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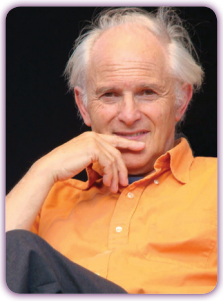

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Carbon in nano and outer space

Curiosity about the chemistry in the atmosphere of an old red giant star about a light year in diameter (i.e. 10,000 million, million meters) resulted in advances in technology at nanometer scale i.e. 100 millionth of a meter which is some million, million, million, million times smaller. When Galileo first used his telescope and realized that the phases of Venus provided the incontrovertible evidence which confirmed the Copernican heliocentric system it cemented his position as one of, if not the, "Father of Science". Thus Science itself was born out of curiosity, not out of expedience, and it is still true today that almost all major breakthroughs are made by the openly curious who generally discover what those with more focused minds tend to overlook. Particularly fascinating, curious and crucial has been the role that the element carbon has played in almost every aspect of the development of our understanding of both the physical and natural sciences. Carbon chemistry is uniquely profuse, i.e. Organic Chemistry. As it is the basis of biology, it is hard to conceive that life could be based on any other element. The most recent big surprise that the element had up its sleeve was the existence of C60, Buckminsterfullerene, the third well-defined form of carbon – the other two being graphite and diamond. The discovery of this molecule was made serendipitously during laboratory experiments which attempted to simulate the conditions in some stars. Follow up work from the C60 discovery led to the re-discovery of the carbon nanotubes which promise paradigm shifting advances in materials engineering and catalyzed the birth of Nanoscience and Nanotehnology (N&N). Research on carbon chain molecules at Sussex in the mid-1970's led to the detection of these chains in interstellar space by radioastronomy together with Canadian astronomers. A little later these species were detected in red giant carbon stars. It was during experiments, using an advanced technique, developed at Rice University for studying clusters, to probe the formation of the chains in these stars that the C60 cage was discovered serendipitously in 1985. Amazingly in 2010 the tell-tale fingerprint signature of C60 was found in infrared spectra obtained by NASA's Spitzer satellite telescope. This sequence of events is yet another example of the remarkable way in which fundamental science in particular in this case the fascination with space has led to major breakthroughs with important implications for innovative technological applications on Earth. The history of scientific progress carries a serious health warning for those who think that fundamental science can be steered by bureaucratic decision-making and the story of the discovery of "Buckminsterfullerene - The Third Form Carbon" and its key role in the birth of Nanoscience and Nanotechnology is yet another example.

Biography

Harold Kroto is currently a Francis Eppes Professor of Chemistry at Florida State University, where he is carrying out research in nanoscience and cluster chemistry as well as developing exciting new Internet approaches to STEM educational outreach. He is a Fellow of the Royal Society of London, and holds an emeritus professorship at the University of Sussex in Brighton, United Kingdom. The research program focuses on the complex range of molecular constituents in carbon vapour; the devel¬opment of novel 2 and 3D metal-cluster/organic frameworks as well as peptides; the stabilization of small fullerenes; and carbon nanotube based devices behaviour. Harry obtained a first class BSc honours degree in Chemistry (1961) and a PhD, in molecular spectroscopy in 1964 at the University of Sheffield (UK). After post-doctoral positions at the National Research Council in Ottawa, Canada (1964-66) and at the Murray Hill Bell Laboratories (NJ, US) in 1966-67 he started his independent academic career at the University of Sussex. In 1970 his research group conducted laboratory began spectroscopic studies on long linear carbon chain molecules with colleague David Walton. In 1995, he launched the Vega Science Trust (www.vega.org.uk) to create science films of sufficiently high quality for broadcast on UK network television. He has numerous awards including the Copley Medal, Faraday Lectureship of the Royal Society as well as the Tilden Lectureship and Longstaff Medal of the Royal Society of Chemistry. Other awards include the Louis Vuitton – Moet Hennessy Science pour l'Art prize and the Italgas Prize for Innovation. He holds over 40 honorary degrees from universities all over the world and is a Freeman of the City of Torino. From 2004 to 2012 he was on the Board of Scientific Governors at Scripps Institute and serves on several other academic advisory boards. He was elected a Foreign Associate of the National Academy of Sciences in 2007.