Julius Wess Award 2022

Elena Aprile

Elena Aprile is Professor of Physics at Columbia University. She is a fellow of the American Physical Society, a member of the American Academy of Arts and Sciences and of the National Academy of Sciences. Prof. Aprile is the spokesperson of the XENON Dark Matter Collaboration since 2002. She was awarded the 2019 Lancelot M. Berkeley Prize for her leadership of the XENON project and its groundbreaking search "for weakly interacting massive particles" and the 2021 Premio Enrico Fermi, together with Prof. Patrizia Caraveo, "for her pioneering research on the properties of liquid xenon for radiation detection and her contribution to the search for dark matter".

Prof. Elena Aprile is internationally exceedingly well known in the field of astroparticle physics, in particular in the field of direct dark matter detection. Prof. Elena Aprile is successfully leading one of the most sensitive series of dark matter experiments, XENON10, XENON100, XENON1T in the past and currently XENONnT. Prof. Elena Aprile has started the XENON program in 2002. She has managed to put together and to lead a very strong international collaboration with extensive experience in all the domains required to build a competitive, ultra-low background dark matter experiment with a large discovery potential. Prof. Elena Aprile has made a significant scientific impact during the last 10 years - the first phase in the XENON program, XENON10, has demonstrated that liquid xenon time projection chambers are suitable detectors for dark matter searches and improved upon the then best constraints from CDMS. The second phase, XENON100, had demonstrated one of the lowest backgrounds of any dark matter experiment and had reached its design sensitivity, thanks to a strong screening and selection program of all employed detector construction materials. XENON1T once again reached the lowest background ever observed in a dark matter detector, thanks to the TPC design, the material screening, the radon emanation measurements and cryogenic distillation columns.

The XENON experiments led to a myriad of new dark matter related results. Strong limits were set on spin-independent and spin-dependent WIMP nucleon cross sections (Phys.Rev. Lett. 123 (2019) 241803), as well as first constraints on WIMP-pion interactions (Phys.Rev.Lett. 122 (2019) 071301). XENON1T observed the rarest decay process in the Universe, the double electron capture in 124Xe, with a half-life of 1.8´1022 years (Nature 568 (2019) 7753, 532). In 2020, XENON1T announced an excess of electronic recoil events at low energies (Phys.Rev.D 102 (2020) 072004), which could be due to solar axions, minute amounts of tritium in the xenon, or could be explainable by other phenomena. The nature of this excess is being further investigated with the XENONnT data, the science run of which is ongoing.

Prof. Elena Aprile conducts a vigorous R&D program on noble liquid detectors in her laboratory a Columbia University, a program which has helped the advancement of the direct detection field. In addition, the publications of Prof. Elena Aprile made crucial contributions to advancing the research area of particle detectors using liquefied noble gases, and have appeared in internationally leading journals. She achieves a great balance between R&D work, and work on large physics experiments that have the potential for a breakthrough in the field.