HESP Project Presentation

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FAU Erlangen-Nürnberg
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Project I
DEM & Visualization

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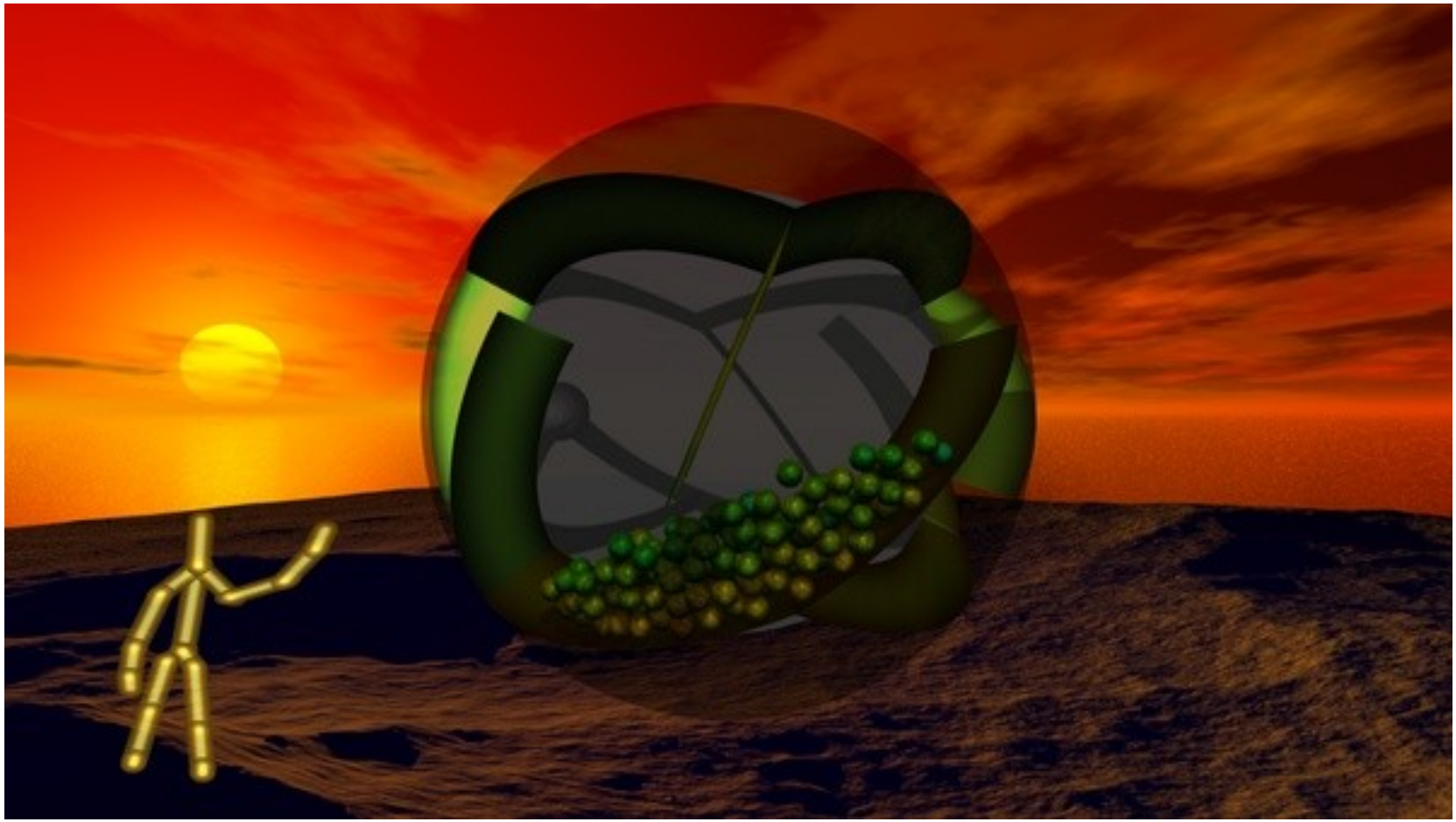
DEM & Visualization



DEM & Visualization

- Task:
  - Implement live visualization using DirectX or OpenGL
  - Share resources between contexts
  - Extend your simulation and visualization with one more type of obstacles (e.g. voxel-based, triangle meshes, plane intersections, etc.)
  - Prepare a nice live demo
- Requirements:
  - Prior knowledge in graphics programming is highly recommended!
- Difficulty:
  - Medium
- Advisor:
  - Sebastian Kuckuk

