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1 A Z-module of rank N in Rd with N>d is the set S of points of Rd that are linear combinations with integer coefficients of N vectors arithmetically independent:

- a Z-module of rank N in Rd is the (irrational) projection of a lattice ZN in RN;

- a Z-module of rank N in Rd forms an enumerable dense set of points in Rd or in a non-empty subspace of Rd;

- if d = N the Z-module is trivially a lattice ZN.

Keywords: Z-modules, twins, dislocations

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The theory of twisted X-rays and their diffraction patterns

Dominik Jüstel[1], Gero Friesecke[2], Richard James[3]

1. Institute for Biological and Medical Imaging, Helmholtz Center Munich, Munich, Germany
2. Department of Mathematics, Technical University of Munich, Munich, Germany
3. Department of Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis, United States of America

email: dominik.juestel@helmholtz-muenchen.de

Most molecular structures that are known today have been found by X-ray crystallography. However, a main drawback of the method is the need to crystallize the structures under consideration. As proteins often do not form crystals, but aggregate in other highly symmetric assemblies, like rods or sheets, we proposed to design electromagnetic radiation that reflects the symmetriy of the structures in the same way as plane waves do for crystals [1,2].

In the special case of heliclal structures, like carbon nanotubes or helical viruses, this approach yields a class of radiations that we call twisted X-rays [1,2], and that are closely related to X-ray beams carrying orbital angular momentum [3].

In this talk, the theory of twisted X-rays and their diffraction patterns will be presented. Furthermore, it will be shown that structure analysis using twisted X-ray diffraction has the potential to solve molecular structures that are recently unaccessible.

Keywords: twisted X-rays, orbital angular momentum