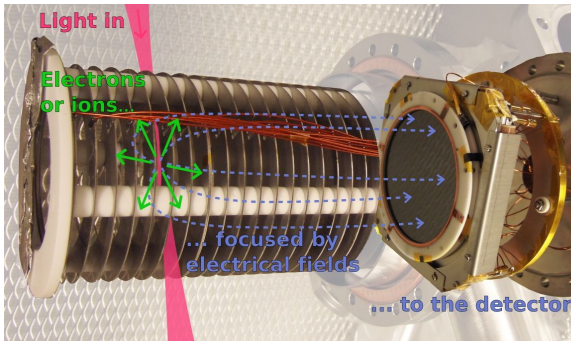
Diploma project: **Autofocus for electrons**

The department of synchrotron radiation research is looking for a student to help us steer electrons during investigation of ultrafast processes in molecules.

Our research involves a 3D spectrometer which can be thought of as a camera that instead of capturing light to a photo-sensor captures charged particles (e.g. electrons) to a detector*. The lens in this "camera" consists of a number of plates where high voltages are applied to create electric fields that direct the particles to the detector.



By choosing different voltages for the plates we can zoom and focus so that different groups of particles give sharp features in the pictures we record. Our spectrometer does not have a *single* zoom wheel – it has 22 individually adjustable plate voltages. And it has no autofocus.

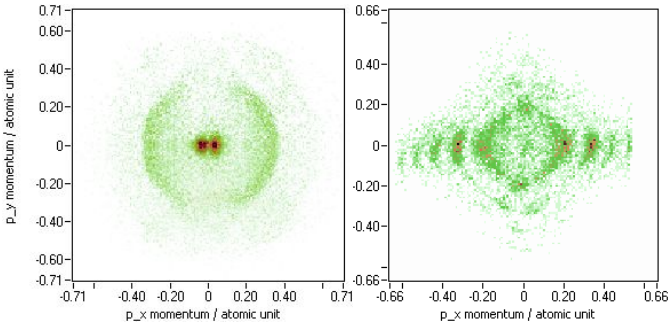
Your task is to help us create a kind of autofocus for our spectrometer, so that it will be easier to control. Via experiments and simulations of the particles' motion you will hopefully be able to let the autofocus program make better voltage choices than we today do manually.

Who are we looking for?

We think you are a physicist with computer interest, programmer with electronics interest or mathematician who want to use your skills in practice.

Since the end product is a computer program you ought to have some experience of programming. Exactly which language you have programmed in is less important, you may learn to use one called LabView within the project. It is a graphical language with much support for controlling electronics and is easy to learn but rather different from text-based program languages.

An important part of the project is to design how the autofocus should work. Here you will have great freedom in using your mathematical intuition to select optimal voltages, based on the user's choice of energy ranges and directions where the images of the particles should be as sharp as possible.



The diploma project is intended for a master student working one semester full-time or half-time for a year. If you want to do a shorter project we can discuss the possibility.

More about the group

The molecules & cluster group is part of the Department of synchrotron radiation research at the science faculty. We collaborate with the attosecond group of Atomic physics LTH, when using the spectrometer that is to be improved in this project. We also use MAX-lab extensively for similar research. Our website is at http://www.sljus.lu.se.

Contact Erik Månsson if you are interested or have questions: erik.mansson@sljus.lu.se, room A408 at Fysicum.

You can start anytime, we need your help as soon as possible!

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* The data has three dimensions (3D) because the spectrometer is able to record which of all the directions (velocities) in space that the particle had initially.