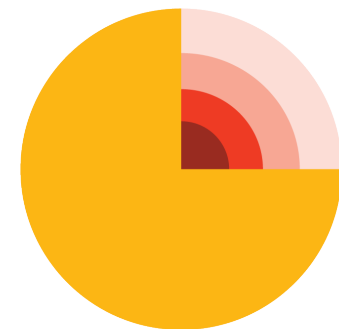


LaMEM

Status of ChEESE-2P Flagship Codes



ChEESE

LaMEM

Lithosphere and Mantle Evolution Model

Physics

- Conservation of momentum, mass and energy
- Compressible poro-visco-elasto-plastic rheology

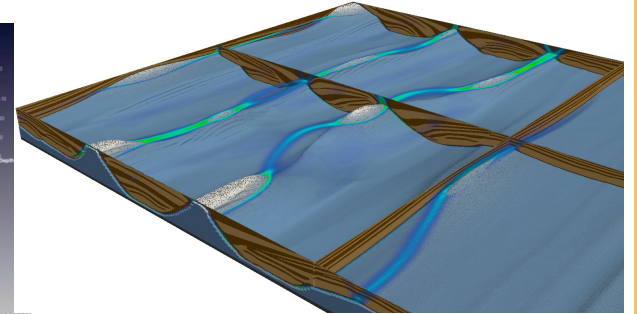
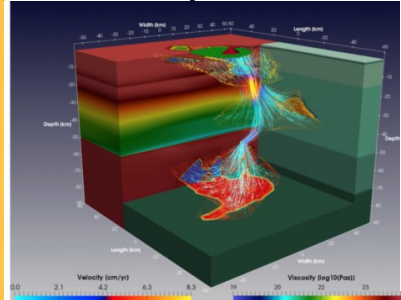
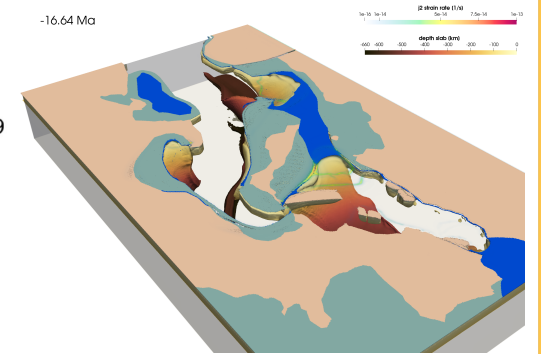
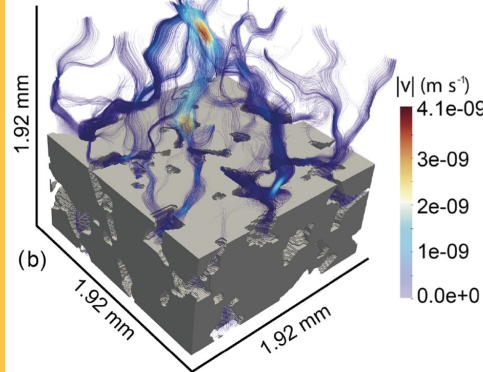
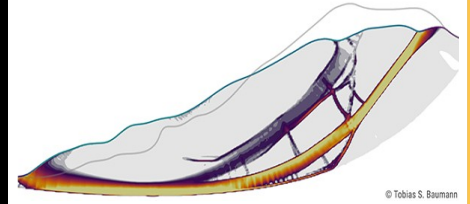
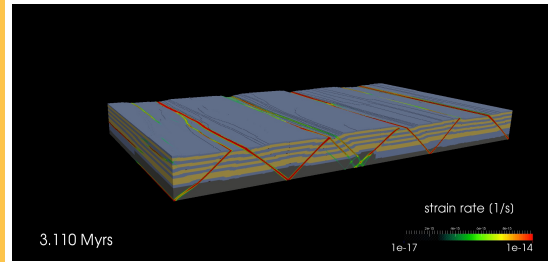
Numerical implementation

