武汉物数所理论交叉学术交流系列报告

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When waves go rogue

– modeling extreme waves

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University of Warwick, Coventry, UK

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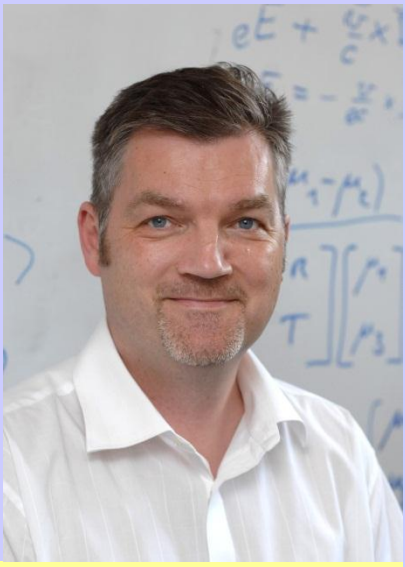
频标楼4楼报告厅

About the speaker:

Rudolf A. Roemer, Professor of University of Warwick, UK, hold a joint position between the Department of Physics and the Centre for Scientific Computing, and is the head of research group Disordered Quantum Systems. He published more than 150 papers. Else he got the Fellow (FInstP) of The Institute of Physics in 2011 and Heisenberg fellow of the German science foundation in 2002. Current Research Interests: Solid state physics, computational physics, disordered materials, quantum Hall effect, transport problems in quantum systems, meso- and nanoscopic physics, exact solutions, mathematical physics, biological physics, various.



Abstract: Optical “rogue waves” generated in fiber systems are sharp, rare and extremely high power pulses that share the main features of the devastating freak waves appearing in the ocean. In fact, rogue waves are known to occur also in plasmas, Bose-Einstein condensates and super-fluid helium. Rogue waves in optics are argued to form due to at least two mechanisms of nonlinear amplification. First, a modulation instability broadens the power spectrum of the waves - and hence “amplifies” waves in frequency ranges where there were none to start with. The second amplification is then due to multiple inelastic soliton collisions. In order to describe rogue waves quantitatively, it has been shown that their probability density function depicts a typical ‘L-shaped’ profile, characterizing the occurrence of many small events as well as, in the horizontal part of the ‘L’, some very rare and extremely powerful events. What drives the formation of this ‘L’-shaped PDF is not yet clear. Recently, it was argued that a third-order dispersion term might be responsible. A remarkable feature of the third-order dispersion is that the energy of the stronger soliton in most of the cases increases after the collision. Hence after multiple such collisions, the strongest soliton will have accumulated most of the energy in the system, it has become a rogue wave!

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