LABORATORI NAZIONALI DEL GRAN SASSO
SEMINAR ANNOUNCEMENT

On **November 25, 2009**, at **3:00** pm, **Wolfango Plastino** from **Department of Physics, University of Roma Tre** and **INFN Roma Tre** will give a seminar entitled:

"Uranium groundwater anomalies and L'Aquila earthquake, 6th April 2009 (Italy)"

Abstract

Monitoring of chemical and physical groundwater parameters has been carried out worldwide in seismogenic areas with the aim to test possible correlations between their spatial and temporal variations and strain processes. Earthquake prediction is widely recognized as being among the most challenging scientific problems, both due to its societal relevance and to the intrinsic complexity of the problem, and it has been analyzed with several controversial discussions, debates, and reviews. Radon (222Rn) as a possible candidate for earthquake's precursor has been studied for a long period, but there is no clear evidence that it is really a good precursor. It has been suggested as one of several possible early signals, and its groundwater anomalies associated with earthquakes and water-rock interactions were detected in several seismogenic areas worldwide indicating possible transport of radon through microfractures or the crustal gas fluxes along active faults. The physical processes associated with radon groundwater anomalies are based on changes of radon emanation rates occurring due to strain signal near the earthquake's nucleation point. Particularly, it is unclear its behavior before, during and after the main shock, considering the consolidated scheme for radon release due to stress-strain processes in the rock. In the geological environment, the radon groundwater concentration depends on the isotopic abundance of its parent radionuclides (238U and 226Ra), and on their geochemical patterns with reference to environmental redox and pH characteristics. The geodynamic processes induced by earthquakes can modify radon migration patterns in groundwater as a potential indicator of strain. However, to predict the activity of radon in fractured lithologies is difficult and the measurement of radon concentration does not uniquely characterize the rock deformation or the chemical inhomogeneity, as well as its relationship with the transient crustal strain signals from 'aseismic' fault slip near the earthquake's nucleation point. Moreover, non-tectonic factors related to variations of chemical and physical groundwater parameters may be of importance. Therefore, in the framework of the scientific program ERMES (Environmental Radioactivity Monitoring for Earth Sciences), the uranium (U) groundwater monitoring was planned and performed at Gran Sasso National Laboratory of the National Institute of Nuclear Physics (LNGS-INFN), Italy, to study the possible pattern for radon sources in groundwater, because anomalies were detected during the Umbria-Marche (Italy) seismic sequence in 1997, located about 80 km from the laboratory. The aim was to test U as a potential strain indicator of geodynamic processes occurring before an earthquake, rather than the consolidated scheme for radon release due to stress-strain processes in the rock. Although, in order to assess the utility of U isotopes as fluid phase earthquake precursors, U concentrations and 234U/238U activity ratios have been monitored in thermal waters, this monitoring at LNGS-INFN was performed in a shallow aquifer with a high dynamic behavior due to high permeability of the cretaceous limestones that form part of the Gran Sasso massif. Moreover, these measurements were performed to test a possible contribution to the variation of the neutron flux background, because it plays a key-role in several research activities for Neutrino Physics and Dark Matter detection in the underground environment. The U groundwater anomalies observed by ERMES collaboration before the seismic swarm and the main shock, which occurred on 6th April, 2009 in L'Aquila, were probably associated with geodynamic processes occurring before the earthquake, which triggered diffusion processes through the overthrust fault. Uranium in groundwater can be used therefore as a potential indicator of pre-earthquake processes as it may be associated with geodynamics of preparation phases of earthquakes. Moreover, another possible physical process during the pre and post-phases of the earthquake could be investigated: the first stage seems to be characterized by U variations in groundwater that can modulate the radon concentration, the second one (after the main shock) do not show any U anomalies, justifying the different radon patterns before and after the main shock. The details of this research activity are published now on Journal of Environmental Radioactivity (http://dx.doi.org/10.1016/j.jenvrad.2009.08.009).

("E. Majorana" room)