Laudatio del Prof. Dr. Emilio Morán Miguélez

on the occasion of the "Honoris Causa Doctorate"

of Professor Sir Harold W. Kroto.

7 June 2012

Honorable Rector, Academic Authorities, dear colleagues and friends, ladies and gentlemen,

It is for me a great honor, a privilege and an enormous satisfaction as well, to introduce to our Universidad Complutense Professor Sir Harold W. Kroto, who from today and with all the honors will be part of our Community.

As he was awarded in 1996 with the Nobel Prize in Chemistry , jointly with doctors Robert Curl and Richard Smalley, other data would be unnecessary to support the today appointment but it would be unfair to stress just only a fact that is not but the consequence of a whole life dedicated to Science and the Society. We are facing an exceptional scientist, universal and polyhedral, a Renaissance man would say I, that not in vain has been distinguished with the "Leonardo" medal.

As Professor Kroto indicates in his autobiography, in the school he was "the kid with the funny name", a family name that seems Japanese and betrays an epic: the one of his ancestors. The father, German Jew of Polish origin, had to move from Berlin to England in those difficult last Thirties of the past century - Nazi apogee- and his last name, Krotoschiner is a Polish place name: there is a city in Silesia called Krotoszyn. The mother, non Jewish German, followed her husband shortly after; I will save you further details but I assure you that with less adventures very good novels have been written. In these difficult pre-war circumstances, October 1939, our protagonist was born. The father, enterprising character, had to remake his life several times and in 1955 he changed his name to the shortest and sonorous Kroto. That same year, on the small city of Bolton, in the Lancashire of the industrial heart of England, founded a printed balloons factory: the adolescent Harry Kroto spent countless hours in the factory and perhaps it is not chance that his greater discovery, the C60 or "fullerene" has a balloon form indeed. After his passage by the Bolton School, from whom he keeps excellent memories by the quality of its education showed preference for Organic Chemistry in the University of Sheffield.

There he got a PhD in 1964 with a work on “Spectroscopy of Free Radicals produced by Flash Photolysis”.

Later, already married with Marg, as he calls affectionately to his wife, a postdoctoral stage in the “National Research Council” of Canada, in Otawa began, working with Dr. Don Ramsay in an atmosphere of total creative freedom. At that time, half-full of the sixties, the NRC was considered as “Mecca” of the spectroscopy and great scientists worked there and had a great influence on the young Kroto. Fruit of this unique period was the discovery, among others, of a singlet-singlet electronic transition of the NCN radical and pioneering photolysis work in microwaves spectroscopy. Two years later (1966) a second postdoctoral stay took place in the prestigious “Bells Laboratories” in Murray Hill (New Jersey, the United States), where the research topic was liquid phase interactions studied by means of Raman spectroscopy. There he carried out theoretical calculations on the electronic transitions of small molecules and radicals. At this point their two children (Stephan and David) had been born, thus it was necessary to look for a permanent job and, as this one was offered in the University of Sussex, the family returned to England. There, taking advantage of the postdoctoral experience, he set up a new laboratory for rotational spectroscopy of microwaves and worked in the electronic spectra of carbon chain species HC5N, studies which are directly connected with the discovery of C60. At this time his research focused an impossible goal: the creation of new organic molecules with multiple bonding between carbon and neighbor elements: the greater achievement was the spectroscopic demonstration of the phosphorus-carbon double bond, a pioneering work that opened the door to phosphalkenes and phosphalkines. At the end of the Seventies combining Chemistry with Radio astronomy he studied chemical species in the interstellar space and stars and demonstrated the existence there of long chains containing carbon and nitrogen, the cianopoliines - surprisingly abundant. Since then this one has become a hot topic of research in Astrochemistry; therefore we can see a Kroto who, although “devote atheist”, as he himself confesses, watches the sky to find answers to the formation and dynamics of our Universe.

The formation of these long chains entered in contradiction with conventional ideas on interstellar chemistry so that, in collaboration with professors Smalley and Curl of the Rice University (Texas, the United States), undertook experiments that tried to simulate the possible conditions of synthesis in the space. Thus, trying to identify the present species in the outer atmosphere of cold and giant N-type red stars, they made experiments of graphite vaporization by means of laser: in the so produced plasma mass spectrometry showed, without any doubt, the presence of a 60 carbon atoms as the main species. They were ten days of febrile activity for all the team that culminated with the proposal of the well-known polyhedral molecular model, based on 12 isolated pentagons, linked by hexagons and that, just thirteen days after beginning the experiments, were published in Nature. I do not know if the model was the result of a dream, as it was the benzene ring for Kekulé, but there is no doubt that the discovery and its circumstances have dream features: two weeks for a Nature!!

