CARDIFF UNIVERSITY
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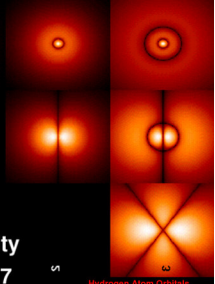

Hydrogen Atom Orbitals
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Date Saturday, 8th March 2008
Time 14:00 - 17:00
Venue School of Computer Science, Cardiff University
5 The Parade, Cardiff, CF24 3AA, Room C/2.07

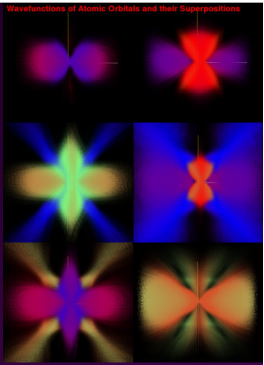
Quantum Engineering

Practical Applications of Quantum Physics and How these Might Transform Society

NATIONAL SCIENCE & ENGINEERING WEEK 7-16 MARCH 2008

A lecture on the fundamentals of quantum physics with hands-on demonstrations and a discussion of the potential impact of quantum technology on everyone's life

Wavefunctions of Atomic Orbitals and their Superpositions



The quest for miniaturisation has lead to nano-scale devices consisting of only a few atomic layers exhibiting quantum effects. Quantum engineering seeks to exploit these effects to develop new applications for such devices. This remains very much a scientific and technological frontier; we perhaps can no more predict how quantum devices will change the world than the inventors of the Internet were able to envisage how it is transforming society now. Yet, quantum effects are already essential for semi-conductor technology used in everyday devices such as mobile phones and there are promising new applications in many areas of technology; from secure communication, to controlling chemical reactions, to biomedical applications, for example.

In this event, aimed at a general audience, we will embark onto a journey into "quantum land" to provide an insight into essential quantum effects enabling such applications. We will also present potential applications and discuss their impact on society with the audience.

Further details on the Internet at http://www.langbein.org/quantum

Free registration by e-mail publicbookings@cardiff.ac.uk or phone (029) 2087 6936
There are a limited number of places available

Organisers Frank Langbein, Cardiff University
Sonia Schirmer, Cambridge University
Contact E-Mail: F.C.Langbein@cs.cf.ac.uk, Phone: (029) 2087 0110

This event is supported by the Welsh Assembly Government and the BA

the BA
british association for the advancement of science

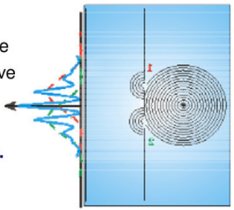
Quantum Engineering

Self-Identity Problems

NATIONAL SCIENCE & ENGINEERING WEEK 7-16 MARCH 2008

Ever wondered who you really are? It would be worse if you were a photon!

Young's Double Slit experiment: ***Light is a Wave!***



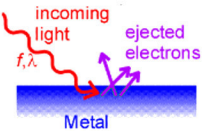
If we point a light source, e.g. a laser pointer, at a double slit, we observe an interference pattern similar to what we would observe for water waves.

Do your own experiment:

Take a laser pointer and shine it at a CD or DVD.

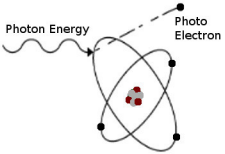
Can you see an interference pattern?

The Photoelectric effect: ***Light is a Particle!***

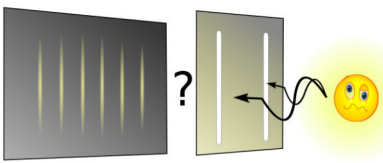


When light is shone on some metals, it produces a small current. This is easy to explain: the light carries energy, and if there is enough of it, it may knock out some of the electrons present in the metal. This is exploited in many applications from solar cells to charge-coupled devices (CCDs) in digital cameras.

It was indeed observed that the number of electrons knocked out increased with the brightness of the light source, BUT ONLY for light of certain colours (frequencies). Below a certain threshold frequency, no electrons were observed, no matter how bright the light source. This did not make sense at all! If light was a wave then the energy of light should depend only on its brightness, not its frequency.



Einstein's genius: If we assume that light is a stream of discrete parcels of energy (photons), and the energy of these photons is proportional to the colour of the light, we can easily explain the observed threshold---photons below a certain frequency do not have enough energy to knock out any electrons. This simple explanation earned Einstein the Nobel prize!



Photon: "Oh great, I was wondering whether I'm visible, an X-ray photon, a radio photon... and now they tell me I can't even be sure whether I'm a wave or a particle!"

Curious to learn more about this and how to see that interference pattern? Come to our National Science and Engineering Week event (for details turn over)!