Project II
Computational Steering

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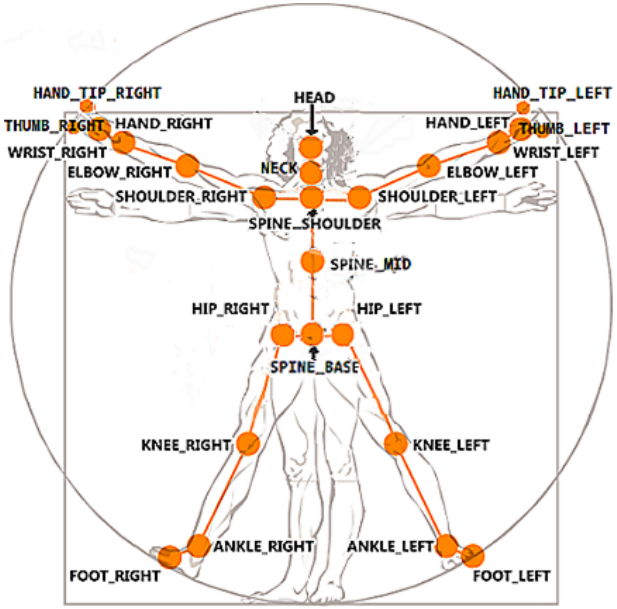
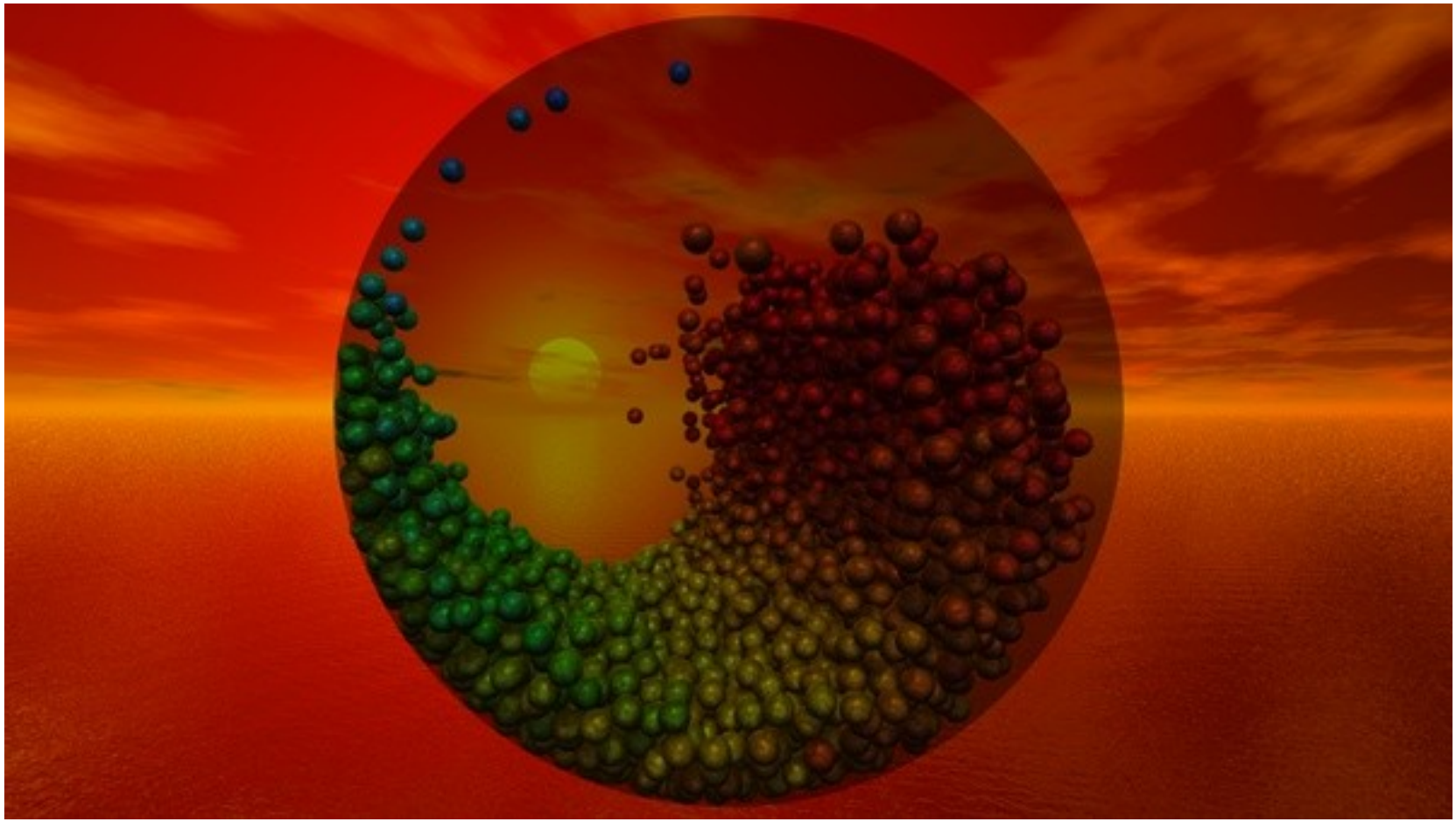
Computational Steering

