VNIVERSITAT DE VALÈNCIA

Laudatio of Professor Dr. Barry Clark Barish delivered at the ceremony of his investiture as Doctor 'Honoris Causa' by the Universitat de València, by the Professor Dr. Juan Fuster.

València, 31 May 2022

Señora Rectora Magnífica María Vicenta Mestre Escrivà,
dignísimas autoridades,
querido profesor Barish
miembros de la comunidad universitaria,
distinguidos colegas de otras Universidades,
amigas y amigos, señoras y señores

It is an immense honor for me to present to the University of València Professor Barry Clark Barish, an exceptional physicist who combines in unique manner the determination to carry out the highest-quality research in fundamental physics, leadership of major world scale projects, love for teaching and independence of thought.

He has received many prizes and recognitions among them the most important in 2017, Professor Barish was awarded the Nobel prize in Physics for the decisive contributions to the LIGO detector and the observation of gravitational waves, jointly with Professor Kip Thorne and Professor Rainer Weiss. The achievement was a culmination of tens of years of work by many people. Gravitational wave was predicted more than 100 years ago by Einstein's general theory of relativity and it occurs when a heavy mass such as a blackhole is accelerated violently, just like an accelerated electric charge radiates electromagnetic waves. The observation of gravitational waves, important "per se", has further implications of even much higher scientific impact as it provides the scientific community with a new "sidereus nuncius" to explore the Universe. In this sense Professor Barry Barish and his co-workers also enter in the history of modern multi-messenger astronomy.

Around 1980, it was established that a kilometer-size laser interferometer would be able to detect gravitational waves generated by certain cosmic events. It would, however, require to detect a change of distance over several kilometers by one thousandth of the size of a proton – a major advance of the state-of-the-art technology. The "Laser Interferometric Gravitational-wave Observatory", LIGO, project was proposed in 1984 but had history of difficulty in leadership and organization. Then, Professor Barish was appointed as the principal investigator in 1994 and as the director in 1997. He served both roles through 2005 and during his tenure he oversaw the construction of the facilities, the installation and commissioning, and the first gravitational wave searches. In 1997, he executed a sweeping change of the organization of LIGO by creating two bodies – the LIGO laboratory responsible for LIGO operations and R&Ds, and the LIGO scientific collaboration responsible for LIGO's scientific researches including data analysis. These put the LIGO collaboration on orbit to the first observation of gravitational waves. It is safe to say that there would have been no LIGO success as well as its first observation of gravitational waves if it were not for the critical contributions of Professor Barish.

The story of Professor Barish's contributions to the successful detection of the gravitational waves demonstrates several characteristics of his approach. He identifies scientific challenges of utmost importance, makes them possible by developing technologies of unprecedented performance, exercises strong leadership to put together a group of first-class people to perform the necessary tasks, and does so by using well thought-out methodologies.

Another example of these characteristics is the International Linear Collider that he led from 2005 to 2013 as the director of the Global Design Effort - the international team to develop the technical design of the facility. The International Linear Collider is a next-generation facility for elementary particle physics designed to perform precision measurements on the Higgs particle and probe for new physics beyond the Standard Model of elementary particle. There is now a general agreement in the field that such facility – a Higgs Factory – is the highest-Priority as the next-generation machine at the energy frontier. Again, realizing such facility required major advances in technology, to accelerate, to focus and to collide beams with unprecedented intensity. In this project is where our paths crossed, as the Instituto de Física Corpuscular which belongs to the University of València and to the Spanish Research Council is a long-term supporter of the same dream. Professor Barish since then has always encouraged our group in all our initiatives and helped in fostering international cooperation for the project.

Let us briefly look back at the career of Professor Barish. He obtained his Ph.D. degree in physics at the University of California Berkeley, and moved to California Institute of Technology as a research fellow, assistant professor, associate professor, and then as a professor. From 1991 on, he became Linde Professor of Physics and then Linde Professor of Physics Emeritus.

In 1970, after working on experiments at Lawrence Berkeley Laboratory, Brookhaven National Laboratory, and Stanford

Linear Accelerator Center, he initiated and built the neutrino physics program at Fermilab together with Professor Frank Sciulli. Both were young professors at California Institute of Technology at the time. They were selected to perform the neutrino physics program during the initial phase of the laboratory. It demonstrated the quark structure of the proton and led to one of the first observations of the Weak Neutral Current predicted by the Glashow/Weinberg/Salam Standard Model of elementary particles.

