



# Overview *Advanced GPU Programming* 2023

19-23 April 2023 | Jan Meinke | Forschungszentrum Jülich, Jülich Supercomputing Centre

# Jülich Supercomputing Centre

- Forschungszentrum Jülich
- Part of Institute for Advanced Simulation (IAS), Gauss Centre for Supercomputing (GCS), PRACE, ...
- Operates supercomputers and connected infrastructure
- Researches in next-gen supercomputers
- Supports applications leveraging machines
- Supercomputers
  - JUWELS Cluster, JUWELS Booster
  - JURECA DC
  - DEEP
  - JUSUF

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  - ⇒ **JUPITER**

# Advanced CUDA Course

## About

- CUDA Course seit **2010**
  - Neuer 2023: CUDA Foundations und **Advanced CUDA**
  - Curriculum: Advanced concepts, *modular days*
  - Virtual, 9:00 - 13:00
  - Interaktiver Kurs – viele Hands-ons
- 

## Tutors



**Kaveh Haghghi-Mood**

Accelerating Devices  
Lab (X-Dev), JSC



**Markus Hrywniak**

NVIDIA Application Lab  
at Jülich, NVIDIA



**Jan Meinke**

Computational Science,  
SimLab Biology, JSC



**Andreas Herten**

NVIDIA Application Lab  
at Jülich; X-Dev, JSC



**Jiri Kraus**

NVIDIA Application Lab  
at Jülich, NVIDIA

# Timetable

Session	Day 1	Day 2	Day 3	Day 4	Day 5
M1	Advanced Multi-GPU <i>Jiri</i>	NCCL/NVSHMEM <i>Markus</i>	Coop. Groups/CUDA Graphs <i>Andreas/Jan</i>	CUDA Fortran <i>Kaveh</i>	OpenACC <i>Andreas</i>
	<i>B</i> <i>Coffee Break (10:45 - 11:15)</i>				
M2	Advanced Multi-GPU <i>Jiri</i>	NCCL/NVSHMEM <i>Markus</i>	CUB/Modern C++ <i>Jan</i>	CUDA Fortran <i>Kaveh</i>	pSTL <i>Jan</i>

# Technicalities

- Supercomputer for this course: **JURECA DC**
- Infrastructure for tasks
  - Jupyter-JSC: <https://jupyter-jsc.fz-juelich.de>  
Instabilities? ssh jureca.fz-juelich.de, but SSH key needed
  - Project: training2320; Partition: LoginNode
  - Activate shell environment! *See next slide!*
- Tasks
  - Sorted by session
  - Solutions are always given, you decide how long you tinker before peeking into solutions  
(Hint: The longer, the more benefit you will get from this course!)

# Course Environment

- Log in to JURECA DC
- Start shell
- Every shell: activate environment

```
source $PROJECT_training2320/env.sh
```

- Sets environment variables
- Creates commands, like `jsc-material-sync`  
*and `jsc-material-sync-force`, `jsc-material-reset-01`, ...*
- Needed for tasks, slides!
- **Source now! and sync material**

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- **Source now! and sync material**
- ! Raise hand if logged in & sourced!**

# Let's Get Started!

*Questions?*