- We provide a Kinect sensor
  -> allows tracking of joints in the body
- Speech SDK can additionally be used for easy speech recognition



Computational Steering



Computational Steering

- Task:
  - Get familiar with the Kinect SDK (Windows SDK recommended)
  - Implement a simplified live visualization using DirectX or OpenGL
  - Find suitable ways to influence the simulation
  - Prepare a nice live demo
- Requirements:
  - Prior knowledge in graphics programming is highly recommended!
- Difficulty:
  - Hard
- Advisor:
  - Sebastian Kuckuk

Project III
Hybrid CPU-/GPU-Parallelization

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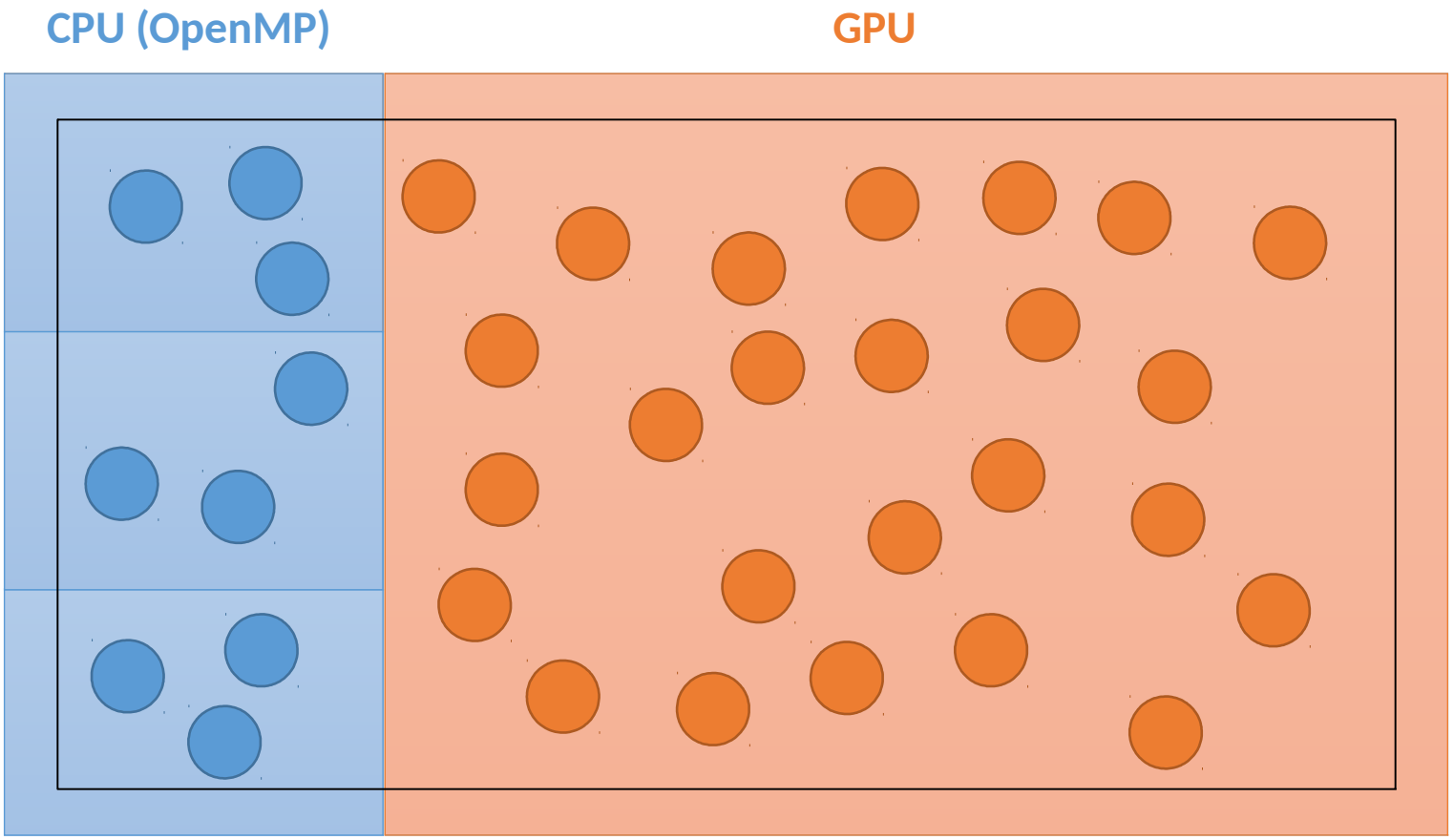
Hybrid CPU-/GPU-Parallelization



