Research on neutrinos allows the discovery of vortices in the abysses of the eastern Mediterranean

May 16 2012

An INFN research project on neutrinos has made it possible to observe for the first time the presence of chains of marine vortices in the Mediterranean at depths of more than 3000 meters, large water structures of diameters of approximately 10 km, moving slowly at speeds of approximately 3 centimeters per second.

The article that describes this discovery (Abyssal undular vortices in the Eastern Mediterranean basin, Rubino et al.) is going to be published today in the online *Nature Communications* scientific journal and signed, among others, by researchers of INFN Roma and Catania Divisions and INFN National Laboratories of the South (LNS).

This discovery was made thanks to oceanographic measurements performed in the realm of NEMO (Neutrino Mediterranean Observatory) experiments, an INFN project for construction of an instrumental device for tracking the passage on the ocean floor of high-energy neutrinos coming from deep space. For the study of the most appropriate location for this device, the NEMO experiment placed a set of instruments 3500 meters deep in the Ionian Sea to measure currents and temperatures, collecting long series of annual temporal data.

The analysis of this data, performed by Angelo Rubino, oceanographer of the University Ca' Foscari of Venice, with his colleagues, has brought to light the presence of chains of deep marine vortices that the

oceanographic community did not expect in a closed basin such as the Mediterranean. The origin of these vortices is explained as possibly local, but the authors of the research do not exclude a remote origin linked to fluidodynamic instability processes in the waters of the Adriatic Sea and/or of the Aegean Sea.

These processes would give rise to rotating lentiform structures able to cross hundreds of kilometers without losing their dynamic and hydrographic characteristics. Numerical simulations, theoretical results and prior measurements on various sites seem to confirm these conclusions. The vortices observed will be of particular interest in the area of climate change in the Mediterranean Sea.

Five years ago, placing an acoustic device 2000 meters deep offshore from Catania, the NEMO experiment revealed the presence - unexpected by many - of cetaceans and in particular of sperm whales in that area of the sea.

Provided by INFN