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REGAE - Time resolved diffraction with relativistic electrons

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Ultrafast electron diffraction (UED) allows studying dynamical processes with femtosecond time resolution at the atomic scale. Due to their strong interaction with matter, electrons are particularly suited for the investigation of very thin samples. For such UED experiments DESY in Hamburg has built and is operating the REGAE facility, being currently the only operating UED facility in Europe.

REGAE is based on a RF-operated linear accelerator which produces short electron pulses with energies of 2 MeV - 5 MeV. A buncher cavity allows to further compress the bunches and allows to conduct experiments with a time resolution of better than 20 fs. For electron diffraction experiments from solid samples REGAE is equipped with a high-precision crystallography goniometer. For recording of diffraction patterns, the instrument is equipped with an integrating Jungfrau 1M detector, capable of direct electron detection with single electron sensitivity and single shot experiments.

In a first demonstration experiment we were able to solve and refine the 3D atomic structures of the layer silicate muscovite and the incommensurate structure of quantum material tantalum disulfide (TaS₂) with a great level of detail and at high quality.

For time resolved diffraction experiments REGAE is equipped with a pump laser system providing wavelengths of 800 nm and 400 nm. The system is currently being upgraded with a NOPA to provide a larger pump wavelengths range and a cryo-cooling system for conducting diffraction experiments at temperatures down to 10 K.

Speed talk:

Normal speed talk selection

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