A new type of energetic mobile nonlinear non-oscillatory lattice excitation in crystals

Conference by professor
F Michael Russell
Heriot-Watt University
Edinburgh, UK

Premises: LENCOS Lecture Hall, Hotel Becquer, Sevilla.

Date and time: Thursday, July 9, 2012, at 09:25.

Conference organized by the Group of Nonlinear Physics of the University of Sevilla

Abstract:

Evidence for a new type of nonlinear, non-oscillatory lattice excitation is presented that involves coordinated motions of atoms on multiple adjacent atomic chains. Called pulseons, they are created in energetic atomic scattering events in crystals. The evidence comes from high and intermediate energy nuclear scattering in crystals, augmented by numerical and analogue modelling of crystal excitations. Within a pulseon the energy and momentum propagates along chains in a manner resembling a kink soliton. The excitation propagates at supersonic speed and spreads slowly laterally. It therefore has a finite range for influencing lattice defects. Hence, it contrasts with breathers or quodons that are persistent, compact, self-focusing, sub-sonic excitations.

There is no clear upper limit to the energy in a pulseon as its creation can locally disrupt crystal structure. Evidence also is presented for pulseons gaining energy from non-thermal potential energy stored in a lattice. It is anticipated that pulseons will play a significant role in annealing radiation damage in solid materials due to their pulse-like structure acting over a distributed moving front in both layered and non-layered crystals.