Hybrid CPU-/GPU-Parallelization

- Task:
  - Conceptualize and implement strategies for domain partitioning and data exchange
  - Extend your approach to allow dynamic load balancing
  - Compare performance of different configurations
- Requirements:
  - None
- Difficulty:
  - Medium
- Advisor:
  - Sebastian Eibl

Project IV
Distributed Memory Extension

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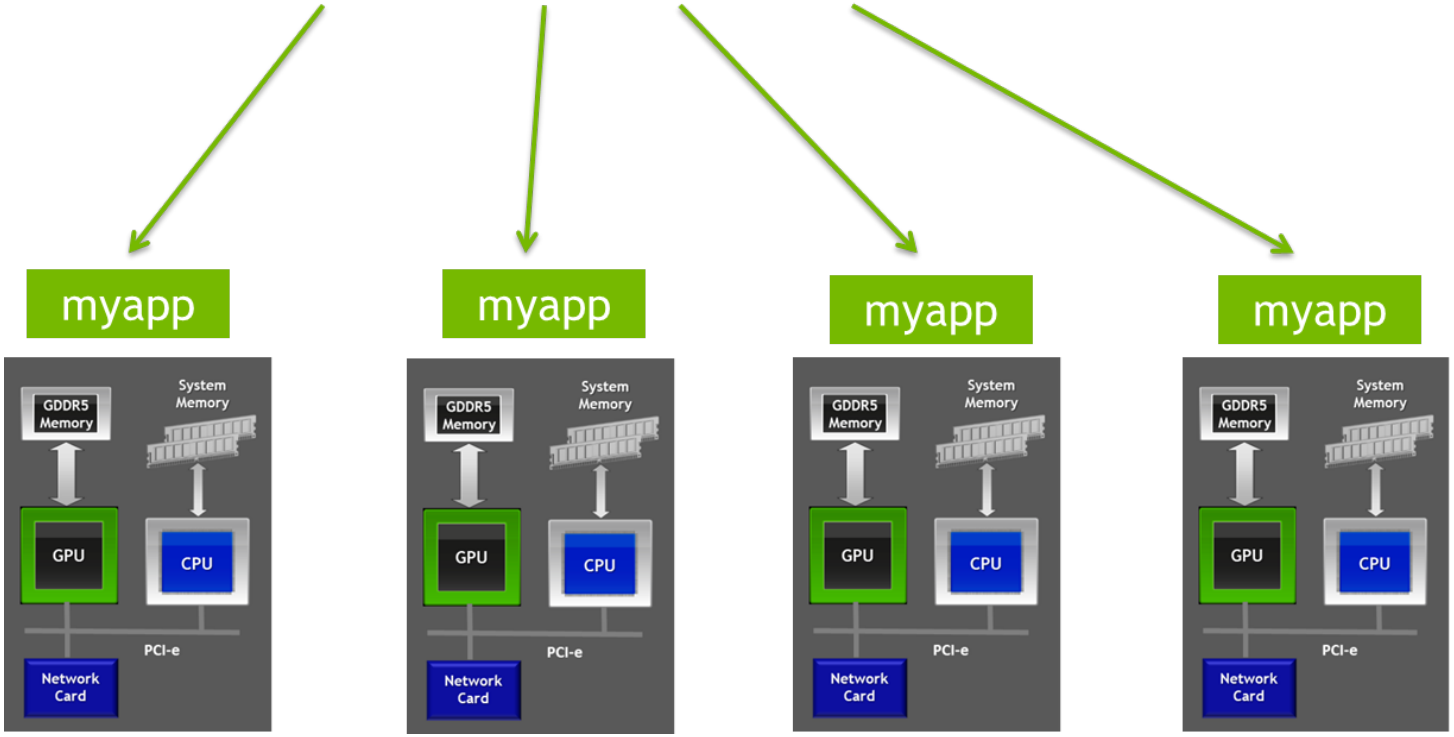
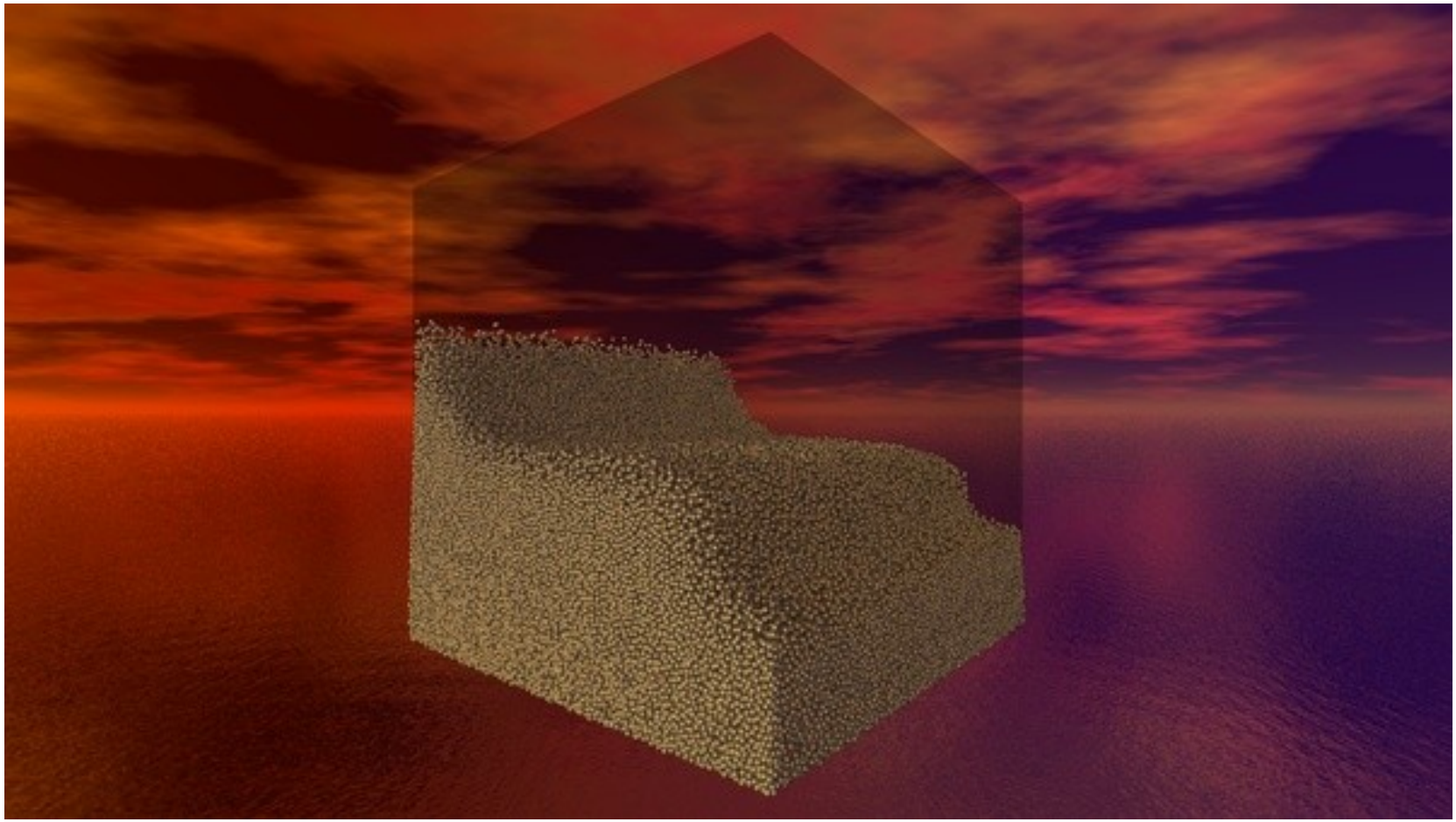
Distributed Memory Extension

```
mpirun -np 4 ./myapp <args>
```



