The significance of research

When promoting the value of their research or procuring funding, researchers often need to explain the significance of their work to the community — something that can be just as tricky as the research itself.

Whether writing a paper or applying for funding, researchers need to devote much attention to explaining the significance of their work. Although not directly related to obtaining research results, explaining the significance of novel work to others can be every bit as tough as carrying out theoretical or experimental studies. It is never an easy task.

A good recent example is the experimental work that verified the existence of the Higgs particle, which was conducted by the European Council for Nuclear Research (CERN) in Geneva, Switzerland. Today, most of us appreciate the momentous significance of this work, as we understand that the Higgs particle is related to the origin of mass — one of the most fundamental questions in physics. Many reasons can be advanced for why this discovery (potentially the greatest of the century) is important, but its real significance lies in its implications for cosmology, particularly those relating to the Big Bang theory, the transition of vacuum and the existence of matter.

Very often the ripple effect generated by one's work is helpful in clarifying its significance. It is sometimes very difficult even for experts in a field to judge whether a novel theoretical work is groundbreaking or just an interesting theory. For example, in 1963, Edwin Jaynes and Frederick Cummings published a paper (*Proc. IEEE* **51,** 89–109; 1963) on the Jaynes–Cummings model — a theoretical model that forms the basis of quantum photonics. For over two decades, the paper was rarely cited. However, that changed in 1987 when Gerhard Rempe and co-workers (*Phys. Rev. Lett.* **58,** 353–356; 1987) experimentally observed quantum collapse and revival in a one-atom maser — a phenomenon theoretically predicted by the Jaynes–Cummings model. Since then, the quantum optics community has acknowledged the validity and the significance of the Jaynes–Cummings model. It has now become well known as it contributes tremendously to research on fields such as photonic crystals, quantum dots and quantum information.

It is generally easier to convey the significance of experimental work to the community than theoretical work. However, experimentalists sometimes experience another problem, namely technological difficulties may make groundbreaking experimental work seem unattainable. For example, when, in the 1990s, Susumu Noda proposed doing pioneering research involving using three-dimensional photonic crystals to manipulate light at a wavelength of around 1.5 μm, he received negative appraisals and sceptical comments. This was because it was impossible at that time to fabricate photonic crystals with the required precision of a few tens of nanometres, as nanofabrication technology had not yet taken off. Despite this, Noda proceeded to fabricate photonic crystals with the required precision. His work has since progressed to the extent three-dimensional photonic crystals can now be used to manipulate light in the visible wavelength range.

It takes time to convince. The examples of the Jaynes–Cummings model and Noda's experimental work indicate that the time required for other people to recognize the significance of research seems to depend on the creation of enabling techniques capable of providing solid evidence that the proposed ideas actually work. A 'pie in the sky' does not motivate people to move forward, whereas a feasible approach for obtaining a real pie does. ❐

International Year of Light

2015 is proclaimed the International Year of Light and Light-based Technologies.

After much consultation involving a large consortium of scientific bodies and UNESCO, it is now official! On 20 December 2013, the 68th session of the United Nations General Assembly proclaimed 2015 the International Year of Light and Light-based Technologies (IYL 2015). This demonstrates that the United Nations recognizes the importance of raising global awareness about how light-based technologies promote sustainable development and provide solutions to global challenges in the areas of energy, education, agriculture and health.

"An International Year of Light is a tremendous opportunity to ensure that international policymakers and stakeholders are made aware of the problem-solving potential of light technology. We now have a unique opportunity to raise global awareness of this," explained John Dudley, chairman of the IYL 2015 Steering Committee.

Many local, regional and international events have already been scheduled for 2015. Major scientific anniversaries that will be celebrated include the publication of the Book of Optics by Ibn Al-Haytham (1015), the proposal that light is a wave by Fresnel (1815), the development of the electromagnetic theory of light propagation by Maxwell (1865), Einstein's explanation of the photoelectric effect (1905) and his incorporation of light in cosmology through the theory of general relativity (1915), the discovery of the cosmic microwave background by Arno Penzias and Robert Wilson (1965) and Charles Kao's achievements regarding light transmission in fibres for optical communication (1965). ❐