

Pioneering Spirit in Space Exploration

Nigel Orr talks to Prof. Susan McKenna-Lawlor about her life and work.

"To have a career in science is to live in an environment of great beauty and challenge and the excitement of it never fades", says Professor Susan McKenna-Lawlor, winner of the Irish Laureate – Woman of Europe Award in 1994 – for her pioneering work in space exploration. Dermot O'Leary, Chairman of CIE, sponsors of the Award, said that, "the Laureate Award is designed to pay tribute to those women throughout Europe who have advanced the European ideal by their personal careers and have contributed, through their achievements to the development of a new Europe."

Professor McKenna-Lawlor is a Professor of Experimental Physics at St. Patrick's College Maynooth, co-founder and Managing Director of Space Technology Ireland (a high-tech company situated on campus which provides job opportunities at the leading edge of technology for young Irish scientists and engineers) and winner of an Irish Person of the Year Award for scientific achievement (1986).

Worldwide Recognition

She was also awarded the Russian Tsiolovsky gold medal for outstanding contributions to cosmonautics (1988); made an honorary citizen (for technological achievement) of San Jose, Silicon Valley, USA (1991); received a personal presentation from ESA of a collage commemorating successful involvement in the Giotto Extended Mission (1992); and elected member of the prestigious International Academy of Astronautics (1993).

A native of Dublin, Professor McKenna-Lawlor was educated at the Convent of the Sacred Heart, Lower Leeson Street, where, notably, science was not one of the subjects offered. "My education was completely unbalanced in that I knew nothing about science when I was leaving school and I was embarrassed about this". On entering University College Dublin, therefore, having matriculated in one year, she used the year gained to good effect: "I decided to spend that year studying science and enjoyed it so much that I decided to make my career in experimental physics."



Prof. Susan McKenna-Lawlor.

"My education was completely unbalanced in that I knew nothing about science when I was leaving school and I was embarrassed about this." Having since redressed this imbalance she says, "it is a great honour to be selected as the Irish Woman Laureate, since this award has given my career such prominence and I hope this might attract girls, who are presently on the threshold of deciding their careers to come into science."

Indeed, she graduated with a science degree from University College, Dublin, and further obtained an M.Sc from the National University of Ireland for a thesis entitled "Determination of the Spin and Parity of the Tau Meson" and a Ph.D from the same body for a thesis entitled "A Detailed Study of Phenomena attending the Disk Passage of an Active Solar Region of Phenomena attending the Disk Passage of an Active Solar Region July 1959". Work for this latter study was carried out at the Department of Astronomy of the University of Ann Arbor, Michigan where she acted as a research assistant.

Dunsink Observatory

Professor McKenna-Lawlor was awarded a post-graduate scholarship to the Dublin Institute of Advanced Studies at the Dunsink Observatory where she studied the phenomenon of solar flares (explosions on the sun). "Solar flares can be associated with huge releases of energy in which particles are accelerated to millions of Electron Volts. This radiation can kill an astronaut as well as do a lot of damage to electronic systems on spacecraft. When I went to the United States, NASA was very worried about the threat posed to the astronauts by flare-associated radiation and I found myself lecturing to the trainee astronauts about these phenomena. It was very interesting for them that somebody had studied this subject in Ireland. That was my introduction to space and I soon afterwards became acquainted with many of the people from the space community," she says.

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Professor McKenna-Lawlor subsequently submitted a proposal to NASA involving participation in a project concerning flare data taken by the Apollo Telescope Mount on NASA's Skylab Mission. She recalls that this was the first space experiment in which she became formally involved and that, following this, she became a guest investigator for NASA's Solar Maximum Mission (at the Goddard Space Flight Centre) – studying the sun.

First Irish Experiment on ESA Satellite

In 1980 she was personally responsible for forming a scientific and technical team (with members from Ireland, Germany and Holland) to design the first Irish experiment to be carried on a European Space Agency satellite (the historic Giotto Mission to Halley's Comet – launch 1985, rendezvous 1986). As Principal Investigator for the Irish experiment she took scientific, technical and administrative responsibility for a highly successful instrument, which has operated perfectly in 1990 during the first encounter of a satellite coming from deep space with the earth, and in 1992 during a unique encounter of the spacecraft with comet Grigg Skjellerup.

