

## Keynote Lecture

KN04

### *Phonon and phasons : from incommensurate phases to quasicrystals*

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Aperiodic crystals are long range ordered phases, which lack translational symmetry. They encompass incommensurately modulated phases, incommensurate composites phases and quasicrystals (1). Whereas their atomic structure is now well understood, even for the case of quasicrystals, the understanding of their physical properties remains a challenging problem. In particular, because of the aperiodic long range order, the lattice dynamics present a specific behavior. In particular, it can be shown theoretically that besides phonon, a supplementary excitation exists in all aperiodic phases named phason. Phason modes arise from the degeneracy of the free energy of the system with respect to a phase shift and are always diffusive modes (1). After a general introduction on the different class of aperiodic crystals, we will illustrate experimental results on phason modes. We will in particular demonstrate that these phason modes lead to a flexibility of the structure that might have important consequences for physical properties. We will also discuss their importance for the understanding of stabilizing mechanisms that lead to the long-range aperiodic order.

[1] T. Janssen, G. Chapuis and M. de Boissieu: *Aperiodic Crystals. From modulated phases to quasicrystals*, Oxford University Press, Oxford 2007

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