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**INFN PROJECT TO STUDY NEUTRINOS RECEIVES EUROPEAN FUNDING**

*Interview with Manuela Cavallaro, researcher at the Southern National Laboratories (LNS) of the INFN in Catania, who has been awarded a European Research Council (ERC) Starting Grant 2016 .*

When Manuela Cavallaro heard that the European Research Council (ERC) had awarded her the ERC Starting Grant 2016 (ERC-2016-SGT), her reaction was a mixture of enthusiasm and incredulity. The prestigious award supports young talented researchers who are starting their careers. The physicist from Catania, a researcher at the INFN Southern National Laboratories (LNS), received the grant for research in fundamental physics. The name of the project is NURE (NUclear REactions for neutrinoless double beta decay) and the € 1,271 million grant is the full amount of funding requested. There were almost 3,000 applications and the European Research Council has awarded 325 ERC-2016-SGTs to young European researchers, for a total of € 485 million.

We asked this young researcher at the LNS to explain the importance of this scientific project.

**What is the ERC-funded project about?**

This is a fundamental physics project that spans the fields of neutrino and nuclear physics. It acts a bit like a bridge between these two different aspects of physics and the ERC was impressed by this feature of the project.

At the LNS we will conduct experiments on systems relevant to double beta decay, an extremely rare decay process, yet undetected, that occurs spontaneously, in which a nucleus is transformed into another nucleus. The idea behind the project is to use nuclear reactions, in particular double charge exchange reactions, to obtain important information about the nuclear matrix elements involved in the crucial phenomenon of neutrinoless double beta decay. While being mediated by different interactions, the two processes - double beta decay and double charge exchange reaction - have many aspects in common, which can be explored in the laboratory.

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### **Why is it important to study this phenomenon?**

The purpose of this project is to investigate certain aspects of the nature of neutrinos. We will study their mass, and test the hypothesis proposed by Ettore Majorana about 80 years ago on the dual identity of neutrinos. According to this hypothesis, a neutrino is both a tiny particle of matter and its own antimatter counterpart: an antineutrino.

Specifically, our project is an experimental contribution to the measurement of one of nature's building blocks, the nuclear matrix element, which links the average life of the nucleus that decays to the mass of the neutrino. Up until now this has been based on theoretical models. In this respect, our experiment can be considered complementary to others conducted elsewhere, for instance at the Gran Sasso National Laboratories (LNGS) of the INFN.

### **What was your reaction when you were told you had been awarded the grant?**

When I first heard the news I was in the United States for a science congress. I still feel really excited when I think about it. This is the greatest achievement in my career. A truly satisfying result, but also a huge responsibility. Now it's time to roll up our sleeves and get down to work.

### **The grant also proves that excellent research can be undertaken, without having to leave Italy.**

Besides giving me great personal satisfaction, this achievement also transmits a broader positive message. It shows that Italy has excellent research facilities as well, and that important results can be attained through dedication and determination. That was something I bore in mind whenever I had to consider moving abroad to continue my research. Fortunately, I eventually found the right conditions and was able to stay in my home town, also thanks to the high-level training provided by the University of Catania and to the INFN's Southern Laboratories, which have enabled the project to compete at European level.

### **How will the grant be used?**

There is one aspect concerning the ERC grant that I wish to underline because for me it is fundamental.

The entire European grant will be used for the physicists who are already working at the INFN Southern National Laboratories in Catania, not to develop new scientific instruments. In fact, this European grant also creates job opportunities for young researchers. There are five of us in the research group. We will work with the entire team at Catania University and the LNS over the next five years to carry out the experiments and analyse the data obtained.

### **What are the possible future developments for the project?**

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The project is part of *What Next?* the INFN think tank established in 2014 to investigate new directions and approaches for research, and falls within the scope of a broader project called NUMEN (NUclear Matrix Elements for Neutrinoless). NUMEN will run for about ten years and should lead to an upgrade of the superconducting cyclotron in Catania and of the detector, the magnetic spectrometer MAGNEX (MAGNetic spectrometer for EXcyt beams). When this upgrade is complete, it will be easier to study the double charge exchange reaction. It will take less time and we will be able to investigate all ten or so candidate nuclei. ■