

# **Honorary Doctor of Science**

## **Professor Claude COHEN-TANNOUDJI**

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English citation written and delivered by Professor Benjamin T'SOU Ka-yin

Pro-Chancellor:

As the most intelligent species in the animal Kingdom, Man has devised useful indices to assess various aspects of human existence to allow for reflective and qualitative feedback on his own existence. Thus, for physical or medical well-being we have BP, HB, BMI etc. For mental or emotional well-being, we have EQ, and even HI (Happiness Index from the Kingdom Bhutan). For financial well-being, we have DJI, HSI, NASDAQ, FOREX, GDP etc. In fact, the three kinds of indices may interact with each other, as is evident in Hong Kong when frequent perturbations of the Hang Seng Index may impact on changes in BP and EQ etc.

However, for assessing advancement in civilisation, Man has difficulties in devising fully effective indices. In academia, for our graduates today, GPA is an important index. For most of their teachers, a citation index of an individual's research work in appropriately recognised journals is often used with effect in the physical sciences, but not in all areas of academic pursuit. However there is usually unanimity in agreeing that the award of a Nobel Prize in the physical sciences recognises incontrovertible original contribution to knowledge beneficial to mankind, and the incremental accumulation of such knowledge is of critical importance to advancement in civilisation more than any of the reversible indices mentioned above. Today, we are here to honour one such individual in the field of Physics: Professor Claude Cohen-Tannoudji.

Claude Cohen-Tannoudji was born into a Jewish family in Algeria when it was still French territory. His father had worked as a clerk and was a Talmudic scholar steeped in Jewish traditions and full of intellectual curiosity, which his son has inherited. The family has its roots on the Iberian Peninsula, but had to leave as a part of the Jewish Diaspora because of the great Inquisition of 1492. Their odyssey brought them to the Middle East and North Africa, as a part of the Sephardim, and the Tannoudji part of the family name was acquired after it stopped over in Tangier, Morocco and did not move on beyond Algeria and Tunisia to the biblical Promised Land.

Professor Claude Cohen-Tannoudji attended a traditional French Lycee, and was keen to read mathematics when he entered the prestigious Ecole Normale Supérieure in Paris on the basis of his performance in competitive national examinations. There he was inspired by Professor Alfred Kastler's captivating lectures on physics and changed his focus of study to this subject. Professor Kastler's inspiring lectures had left a deep impression on him to this day and provided him with the model for a good teacher which he continues to strive for, and sees as a challenging goal.

Early in his career he was attracted to atomic physics and to the understanding of light-matter interactions. Following his PhD at ENS in 1962, he was invited to continue to do research at his alma mater while also teaching at the University of Paris from 1964 until 1973, when at the age of 40, he was offered the Chair of Atomic and Molecular Physics at the world renowned College de France.

As is known, matters in the physical world are composed of atoms and molecules and their constituent elementary particles which have characteristic properties too minute to be physically observed by the naked eye. But progressive breakthroughs to capture the physical characteristics of different substances are necessary for a better appreciation of the physical world underpinning our civilisations. There have been various postulations on the composition and nature of the atom which would benefit from tangible substantiation of their attributes.

Professor Claude Cohen-Tannoudji's contribution to physics was in devising breakthrough mechanisms to explore the properties of the atom by means of extreme temperature lowering to nearly absolute zero ( $-273.15\text{ }^{\circ}\text{C}$ ) so that the velocity of atomic particles could be drastically reduced to values in the order of one centimetre per second. The corresponding deceleration could be simplistically compared to the deceleration of an A380 jet plane hurtling through space and stopping in a distance of one meter. This new method of cooling and trapping atoms with laser light allows them to be observed for a much longer period of time and hence to increase considerably the precision of the measurements.

This success has opened up new applications in many fields. For example, high precision atomic clocks (with an error of less than one second in  $3 \times 10^8$  years) can be developed, which would be useful for GPS application. Another example is the realisation of "atom lasers", which are the equivalent of optical lasers where light waves are replaced by de Broglie matter waves. For this seminal contribution, the

Nobel Prize was awarded to Professor Cohen-Tannoudji, who shared it with the two other physicists in 1997.

It is known that GPS offers an undeniable advantage for pinpointing location in all kinds of useful applications, such as navigation, to benefit the human race. Yet it could also have awesome applications as only the human mind is capable of conceiving. One example could be precision bombing resulting in maximum destruction. Likewise, these mechanisms can contribute to yet broader research by others on DNA identification, thereby enabling the appropriate decision-maker to pursue genetic engineering to improve health, or to facilitate the manufacture of WMD.

Professor Claude Cohen-Tannoudji is fully cognisant of this paradox, and, when asked, indicates that education is the only means to help the decision-maker strike the right balance between what is morally right and wrong. In fact, education provides an individual with the ability to distinguish goodness from evil and it is only when wise judgment is conscientiously exercised and shared that scientific discoveries do not become a double edge sword.

This firm belief in the value of education is shared by both Jews and Chinese as well as many other cultural groups. It is also interesting that one of his fellow recipients of the Nobel Prize in Physics in 1997 is a Chinese scientist, who was also caught up in a more recent Chinese diaspora in the middle of the 20th Century, which produced five Chinese winners of four Nobel prizes (three of them in physics). But then why have they all been part of the Chinese diaspora rather than home grown? It is perhaps not a coincidence that children brought up in the Jewish and Chinese diasporas often succeed better outside their homeland because they have managed to heed firm parental advice that education provides a secure means for success in a competitive world, and because they have successfully confronted the challenges facing their diaspora.

For his many wide-ranging contributions, Professor Cohen-Tannoudji has been honoured by many distinguished academic bodies, such as the French Académie des Sciences, the US National Academy of Sciences, the American Academy of Arts and Sciences, the Académie Royale of Belgium, the Accademia dei Lincei of Italy, the Pontifical Academy of Sciences, the Russian Academy of Sciences, and the National Academy of Sciences of India. He has also received the Ampère Prize of the Académie des Sciences, the Thomas Young Medal and Prize of the Institute of Physics, a Research Award of the Alexander von Humboldt Foundation, the

Lilienfeld Prize of the American Physical Society, the Charles Townes Award of the Optical Society of America, the Matteucci Medal of the Accademia Nazionale delle Scienze, the Harvey Prize in Science and Technology of the Technion Israël Institute of Technology, the Quantum Electronics Prize of the European Physical Society, and the Gold Medal of the Centre National de la Recherche Scientifique. He has been also awarded honorary doctorates from the Universities of Uppsala, Jerusalem, Bar Ilan, Sussex, Recife, Brussels, Liège, Peking and Tel Aviv.

Yet for all his accomplishments, Professor Cohen-Tannoudji feels no greater challenge and satisfaction than those coming from being a good teacher.

In recognition of Professor Cohen-Tannoudji's many accomplishments and contributions, Mr Pro-Chancellor, I have the great honour to call upon you to confer on him the degree of Doctor of Science, *honoris causa*.