According to Professor McKenna-Lawlor, "to fulfill the requirements of the European Space Agency (ESA) it is first necessary to satisfy the agency that the proposed experiment is original and worth doing; that the instrument designed to carry out the experiment can be successfully integrated with and work on the spacecraft and that the proposer has a track record which shows that we can really implement the project suggested. All of these points are considered by international referees who critically review each proposal, and report back to ESA. She noted the fact that Ireland had the ability to propose a successful instrument for space was very much to the advantage of the instrument by ESA on the Irish side," the realisation we had dared to dream."

Pioneer Observations at Mars

Early on, she proposed the first Irish experiment – the highly successful

SLED instrument – to fly on a Russian satellite (the Phobos Mission to Mars and its Moons) with a team formed from Irish, German, Hungarian and Russian participants. This instrument later made pioneering observations at Mars.

Indeed a mark of her work is the use of co-operative research programmes – involving technology transfer and the interchange of academic and technical personnel – to achieve joint research and developmental work at the leading edge of technology between many European countries. This use of international teams – she says – "brings a great richness to the consideration of different kinds of scientific and technical problems, with each person coming from a different background and contributing his or her view of the problem and how it can be solved. In those interactions there is a synergy and you end up with the whole being greater than the sum of the parts."

Current Work

Professor McKenna-Lawlor is currently involved in ten international space projects for missions to be launched by the European (ESA) American (NASA), Japanese (ISAS) and Russian (INTERCOSMOS) Space Agencies. All these projects include multinational teams, and for one of them (Mars - 96) she is involved in the construction of four scientific instruments. During last year, uniquely fault-tolerant data-processing units built by her group were delivered for flight on British, German and Russian space experiments – thereby providing state-of-the-art technology transfer out of Ireland. At present she is involved with European and American groups in developing experiments designed to provide rigorous tests of Einstein's General Theory of Relativity in space.

The Challenge of Space Exploration

It is not surprising – given her achievements – that Professor McKenna-Lawlor works extremely hard, and can "keep on working when most other people would collapse". She attributes this to the fact that she enjoys the work that she does and refers to it as "a pleasure" and "a challenge". "It is very exciting to imagine the environment in which an instrument will fly, to design for that and to

formulate a question for Nature. All the activities associated with space exploration are challenging, each in its separate way," she says.

She regards as a very great honour her selection as the Irish Woman Laureate. (The Irish selection is organised by the European Movement and sponsored by CIE). "Since – as a woman – my scientific career was given so much prominence in association with the award, I hope that this might attract girls who are presently on the threshold of deciding their careers to come into science."

Pursuing A Career in Science

For those interested in pursuing a career in a scientific research, Professor McKenna-Lawlor says that it can be very useful to study Experimental Physics, Mathematics and Computer Science as a basic group of topics and to then proceed to a Ph. D. "It is only at post doctoral level that you start to come to grips with the realities of carrying out research in an independent framework.

You have to be able to master a number of skills. You have to be able to choose a project to begin with that is meaningful, to work out how to implement that project in hardware and software, to construct it so that it works and to deliver it on the day when it is needed. You have to consider the measurements and to understand the limitations of those measurements in terms of their inherent accuracy, to interpret the data and to present the results in a way that can convince the world community of the correctness of your interpretation."

Her special appointments include that by STIP as a World Co-ordinator of Solar Activity; by ESA to a team compiling their policy document "Space Science Horizon 2000" (which identifies study targets for the Agency for the next 20 years); by Intercosmos to an international Initiative Group planning the successful Mars-94 Mission; by the SOLTIP Project of the International Council of Scientific Unions as a World Co-ordinator of the June 1980 SOLTIP Campaign and also of the World Interval (IV) covering the impact of comet Shoemaker-Levy 9 with Jupiter. In addition, she is a member of the Space Exploration Committee of the International Astronautical Federation.