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Optimizing SasView models

Enhancing performance by rewriting kernels from OpenCL/OpenMP to Futhark

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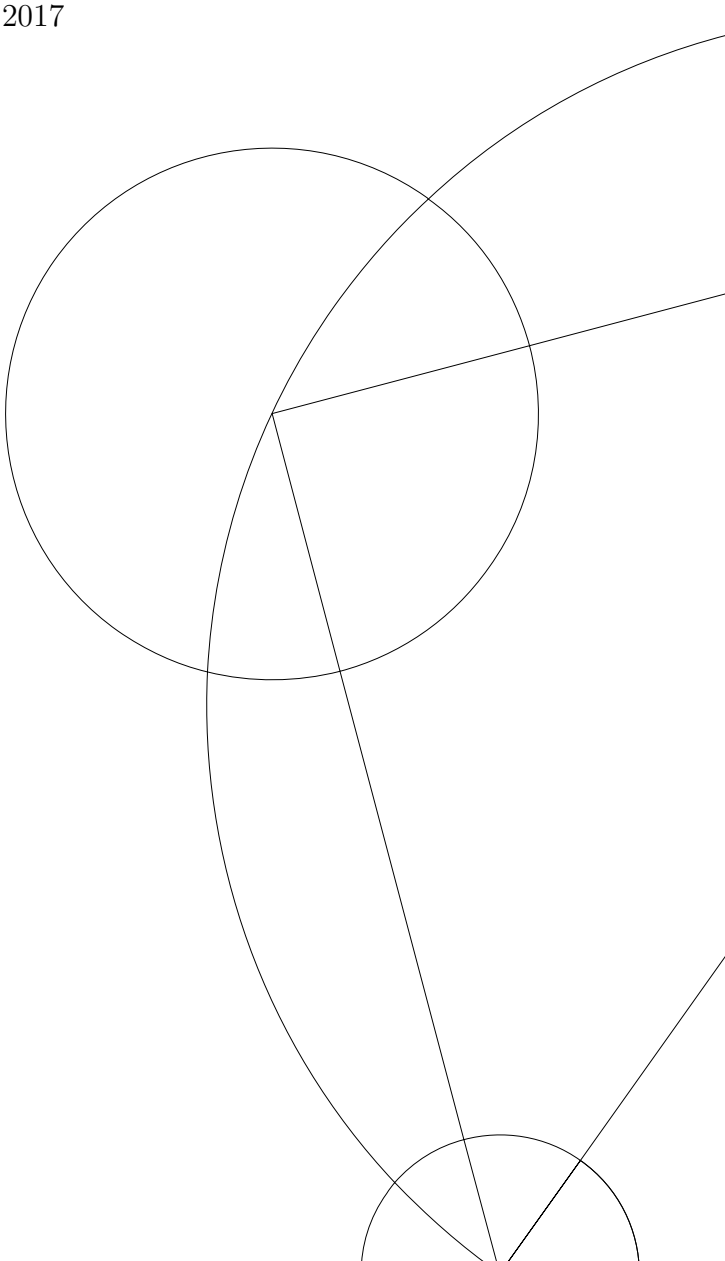
September 25, 2017



Goal and motivation

SasView is a Small Angle Scattering (SAS) analysis package for the analysis of 1D and 2D scattering data directly in inverse space. As *SasView* is given data, it performs its analyses by running the input data through theory models provided by the standalone module *Sasmodels*.

The *Sasmodels* models utilizes a set of kernels, which are implemented in both OpenCL and OpenMP. However, benchmark comparisons[1] between the parallel algorithm library *Thrust* (implemented in C++/CUDA), and the array programming language Futhark, shows that there might severe speed improvements to gain by running these model calculations in Futhark, instead of in OpenCL and OpenMP.

The goal of this project is to explore the potential speed gains obtained by rewriting, and testing the resulting speed improvements of, a subset of the *Sasmodels* models. The subset will be chosen so that there are at least one "simple" model, one model of intermediate complexity, and one complex model in it.

If rewriting the models results in a significant[2], speedup, it will reasonable to believe that the rest of the models in *Sasmodels* can be rewritten for a similar speedup.

[1] https://futhark-lang.org/performance.html

[2] I.e. a speed increase in order of at least a magnitude