John Adams Institute for Accelerator Science

John Adams Institute for Accelerator Science Lecture Series

Tuesday 15th October 2013 at 4:15pm
Fisher Room, Denys Wilkinson Building

Progress with Metamaterial Research

The lecture will be delivered by

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Abstract: Left Handed Material (LHM), or more popularly Metamaterial, possible with simultaneous negative permittivity and permeability which can exhibit exotic properties like reversal of Snell's law, reversed Doppler Effect and reversed Cherenkov effect was theoretically proposed by Russian scientist V.G. Veselago in 1967. First experimental demonstration of negative refractive index with plasmonic metamaterial was done by D.R. Smith and his colleagues in 2001 at UCSD, U.S, on the basis of the possibility of practical realization of negative permittivity and negative permeability suggested in his landmark work by J.B. Pendry in 1999. The transmission line metamaterial was reported by Eleptheriades et. al in 2002 using periodically loaded transmission lines.

Following these initial developments in metamaterial research there has been an exponential growth both in terms of volume and variety leading to a phenomenal progress with the theme and avenues of metamaterial research. We can now hope of the possibility of 'superlens' overcoming the diffraction limit of conventional optics, 'sub-wavelength imaging' with evanescent wave growth caused by surface plasmon polaritons and resonant tunneling phenomena in plasmonic metamaterial, 'cloaking' of objects opening up new possible directions for stealth technology and so on. Apart from these exotic applications, active and advanced research is going on with new ideas emerging every new morning for the developments of metamaterial based microwave passive components and antennas with improved performance along with size miniaturization.
Metamaterial is no longer just an 'artificial material' with negative permittivity and permeability, its functionality is permeating also as a 'device' and it is now assuming a new paradigm shift in application areas like laser technology, nano technology and so forth. Though initial developments in metamaterials took place at microwave frequency spectrum, advanced developments are taking place these days mostly in terahertz and optical frequency range. In fact ultimate fruit of metamaterial research will be most effective only when three-dimensional optical metamaterial will be a commonplace reality.

The aim of this talk will be to make a technical journey through all the relevant developments and recent progress and possibilities in metamaterial research, looking forward even to quantum metamaterials. The talk will also cover glimpses of our research activities since 2007 at the University of Calcutta with our collaborators SAMEER, Kolkata Centre and BARC, Mumbai, India.

For further details contact Glenn Christian at g.christian1@physics.ox.ac.uk