The discovery of the C60 was not free of controversy but, when in 1990 Krätschmer and Huffman, along with students Fostiropoulos and Lamb, produced macrocospic amounts (milligrams) of C60 by means of electrical arching between graphite electrodes and were able to isolate it, all doubts vanished: a new and exciting field of study was born, that of new carbon forms, different from the classic ones: diamond, graphite and others less known. Since the C60 has the form of a truncated icosahedron, exactly the one of a soccer ball, it could have been called "footballene" but considering that what for the Europeans is "football" for the North Americans is "soccer" the name did not prosper. In its place, like a tribute of our protagonist towards the figure of a visionary architect, Richard Buckmister-Fuller, the author of spectacular geodesic cupolas (like the one of the Expo of 1967 in Montreal) and, since other specimens with a much greater number of carbon atoms do exist, he proposed the denomination of "buckminsterfullerenes" for these new closed and hollow forms of carbon, a name that soon derived in the brief and the simpler generic one "Fullerenes". The raised interest was huge and reached many fields of Chemistry, Physics or Science of the Materials which, among other consequences caused that previous works on carbon were carefully re-examined. Thus, in 1991, one of the best scientists in the world for electronic microscopy, the Japanese Ijima, found, photographed and characterized carbon nanotubes, ubiquitous but unnoticed, for the first time. As it always happens, a great discovery excites the collective imagination and induces others: the New Age for "Nanoscience and the Nanotechnology", not only fitted to carbon, was started. The last chapter, so far, of this saga of carbon has been that one of graphene (just one graphite sheet, a carbon hexagonal network with exceptional properties) and that, by the way, also has taken to the Nobel Prize, this time of Physics in 2010, to both more outstanding investigators, André Geim and Konstantin Novoselov, of the University of Manchester.

A great scientist, Feynman also Nobel prized, said in 1956 that famous sentence "There is plenty of room at the bottom" but he never could imagine that there was that much: nanoparticles, nanowires, nanobelts, nanodevices, etc., and always with exceptional properties, very different from which any material displays in macrocospic form and all of them offering great possibilities of technological applications (electronics, medicine, energy, etc, etc.). It is worth to recall that, being this branch of Science highly oriented towards technology, its grounds are an almost fortuitous discovery (watching stars), a free of spirit scientist and thus, Basic (fundamental) Science. The Applied versus Basic debate for Science is meaningless. On the other hand, C60 itself, a hollow sphere of 10 nanometers of diameter is one single nanoparticle with exceptional chemical, electrochemical and mechanical properties that can originate, among other things, superconducting materials with critical temperatures unusually high. It is possible to emphasize the great possibilities that, like the benzene, these new carbon forms offer to Organic Chemistry on the basis of their resonant connections. In this sense professors David Walton, collaborator of Kroto in the University of Sussex or Fred Wudl in the University of California in Santa Barbara, have known to operate this aspect shiningly. By

the way, professor Wudl is, from 2004, doctor “Honoris Cause” in our University after proposal of the Department of Organic Chemistry.

As it could not be differently, after the concession of the Nobel prize (who never was a goal in itself for our protagonist), professor Kroto was continuously was asked for conferences, seminaries, courses and other activities everywhere without leaving research in the University of Sussex. Fruit of this period is an ample number of nanostructured materials, in special nanotubes and nanowires (some with atoms different from carbon) and the advance in the understanding of their mechanisms of formation. In that fruitful period, reaching until 2004, professor Kroto was distinguished by her Majesty, Queen Elizabeth of England with the aristocratic title of “Sir”. Also he has received a nourished number of honorary appointments and prizes distributed everywhere. Nevertheless and lamentably, all it did not prevent that in the change of millenium and for economic and merely administrative reasons, some Departments of Chemistry of English Universities were closed, In protesting these facts, professor Kroto returned the appointments “Honoris Cause” of the Universities of Hertfordshire and of Exeter. Then he undertook a new stage in the University of Florida, where he continues from 2004 his educational and research work.

In which concerns myself, I had the honor to know professor Kroto in a Complutense Summer School, back in 1994 at El Escorial, which he conducted and I was the secretary. That course, although only lasted one week, left a fort impact between all the assistants and, when just two years later we had the news about the Nobel of Chemistry awarded to him, the prize was not a surprise.

I have left for the end something very important: the VEGA Foundation. In 1985, along with Patrick Reams, a producer of the BBC, Harry Kroto created this foundation with the purpose of producing scientific movies of high quality (the documentary ones of the BBC always are very good although mostly oriented towards Biology). The idea was to include other topics of Physics, Chemistry and other sciences on an attractive way, to simultaneously reflect the emotion and the excitement of the discoveries while explaining the scientific foundations of such. Until now they have produced 20 films (when shall we see them in our TVE-2?) and their activities, not only limited to the production of movies, can be followed in their webpage: www.vega.org.uk. To figure out how important is the VEGA Foundation for Kroto, let us say that the economic dowry of the Nobel prize was completely destined to it. Nevertheless, the present economic crisis - the second Great Depression is taking everything ahead and, lamentably, the Foundation has closed its production from the 22 of March of this year leaving behind an important legacy for the diffusion of Science.

Thus, all these academic, scientific and human merits constitute more than sufficient reasons for the Faculty of Chemical Sciences, in the occasion of the International Year of Chemistry 2011, to propose the appointment of Professor Sir Harold W. Kroto like Doctor

Honoris Cause of our University. Quoting Einstein “Imagination is more important than knowledge” and, to summarize all that previously said, Professor Kroto has put in our imagination a plethora of new beings that have become real chemical species. Therefore, we welcome today one of the most excellent scientists in Chemistry whose presence honors to us and makes us better.

Thank you very much.

Said in Madrid, 7th of June, 2012