Distributed Memory Extension



Distributed Memory Extension

- Task:
  - Get familiar with ways to combine CUDA (or OCL) and MPI
  - Implement strategies for domain partitioning and data exchange
  - Perform some scaling experiments (e.g. at the LSS cluster)
- Requirements:
  - Prior experience with MPI is recommended
- Difficulty:
  - Hard
- Advisor:
  - Sebastian Kuckuk

Project V
Smoothed Particle Hydrodynamics (SPH)

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Smoothed Particle Hydrodynamics

Smoothed Particle Hydrodynamics

- Task:
  - Implement SPH (reference of your choice)
  - Adapt your acceleration structures
  - Think about suitable visualization techniques (online or offline)
  - Prepare a nice demo
- Requirements:
  - Knowledge about SPH advantageous
- Difficulty:
  - Hard
- Advisor:
  - Sebastian Kuckuk

Project VI
DEM & Rotations & Complex Geometries

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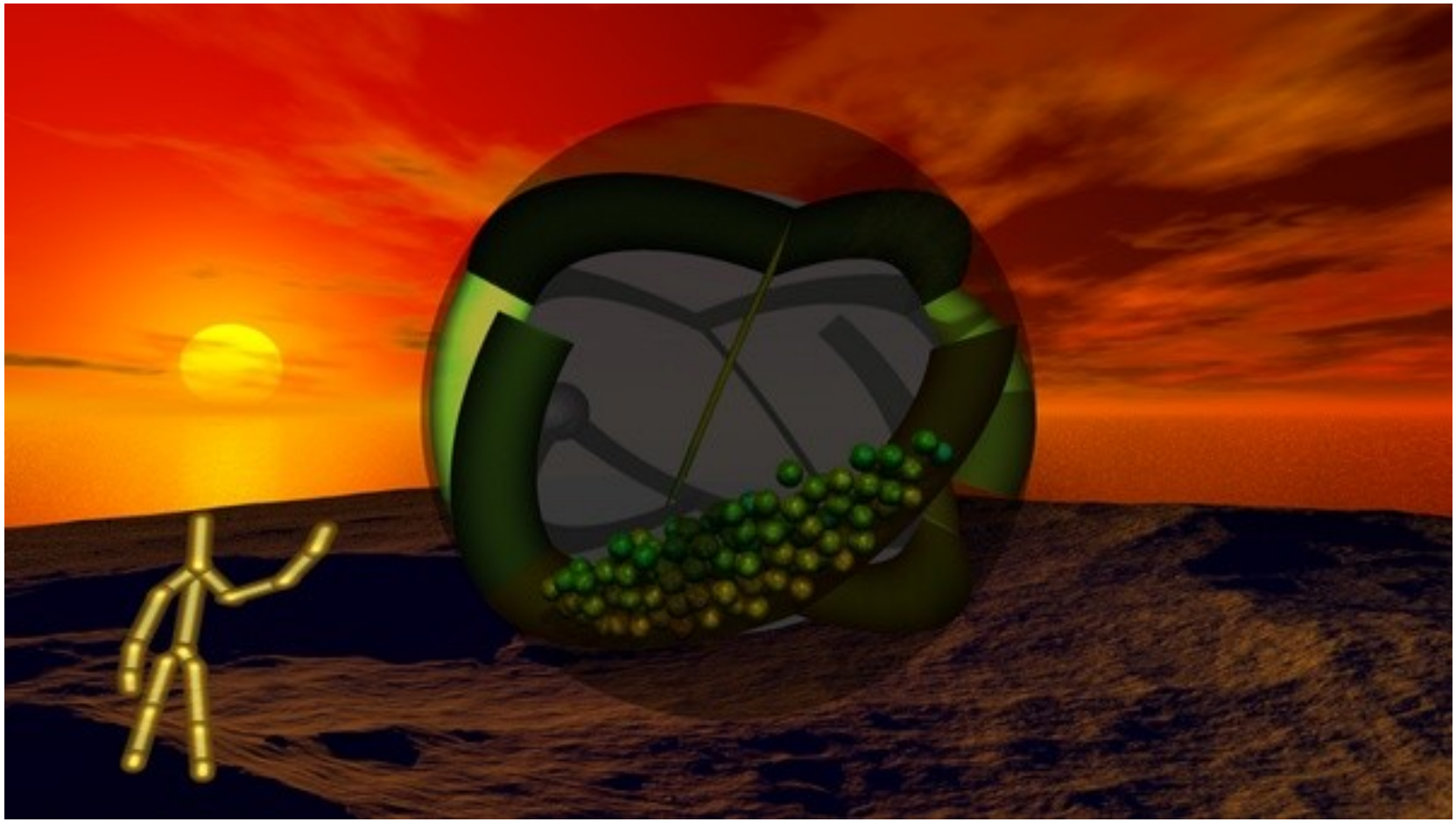
DEM & Rotations & Complex Geometries



DEM & Rotations & Complex Geometries

- Task:
  - Implement the DEM with rotations
  - Implement additional geometries
  - Prepare an interesting test case
- Requirements:
  - No previous knowledge required
- Difficulty:
  - Medium
- Advisor:
  - Sebastian Eibl

Project VII
Cellular Automata

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Cellular Automata

Cellular Automata

- Task:
  - Implement at least three cellular automata on the GPU
  - Think about a simple visualization
  - Prepare a nice (live) demo
- Requirements:
  - No previous knowledge required
- Difficulty:
  - Easy
- Advisor:
  - Chaitanya Dev

