Georg-August-Universität Göttingen **Module M.Inf.1829: Practical course in High-Performance Computing**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
The students will be able to • Construct parallel processing schemes from sequential code using MPI and OpenMP • Justify performance expectations for code snippets • Sketch a typical cluster system and the execution of an application • Characterize the scalability of a parallel application based on observed performance numbers • Analyze the performance of a parallel application using performance analysis tools • Describe the development and executions models of MPI and OpenMP • Construct small parallel applications that demonstrate features of parallel applications • Demonstrate the usage of an HPC system to load existing software packages and to execute parallel applications and workflows • Demonstrate the application of software engineering concepts	Attendance time: 56 h Self-study time: 124 h

Course: M.Inf.1829.Lab **Practical course in High-Performance Computing (PCHPC)** (Block course)	4 WLH
Contents: High-Performance Computing is the field that allows us to utilize the combined resources of 1000's of computers. Applications can utilize this compute power to solve research questions at the frontier of science but also solve important questions for our daily lives such as a weather forecast. *Teaching und learning methods:* This practical course is comprised of two parts: firstly, a crash course on the basics of High-Performance Computing is delivered during a one-week tutorial. In a hands-on experience, it covers the theoretical knowledge regarding parallel computing, high-performance computing, supercomputers, and the development and performance analysis of parallel applications. Practical demonstrations encourage you to utilize the GWDG cluster system to execute existing parallel applications, to start developing your own parallel application using MPI and OpenMP, and to analyze the performance of these applications to ensure they run efficiently. During this week, we will use group works and small exercises to foster the training. We will start forming a learning community that will blend into the second part of the course. Equipped with this experience, in the second part, you will team up in groups of two and parallelize a non-trivial problem of your choice. Firstly, you will decide upon a problem you like to solve, then you create a sequential solution to this problem, and lastly, you apply the experience of the block course to parallelize and analyze the scalability of the application.	

The results will be shared with the peers in a presentation at the end of the term, and documented in a report - these components will be assessed and marked. *Remark:* If you like to prepare for the topic early, we can hand out a topic during the lecture free time before the term - just contact us.	
Examination: Presentation (15 min) and report (max 15 pages) for student project M.Inf.1829.Mp: Practical course in High-Performance Computing **Examination prerequisites:** Participation in the block seminar **Examination requirements:** Report (70%) and final presentation (30%)	6 C

Admission requirements: none	**Recommended previous knowledge:** • Programming experience in C++, C or Python • Parallel programming concepts • Linux
Language: English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	