Soon after the tau lepton was discovered at Stanford Linear Accelerator Center, he realized that the tau lepton could be studied in detail at Cornell Electron Storage Ring. He proposed and built the entire scientific program on tau lepton leading to precision determinations of tau lepton parameters. This led to another experiment – DELCO experiment - at the newly-constructed electron-positron collider at Stanford Linear Accelerator Center – Positron Electron Project (PEP) - to study production and decay of the charm quark leading to detailed verifications of the Standard Model of elementary particles.

In 1984, Professor Barish proposed an underground experiment to search for the magnetic monopole. The experiment called MACRO was one of the flag ship experiments at the Gran Sasso underground laboratory (Italy). It took data from 1990 to 2000 and produced important results in neutrino astronomy, muon astronomy, cosmic ray compositions, new heavy particle searches, and the best upper limit to date on magnetic monopole from cosmic origin. It is also worth noting that it produced the

most significant independent confirmation of atmospheric neutrino oscillations as discovered by the SuperKamiokande experiment in Japan.

From 1991 to 1993, Professor Barish served as the spokesperson of the GEM experiment for the Superconducting Super Collider, the equivalent version of the European Large Hadron Collider. The main goal was to discover and study the Higgs particle and probe for physics beyond the Standard Model. Unfortunately, the Superconducting Super Collider project was cancelled in 1993, but his experience in leading large international collaboration was fully utilized for the LIGO experiment and the International Linear Collider. On the other hand, this fact also proves that Professor Barish is first a human-being who not always succeeded in all his enterprises and, second, that in the recovery of a disaster higher goals can be envisaged.

Apart from the Nobel prize, Professor Barish has received numerous honors globally. In 2016 he received the Enrico Fermi prize and the Smithsonian Magazine's American Ingenuity Award in Physical Science, in 2017 the Henry Draper Medal of National Academy of Science and also in 2017 the Princess of Asturias for the Research in Science and Technology. He was the president of the American Physical Society for 2011, and elected to the American Academy of Arts and Sciences and National Academy of Sciences, and held fellowships at American Association for the Advancement of Science as well as the American Physical Society. He has received honorary doctorates from the University of Bologna, University of

Florida, University of Glasgow, Southern Methodist University, and Sofia University – to which University of Valencia is being added today.

His contributions ranged widely from fixed-target experiments, neutrino physics with and without accelerator, electron-positron colliders, deep-underground experiments, and gravitational waves observatory. In each of these experiments, Professor Barish's contributions have been indispensable. He has served on many committees all over the world and shared his vision, experience, and wisdom with the researchers of the field promoting the global progress of particle physics. He gladly accepts request to attend gatherings or events when he thinks that he can contribute to science in general. He is very approachable for all his collaborators and knows how to listen.

In ending this speech, I would like to add that, even though Professor Barish is a genuine American in his own culture but has deep as well interest and respect for other cultures. In Japan, for example, he would actively attend Japanese tea ceremonies as well as traditional hot springs and ask many questions to understand what is behind each feature that may sound or look strange to ordinary Americans. He follows the Spanish events and is very eager to know about progress in Spanish science. He is very sensitive about the situation on the evolution of young researchers.

Barry Barish knows well that one his most precious treasures he has is his family which he loves, he is married to Samoan Barish and has one daughter, Stephanie Barish, one son, Kenneth Barish, and three grandchildren, Milo Barish Chamberlin, Thea Chamberlin, and Ariel Barish.

Definitively, overall things, Professor Barry Barish is an excellent candidate to be considered "a Man" in capital letters, in the spirit as written by Rudyard Kipling,

"if you can keep your head
when all about you are losing theirs and blaming it on you"
…
"if you can trust yourself when all men doubt you,
but make allowance for their doubting too"
…
"and yet don't look too good, nor talk too wise"
…
"if you can dream—and not make dreams your master"
…
"if you can think—and not make thoughts your aim"
…
"if you can meet with Triumph and Disaster
and treat those two impostors just the same"

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