Project VIII
Performance Engineering

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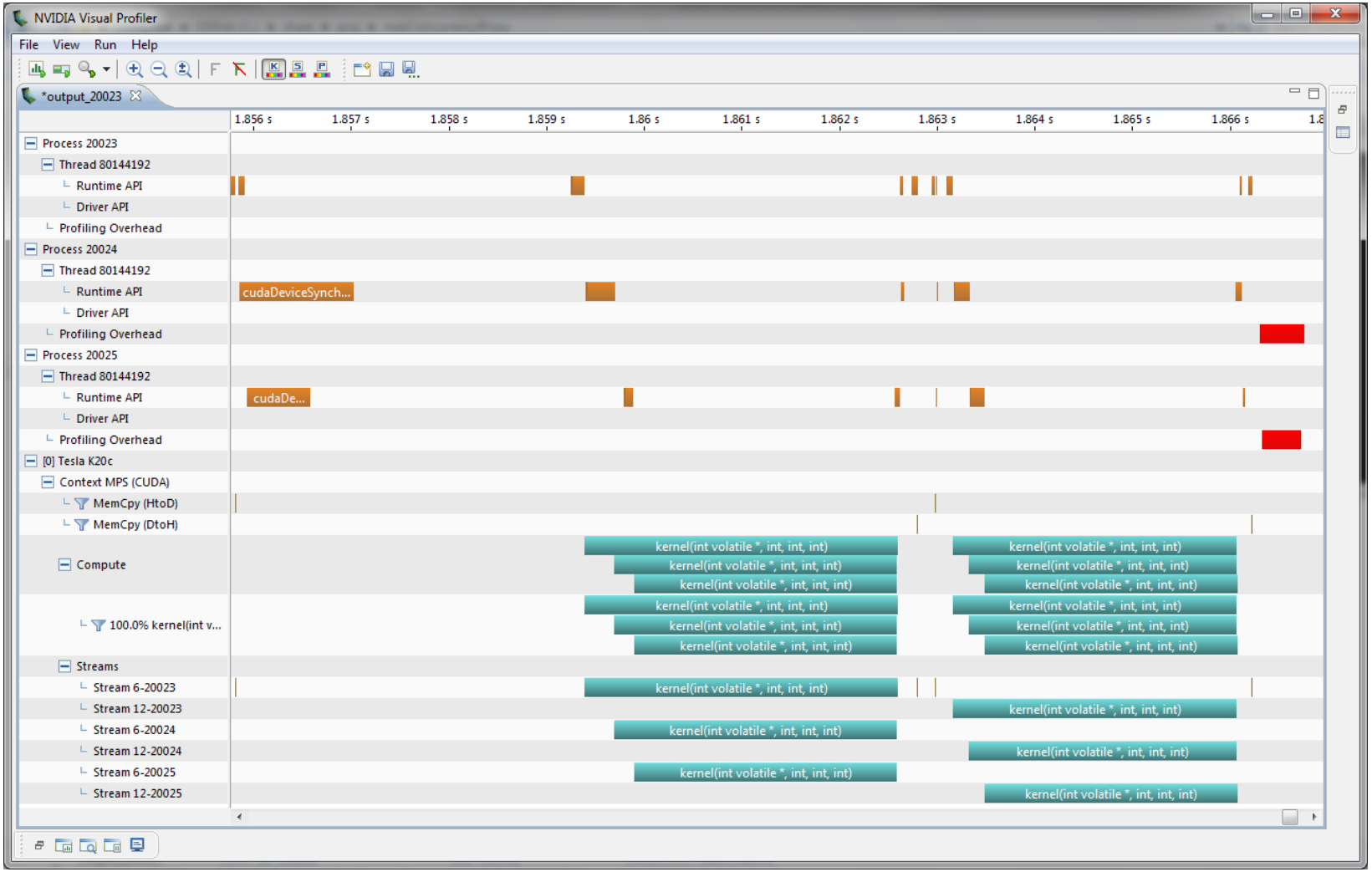
Performance Engineering



Performance Engineering

- Task:
  - Make yourself familiar with GPU profiling
  - Estimate maximum performance of your kernel
  - Profile your kernel
  - Improve your kernel
- Requirements:
  - Previous experience with optimization advantageous
- Difficulty:
  - Medium
- Advisor:
  - Harald Köstler

Project IX
Lattice Boltzmann Method (LBM)

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Lattice Boltzmann Method

Lattice Boltzmann Method

- Task:
  - Implement an LBM solver for GPUs
  - Support arbitrary obstacles
  - Read in your simulation geometries
  - Think about some visualization
- Requirements:
  - Knowledge about LBM advantageous
- Difficulty:
  - Medium
- Advisor:
  - Sebastian Eibl