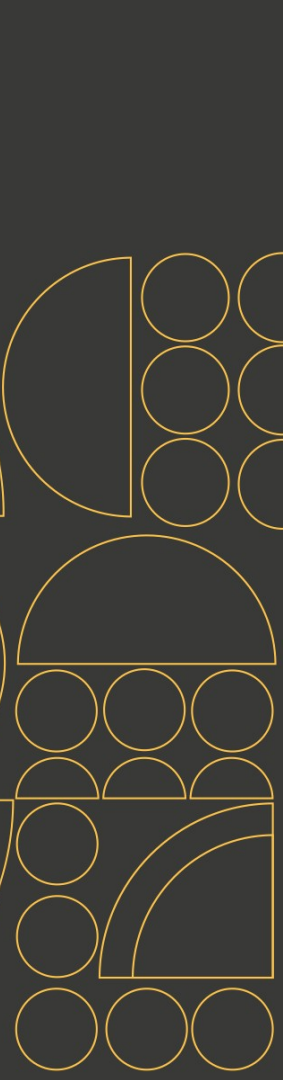
- 3D staggered finite-difference, marker & cell
- MPI parallel, using PETSc
- Galerkin multigrid & Newton solvers
- Adjoint-based sensitivity framework
- Written in C/C++

Repository

<https://bitbucket.org/bkaus/lamem>

GPL License



A decorative vertical bar on the left side of the slide, featuring a dark grey background with yellow geometric patterns including circles, semi-circles, and arcs.

LaMEM team

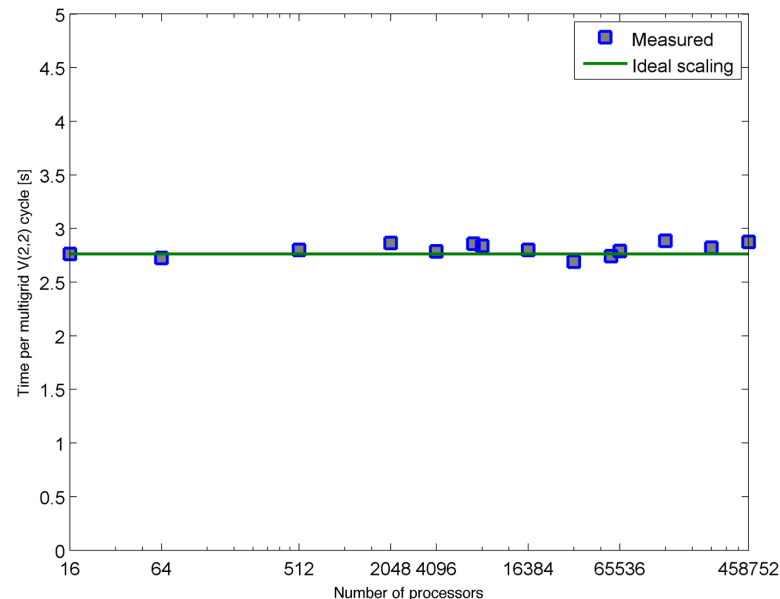
- Boris Kaus (UM)
- **Anton Popov (UM, LaMEM contact WP2)**
- Post-doc (UM, we are hiring)

UM - Johannes Gutenberg University Mainz, Germany



Performance status LaMEM

- No systematic scaling campaign yet
- CPUs: tested up to >458000 MPI ranks
- Typical runs 256-1024 MPI Ranks
- GPUs: not tested yet
- Planned to introduce support for CUDA, OpenCL via PETSc (both AMD and NVIDIA)
- Relevant PETSc examples demonstrate considerable speedup on NVIDIA A100 GPUs



JUQUEEN: IBM Blue Gene/Q
Jülich Supercomputing Centre

LaMEM Release Information

- Latest version: LaMEM 1.2.3
<https://bitbucket.org/bkaus/lamem/src/master/>
- Wiki: <https://bitbucket.org/bkaus/lamem/wiki/Home>
- MPI (CPU, GPU unsupported yet)
- Mini-app: does not exist
- Test suite consisting of ~75 tests

Dependencies:

- Python, NumPy, Julia, Cmake, BLAS, LAPACK, ScaLAPACK, MPI
- PETSc 3.18.5



LaMEM Tasks

- Port LaMEM to GPUs via PETSc
- Implement matrix-free option in geometric multigrid solver
- Implement weighted BFBT preconditioner
- Implement staggered grid interface to coarse grid solver on a sub-communicator (PCTELESCE in PETSc)

