muon to tau neutrinos has now for the first time reached the statistical accuracy of 5 sigma, the level required for a discovery in particle physics. It so possible to announce the discovery of the appearance of tau neutrinos in a muon neutrino beam. This result emerges from the analysis of the data that OPERA collected during his activity at the INFN Gran Sasso National Laboratories. The construction of the OPERA detector has been completed in spring 2008 and the experiment was taking data up to the end of 2012. ■