Project X
Fractal Flames

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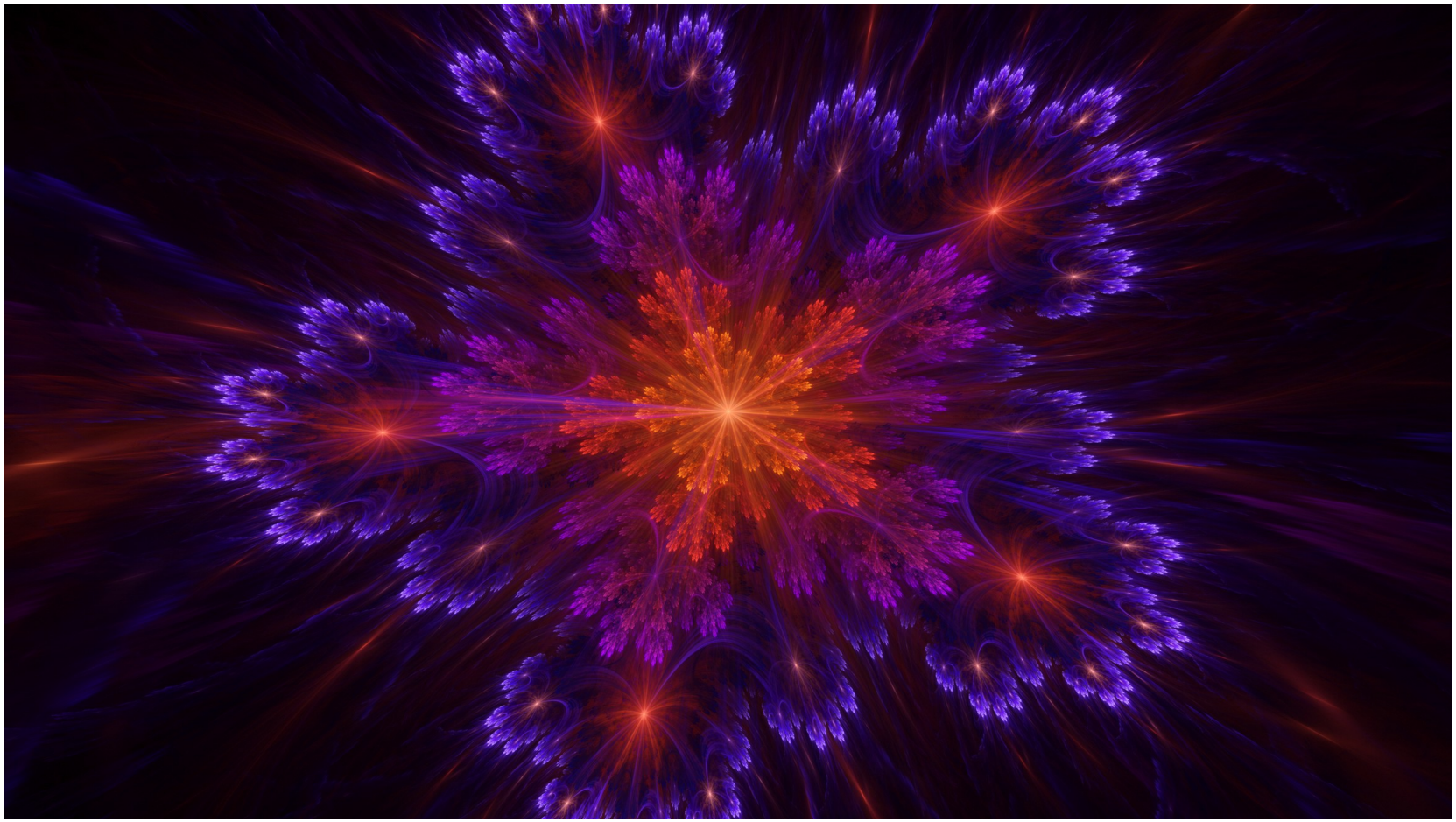
Fractal Flames



Fractal Flames

- Task:
  - Acquaint yourself with the fractal flames algorithm
  - Think about an efficient implementation on the GPU (and do it!)
- Requirements:
  - No special knowledge required
- Difficulty:
  - Medium
- Advisor:
  - Sebastian Eibl

General Remarks

General Remarks

- Project assignment will be done via StudOn
  → First come, first served
- Progress report in 2 weeks (Friday, 22.06.2018)
  → 5 minutes presentation per team
  → 3 slides (2 for the method, 1 about your plan)
- Final presentation at the end of the semester (Friday)
  → 5 minutes per team
  → 3 slides (1 what did you implement, 2 results, live demo)
- Upload your final project via StudOn
- **There will be questions in the exam about the project and which part(s) you were responsible for!**

Thank you for your Attention!

Questions?

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