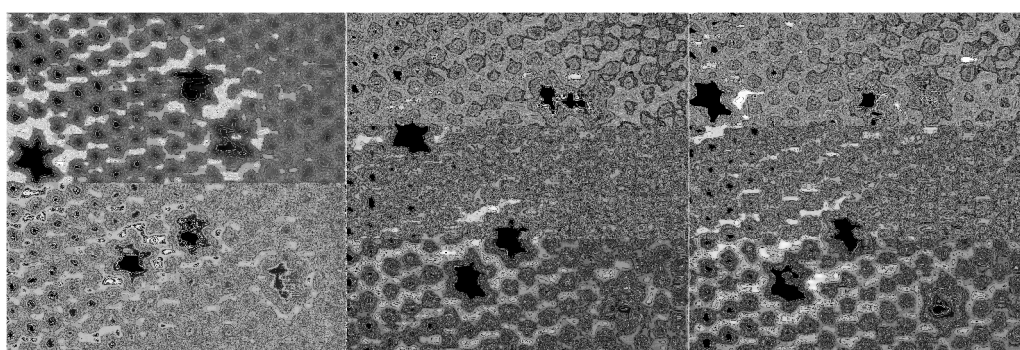


Development of a python-based loader for FastSTM movies

The project involves the development of a program to load, process and export movies of chemical reactions at surfaces acquired at the atomic scale with video rate time resolution.

Motivation

We have recently developed an electronics add-on module (FAST) that enables to push the imaging speed of commercial scanning tunneling microscopes from ~ 1 image/minute to more than 100 images/s. The figure below shows a sequence of three consecutive FastSTM frames (105×105 pixel, $3 \times 3 \text{ nm}^2$, 36 images/s) of the mobility of carbon monoxide molecules (black “stars”) on a graphene layer at a temperature of 400°C .



A program needs to be written that loads the HDF5 data files, re-shapes, displays, processes and exports the data to user selected and customizable movie and/or image formats. Strong emphasis will be given to the customizability of movie filters/processors and to proper control of compression/quality tradeoff.

Highlights of the tasks involved in the project

The project goals involve getting acquainted with a variety of state-of-the-art topics in software development. In particular, specific tasks will include:

- **software design:** a modular, cross-platform software architecture allowing for easy expandability and customization is required;
- **GUI development:** a robust and extensible GUI based on the Qt framework and its python bindings (PyQt) will be developed, starting from a working prototype;
- **big data:** memory and processor-efficient filters and algorithms to process very large data arrays need to be optimized, including 1D (temporal) and 2D (spatial) FFT filters, distortion corrections, background compensation, feature tracking, movie and frame export (numpy/scipy, opencv);
- **project documentation:** the software and the code will be documented by using the modern python3 standards (sphinx);
- **collaborative development:** the adoption of a distributed version control system (git + github) for code sharing, discussion of features, issue tracking, collaborative addition of functionalities together with our collaborating group at TU Munich

Contacts

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