

## Tenth Ewald Prize Lecture

EL

### *Aperiodic Crystals*

T. Janssen<sup>1</sup>, A. Janner<sup>1</sup>

<sup>1</sup>*University of Nijmegen, Theoretical Physics, Nijmegen, The Netherlands*

2014 is the International Year of Crystallography. During at least fifty years after the discovery of diffraction of X-rays by crystals, it was believed that crystals have lattice periodicity, and crystals were defined by this property. Now it has become clear that there is a large class of compounds with interesting properties that should be called crystals as well, but are not lattice periodic. A method has been developed to describe and analyze these aperiodic crystals, using a higher-dimensional space. In this lecture the discovery of aperiodic crystals and the development of the formalism of the so-called superspace will be described. There are several classes of such materials. After the incommensurate modulated phases, incommensurate magnetic crystals, incommensurate composites and quasicrystals were discovered. They could all be studied using the same technique. Their main properties of these classes and the ways to characterize them will be discussed. The new family of aperiodic crystals has led also to new physical properties, to new techniques in crystallography and to interesting mathematical questions. Much has been done in the last fifty years by hundreds of crystallographers, crystal growers, physicists, chemists, mineralogists and mathematicians. Many new insights have been obtained. But there are still many questions, also of fundamental nature, to be answered. We end with a discussion of these open questions.

**Keywords:** Aperiodic Crystals, Incommensurate Phases, Quasicrystals