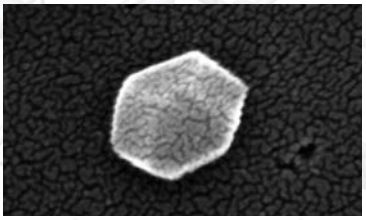
Quantum Communications Victoria

Secondary School Quantum Physics Newsletter - Volume 1 November 2006



This newsletter aims to introduce students to quantum physics and some of the ways it can be taken out of the lab and into "real world" applications. It will also keep you up to date with the latest developments and breakthroughs in this fascinating field of study.

QCV - Who are we and what do we do?

QCV is located at the University of Melbourne in the School of Physics and is a Victorian Government Industry Development Initiative. QCV was founded after being awarded $3.3m as part of a Strategic Technology Initiative (STI) grant from the Department of Innovation Industry and Regional Development

QCV has developed a new technology that uses a unique diamond-based device that can produce a single particle of light (or photon). This photon device can be used to send 100% encrypted information down an optical fibre. Therefore if an eavesdropper tries to monitor the signal it is distributed in such a way that the sender and receiver are alerted immediately.

What is Quantum Physics?

In the early 20th century, it was discovered that the laws that govern objects visible to the naked eye did not function the same in the microscopic realm. Quantum physics is the study of the behavior of matter and energy, that we can't see, at the molecular, atomic and nuclear levels.

What Does Quantum Mean?

"*Quantum*" comes from the Latin meaning "*how much?*". It refers to the discrete units of matter and energy that are predicted by and observed in quantum physics.

Who Developed Quantum Physics?

The birth of quantum physics is attributed to Max Planck's 1900 paper on blackbody radiation. Max Planck, Albert Einstein, Niels Bohr, Werner Heisenberg and Erwin Schrodinger, amongst others, made major contributions to this field in the early days of its development.

Quantum Physics Update - Latest News & Developments:

24 August 2006: A team of physicists and engineers from The Australian National University and the University of Queensland won the 2006 University of New South Wales Eureka Prize for Scientific Research for inventing an unbreakable code based on quantum physics.

20 May 2006 – QCV was Finalist in the Next Big Thing Awards: INNOVIC's Next Big Thing Award™ is an annual national competition to find and showcase new Australian products with the potential to become the 'next big thing'. The award celebrates and promotes Australian Innovation and is a key event of the Australian Innovation Festival. QCV's "Single Photon Source" was amongst nineteen finalists in the 2006 competition.

1 May 2006: Alice & Bob Beef up Security: Talk to anyone in the field of quantum cryptography and the conversation inevitably turns to Alice, Bob, and Eve. Wanting to keep their communications private, Alice (the sender) and Bob (the receiver) decide to set up a quantum encryption system that uses a stream of single photons to transfer a unique cryptographic key between them. Their goal is to foil the attempts of Eve (the "eavesdropper") to hack into the system and intercept their message, thus disrupting the security of the transaction. In essence, quantum cryptography works by exploiting a basic law of quantum physics: the process of observing a quantum object changes that object forever.

QCV Staff in the Spotlight: Dr Eric Ampem-Lassen:

I graduated from the Cape Coast University, Ghana with a Diploma of Education, and Bachelor of Science in Physics. My interest in physics started in the second year of my undergraduate degree when one of my physics professors who studied in Russia made physics look very simple! In 1999 I completed my M.Phil degree from the same university. My dream was to pursue postgraduate studies in physics. In September 1999 I successfully appplied for an International Postgraduate Research Scholarship (IPRS) in the School of Physics at the University of Melbourne. I worked under the supervision of Dr Ann Roberts, Dr Shane Huntington and Professor Keith Nugent. My thesis was entitled *"Photonic Device Imaging and Characterisation"*. During my research work I characterised various types of optical fibre using different techniques like Near-field Scanning Optical Microscopy (NSOM), Atomic Force Microscopy (AFM) and Quantitative Phase Microscopy (QPM). I graduated in September 2004 and am now the Optical Scientist in QCV.

Physics History: Max Plank - The Father of Quantum Physics:

Max Plank was born in Germany on April 23, 1858. His earliest work was on the subject of thermodynamics, a subject he became interested in while studying under Gustav Kirchoff.

Plank became interested in the problems of radiation processes. He showed that these processes should be considered electromagnetic in nature. His studies in this area led him to the problem of energy distribution in the spectrum of full radiation.

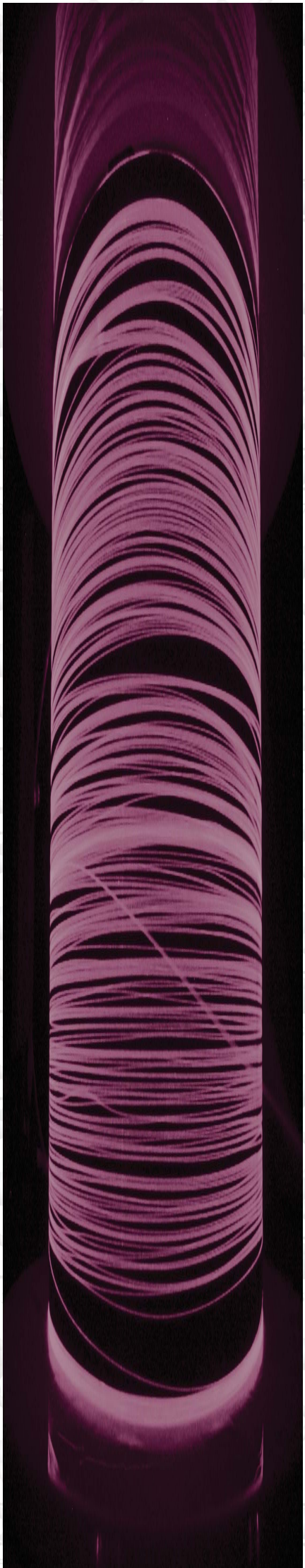
Plank's experimental observations on the wavelength distribution of energy emitted by a black body as a function of temperature were at odds with the classical physics of the time. Eventually, Plank was able to infer a relationship between energy and the frequency of radiation.

In a paper, published in 1900, Plank set out his findings on the relationship between energy and the frequency of radiation, which was based on the idea that the energy emitted by a resonator could only take on discrete values (or quanta). The result of Planks work was the theory now know as "Plank's Constant":

E = hf

Where E = energy, h = Plank's Constant and f = frequency.

This discovery was Plank's most important work. The effects of his discovery were far reaching but not widely appreciated at first. However, the evidence for the validity of his theory grew steadily to the point where it was conclusive. The applications and developments of Plank's Constant accounted for many discrepancies between observed phenomena and classical theory.



As a result of his research, Plank was awarded the Nobel Prize for Physics in 1918. He is regarded as the father of quantum physics and considered one of the greatest scientific minds of the twentieth century.

Want to know More?

Check out the QCV web site

www.qcvictoria.com

If your school would like a visit from QCV for a practical demonstration of quantum physics, call our Operations Centre on (03) 8344-8744 or send us an email at wattss@unimelb.edu.au

If you would like to arrange a visit to the School of Physics for a tour or to arrange a MUPPET (Melbourne University Physics Promotion, Education and Teaching Services show), please contact the School Office on (03) 8344-7670.