chemisch
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Gegründet im Jahre 1869 von H. Hlasiwetz, J. Loschmidt, J. Petzval und J. Stefan

EINLADUNG

zum Vortrag von

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What is the best energy for imaging molecules with electrons?

am Dienstag, 21. November 2023, um 18:00 Uhr

Ort: Lise-Meitner-Hörsaal, Fakultät für Physik, Universität Wien,
1090 Wien, Strudlhofgasse 4 / Boltzmanngasse 5, 1. Stock

Barrierefreier Zugang: Boltzmanngasse 5, Lift, 1. Stock rechts über den Gang zum Hintereingang des Hörsaals

Abstract:

Radiation damage sets the ultimate limit to structure determination using any form of ionising radiation with sufficient energy to resolve the positions of atoms in a molecule. Electrons, since they interact strongly with biological specimen, induce severe radiation damage, but also provide maximal contrast per unit damage event when compared to X-rays and neutrons. While the amount of information per unit damage for electrons is thought to be approximately constant over the energy range of 10 to 1000 keV, published measurements of radiation damage to biological specimen are not of sufficient accuracy to determine if there is an advantage, in terms of contrast per unit damage, to reducing or increasing the energy of the electron beam. Recently, our measurements of specimen charging and the demonstration of Ewald sphere correction indicate that neither of these present a barrier for reducing the energy of the electron beam from 300 keV, which is the current standard for most commercial high-resolution electron cryomicroscopes. Some theoretical estimates indicate that the ratio of the inelastic to elastic scattering cross sections for carbon may drop significantly as the energy is reduced. With this in mind, we wish to understand both theoretically and experimentally, if there is a potential advantage in changing the energy of the electron from the conventional 300 keV used for most cryoEM. Here we present our recent progress in measuring how the amount of structural information in electron cryomicrographs of biological specimen scales vs. damage when changing the energy of the incident electron beam. We measure the high energy elastic scattering cross sections of carbon to high accuracy using pure carbon specimens. We compare these data to established theory of electron scattering as well as measurements of damage using the fading of diffraction spots from 2D crystals of paraffin and bacteriorhodopsin (purple membrane). Finally, we present a demonstration of the first atomic structures of a range of protein specimens determined at 100 keV. From this work, we conclude that determining the structures of biological macromolecules.

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