Institute of Physics Conference,
in association with the
University of Glasgow and The Royal Society of Edinburgh

Kelvin 2007

14 November 2007

On November 14 2007 in the Kelvin Gallery of the University of Glasgow we celebrated 100 years of Lord Kelvin's legacy. Kelvin was born William Thomson in Belfast in 1824. He studied at Glasgow University, passing his exam 1840, and returning in 1864 at 22 years of age to take the Chair of Natural Philosophy. Far beyond the laws of thermodynamics his scientific achievements spanned many aspects of physics, engineering and - as a man ahead of his times - its commercialisation.

Rather than concentrating on his historical achievements, the day's lectures centered on exploring the modern legacy of some of the scientific fields that occupied Kelvin - presenting modern day insights to work that he can be said to have started.

Like many scientists of his time, Kelvin believed that light travelled through ether which filled the vacuum. Kelvin proposed that atoms and molecules were formed from vortex loops and knots within this ether, a theory somewhat undermined by the subsequent discovery that light needed no ether at all! Although flawed as a theory for atoms and molecules, vortex lines within wave fields are prevalent in many branches of physics, ranging from superfluids and cosmic strings to light itself. Professor Sir Michael Berry FRS HonFRSE explained how, ever since the time of Newton, light was known to exhibit vortex-like properties. Optical vortices are an inescapable feature that arises whenever three or more light beams overlap. Professor Berry revealed how for special superpositions of beams, the resulting vortex structure can form both links and knots - a topic of current research within Glasgow University.

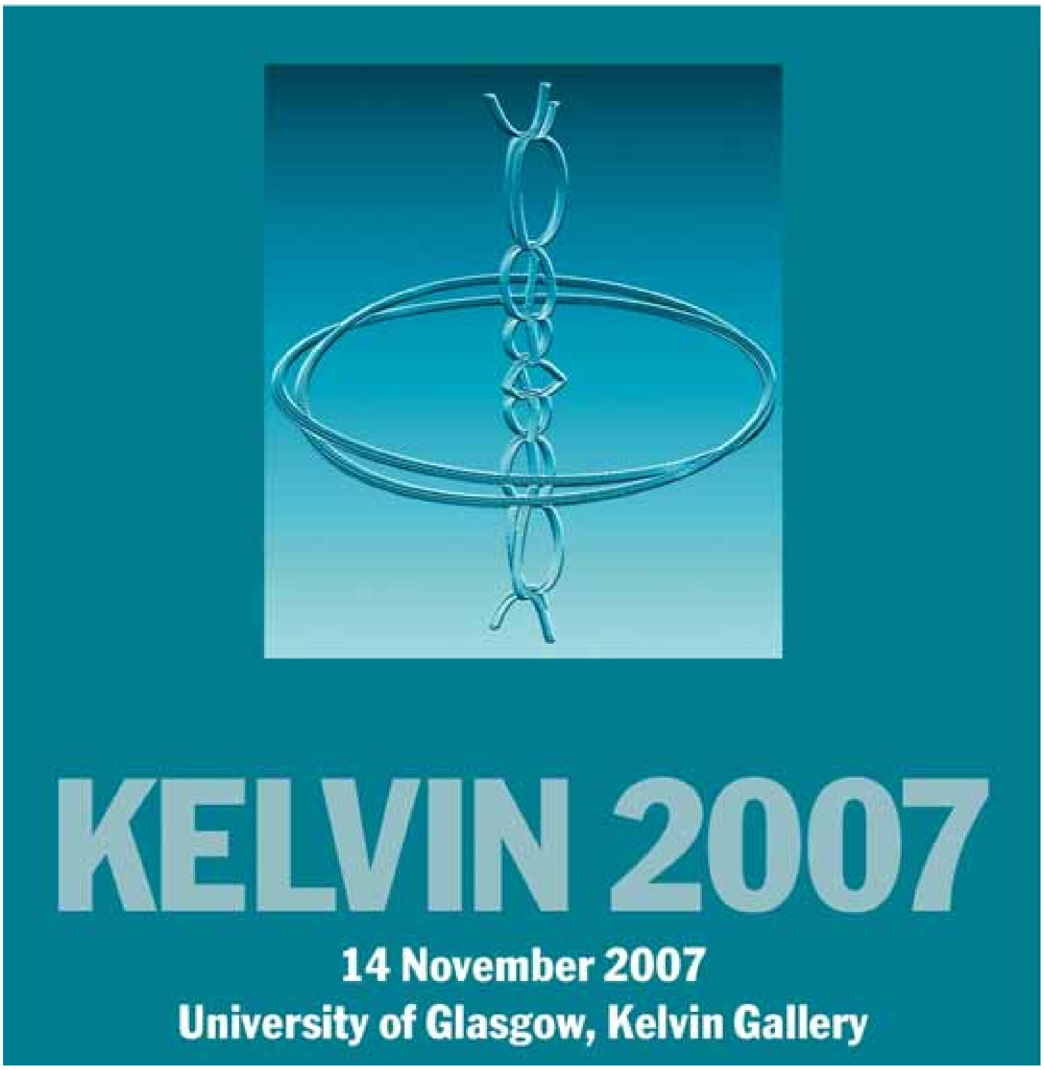
Kelvin gave his name to the temperature scale, which sets absolute zero as zero degrees Kelvin. Not foreseen by Kelvin is that when gas atoms are cooled to a fraction of a degree above absolute zero, their effective wavelength extends beyond the separation between individual atoms. Rather than considering the gas as individual atoms, one now considers the gas as a whole. These Bose-Einstein condensates are one of the hot topics of modern physics. Professor Ed Hinds produced one of the world's first condensates and has established many new techniques for their transport and control. A related area of excitement is that it is possible to hold a single atom within a miniature cavity formed between the end of an optical fibre and a neighbouring mirror. The enhancement provided by the cavity means that it is possible to interact with the atom using a single photon of light. These quantised interactions will form the basis of a completely new form of information processing – capable of performing tasks impossible by any classical computer.

Beyond Thermodynamics, for which Kelvin is most famous, his contributions to the commercial exploitation of modern science were truly impressive. Nowhere was this more impressive than his contribution to worldwide communication. Professor Wilson Sibbett CBE FRS FRSE outlined Kelvin's contribution, both the unsuccessful and subsequently successful laying of the first transatlantic telegraph cable, an undertaking that also required the building of the world's largest steam ship. Kelvin's key contributions to the project included the design of the highly sensitive receiver, capable of measuring the small currents emerging at the far end of the cable. Professor Sibbett explained how electronic communication has been largely superceded by optical communication and how UK science had developed the essential optical amplifiers required to boost the light levels throughout the 1000s km of fibre optic cable. Professor Sibbett's own work has centred on making the ultra-short laser pulses that form the basis of high-speed optical communications.

Returning again to the ether, Kelvin pondered also its structure, which had to be light, yet to account for light's high velocity, also very stiff. Kelvin speculated that the ether had the same structure as foam, famously only taking a few weeks to establish the lowest energy unit cell. His foam structure was considered the optimum foam until the mid 90s, when Professor Denis Weaire established an alternative structure slightly more efficient than Kelvin's proposal. Interestingly, this structure rarely occurs in nature. However, Professor Weaire showed us how his foam structure has been adopted as the design for the steel framework of the Beijing Olympic swimming venue. Surely even Kelvin would have been proud.

The event was chaired by the present holder of the Kelvin Chair, Professor David H Saxon OBE FRSE and attracted over 150 active researchers from across Scotland.

Professor Miles J Padgett FRSE



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