The EMAT electron microscopy research group and Vision Lab at the University of Antwerp, Belgium, announce an open

Ph.D. position

on the theme

Quantitative three-dimensional structure determination using transmission electron microscopy : from images toward precise three-dimensional models of nanostructures at atomic scale

Project

Nanostructures play key roles in a wide range of materials and devices because of their unique physical and chemical properties. These properties are controlled by the specific three-dimensional (3D) morphology and composition. Therefore, development of new techniques to determine the structure at atomic scale in three dimensions would allow the properties of the resulting materials to be fully understood and greatly enhanced, increasing the number of applications. Aberration-corrected (scanning) transmission electron microscopy ((S)TEM) is considered as one of the most promising techniques to achieve atomic resolution in three dimensions at a very local scale because of the strong interaction of electrons with small volumes of matter. However, the images provided by means of (S)TEM are two-dimensional projections of the object along the optical axis so that most information of the distribution of the object is lost in this third dimension. In order to reconstruct the 3D structure one has to resort to specialized 3D imaging techniques of which tomography is the most widespread. Tomography is the discipline of retrieving the 3D structure of an object from a series of two-dimensional projections which are obtained by rotating the sample about a rotation axis. The aim of this research project is to realize a breakthrough towards quantitative 3D reconstruction at atomic resolution using (S)TEM. The main focus in this project will be the theoretical investigation of different imaging modes and the development and implementation of new reconstruction schemes. The work performed within this project will take place at the University of Antwerp in collaboration with the Institute for Solid State Physics at Bremen University, and the Centrum Wiskunde & Informatica in Amsterdam.

Tasks

The PhD candidate will be expected to

- acquire knowledge in the field of electron microscopy (image formation and electron-object interaction), 3D reconstruction techniques, and statistical parameter estimation theory
- develop, implement, and apply (Matlab, C, or C++) new techniques to reconstruct unknown objects in three dimensions
- discuss the results in terms of the expected performance of the technique and fundamental physical limitations
- publish and present research results in the form of articles in international peer reviewed journals and papers at international conferences.

Your profile

Candidates for this challenging project should have a Master's degree and a background in e.g., physics, mathematics or scientific computing. The candidate must be enthusiastic and greatly interested in applied statistics, physics, scientific programming and fundamental theoretical research. A background in electron microscopy will be considered as a plus, but is not necessary. In addition to this, a good command of the English language is required.

Project term

Enrolment will start as soon as possible. The Ph.D. student will be appointed for a period of four years; after the first year an evaluation will take place. You will form part of a world-class research environment with state-of-the-art instrumentation (see also http://www.emat.ua.ac.be and http://www.visielab.ua.ac.be/).

Information and application

Additional information about the vacancy can be obtained from: S. Van Aert, tel. +32 3 265 3252, Sandra.VanAert@ua.ac.be or J. Sijbers, tel. +32 3 265 2464, Jan.Sijbers@ua.ac.be, University of Antwerp, EMAT, Groenenborgerlaan 171, B-2020 Antwerp, Belgium, http://www.emat.ua.ac.be and http://www.visielab.ua.ac.be/

Interested applicants should send their Curriculum Vitae, the names of two professional referees, a summary of their M.Sc. thesis and a cover letter stating their motivation to Prof. Dr. S. Van Aert and Prof. Dr. J. Sijbers.

Antwerp, January 2012