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The Hidden Force: a dialog between Physics, History and Art

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This contribution presents “The Hidden Force. Women Scientists in Physics and in History”, where the lives of four twentieth-century female scientists, who overcame the stereotypes of their era, invite us to discover the importance of women’s contributions to the advancement of knowledge. This is actually more than a theatre play for science outreach, it is a project to nurture a dialog with the public on Physics and History, and to tell and celebrate women who always played a crucial, but less recognized, role in Science and Society. The pièce was created by a team of women researchers in physics, technological innovation, history and theatre, who combined their skills and experiences to talk about Science through the poetic word, the song, the scenic space: this work demonstrates that Art can complement and enrich the STEM (Science, Technology, Engineering and Mathematics) know-how, to create a truly STEAM project in Education.

The show offers a view of the complexity of the twentieth century through the eyes of four women physicists, who were only partly credited protagonists, in spite of their important discoveries and their ingenuity: the nuclear physicist Marietta Blau, the particle physicists Chien-Shiung Wu and Milla Baldo Ceolin and the astronomer Vera Cooper Rubin. Their work ranged from innovative methods to reveal the essence of nuclear processes to experiments on their hidden symmetries, from the elusive nature of neutrinos to the observation of distant galaxies. Their scientific and personal lives were intertwined with the social and historical changes of an international context characterized by great upheavals. Their stories reveal a common fabric of strong intellectual and human value, talent and determination, which led them to achieve fundamental scientific results towards a deeper understanding of nature.

Today we know that there are four fundamental forces that govern every process in the Universe, from the infinitely large distances of the cosmos to the most intimate structure of matter and radiation: they are the gravitational force, the electromagnetic force and the weak and strong nuclear forces. The theoretical and experimental study of these interactions through quantum processes between elementary particles, astrophysics, nuclear physics and gravitational phenomena, with their effects and their technological applications, are the core of the mission of research institutions such as the National Institute for Nuclear Physics (INFN). The INFN, born with Enrico Fermi and the boys of Via Panisperna, today celebrates its 70 years and drives scientific progress alongside Italian universities, in its laboratories and on the international scene.

After the Second World War, the European Council for Nuclear Research (CERN), the present largest physics laboratory in the world, was created with a dual mandate to provide excellent science and to bring nations together i.e. to guarantee science for peace. Today it is a strong voice for both Fundamental Physics and international cooperation, also with respect to the current humanitarian crises.

The century of the greatest discoveries in Science brought huge progress to the human society, while it was the century of horrors like the Holocaust or the atomic bomb. In the limited space and time of a theatre play, we could address all such essential themes, framing the passion and the roots for fundamental physics discoveries within the real lives of four exemplary women.

In the context of (Physics) Education, The Hidden Force wants to encourage all young people and especially women, through the strong emotion that art can recreate, to follow with determination their interests, their talent and their heart in the choice of their path of study and life.

In a broader panorama, the show is an excellent pretext to rekindle in each spectator, man or woman, young or not, the desire to seek and recognize the seeds of that Hidden Force, which drives us to love Science as a place of respect and civil coexistence.

The play is directed by Gabriella Bordin, performing Elena Ruzza and the soprano Fé Avouglan, accompanied at the piano by Diego Mingolla. The text was written and published together by the scientific and artistic team.

The music was mostly chosen by Fé Avouglan, while some pieces were created expressly by the musician Ale Bavo. It was performed since October 2020 in 12 theaters and academic institutions and it will be staged in the near future in Genova, Milano, Reggio Calabria and Rovereto.

More information can be found on the web site <http://laforzanascosta.to.infn.it>.

Vera Cooper Rubin (1928 -2016), American astronomer who made fundamental observations on the orbits of stars around the center of their galaxy and on the distribution of galaxies in the Universe, establishing their organization in clusters. She was responsible for the discovery of the anomaly of the motion of stars in galaxies, an experimental evidence in support of the theory of dark matter formulated by Fritz Zwicky in the 1930s.

Marietta Blau (1894 -1970) was an Austrian nuclear physics, who pioneered the detection and study of the processes between elementary particles by means of photographic emulsions, establishing a method that was the basis of Nuclear Physics in the 1900s. She explored the properties of cosmic rays and high-energy particles, discovering the phenomenon of disintegrating stars in the nuclear spallation.

Chien-Shiung Wu (1912 - 1997), a Chinese nuclear physics, moved to the United States before the Second World War, became a reference in the study of beta decay and nuclear physics. She designed and carried out a famous experiment that demonstrated the violation of parity symmetry in processes dominated by weak interactions, opening new scenarios in Physics and the way to the Nobel Prize for Lee and Yang.

Milla Baldo Ceolin (1924 - 2011), an Italian particle physics, cultured and multifaceted, was the first woman to obtain the professorship at the University of Padua in 1963, where she graduated in 1952. Her research on weak interactions ranged from the study of K mesons in cosmic rays, to neutrinos and their oscillations, to the stability of matter. She experienced the transition from the “small science” of the study of particles using nuclear emulsions to the “big science” of large accelerators.

In-person participation

Yes

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