Symposium Numerik (SYNU)

gemeinsam veranstaltet
vom Fachverband Extraterrestrische Physik (EP),
vom Fachverband Gravitation und Relativitätstheorie (GR),
vom Fachverband Theoretische und Mathematische Grundlagen der Physik (MP) und
von der Astronomischen Gesellschaft e.V.

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Übersicht der Hauptvorträge und Fachsitzungen

(Hörsaal HS 2)

Hauptvorträge

SYNU 1.1	Do	16:30–17:00	HS 2	**Trends in Numerical Mathematics** — •Wolfgang Hackbusch
SYNU 1.2	Do	17:00–17:30	HS 2	**Challenges in Numerical Astrophysics: Modeling the Formation of Stars** — •Ralf Klessen
SYNU 1.3	Do	17:30–18:00	HS 2	**Black Holes on the Computer** — •Thomas Baumgarte
SYNU 1.4	Do	18:00–18:30	HS 2	**Astrophysical simulations of gas dynamics with ionising radiation transport** — •Jonathan Mackey

Fachsitzungen

SYNU 1.1–1.4	Do	16:30–18:30	HS 2	**Numerik**

SYNU 1: Numerik

Zeit: Donnerstag 16:30–18:30 Raum: HS 2

Hauptvortrag SYNU 1.1 Do 16:30 HS 2

Trends in Numerical Mathematics — •Wolfgang Hackbusch — Max-Planck-Institut für Mathematik in den Naturwissenschaften, Leipzig, Germany

I shall give an overview about present activities in Numerical Mathematics/Scientific Computing. According to my interest, I shall focus on the treatment of (in particular elliptic) partial differential equations: discretisation techniques, adaptive refinement, error control, and solution techniques. Another aspect is the treatment of large, fully populated matrices and of high-dimensional problems.

Hauptvortrag SYNU 1.2 Do 17:00 HS 2

Challenges in Numerical Astrophysics: Modeling the Formation of Stars — •Ralf Klessen — Zentrum für Astronomie der Universität Heidelberg

Many recent developments in theoretical astrophysics are driven by advances in numerical simulation techniques and by the ever improving capabilities of modern supercomputers. I will discuss some of the challenges in the field that result from the intrinsic multi-scale and multi-physics nature of the processes that govern the formation and evolution of cosmic structures. I will focus on the physical processes that initiate and regulate the birth of stars in the early Universe as well as in galaxies such as our Milky Way today. Stars form by gravoturbulent fragmentation of interstellar gas. The supersonic turbulence ubiquitously observed in the Galaxy generates strong density fluctuations with gravity taking over in the densest and most massive regions. Collapse sets in to build up stars and star clusters. Turbulence plays a dual role. On global scales it provides support, while at the same time it can promote local collapse. This process is modified by the thermodynamic response of the gas, which depends on the intricate interplay between various heating and cooling processes. To model the dynamical evolution of the interstellar medium, it is necessary to couple the equations of magnetohydrodynamics with time-dependent chemistry and at the same time follow the interaction with the interstellar radiation field. To do so fully consistently is beyond our current capabilities, so the search for acceptable and computationally feasible approximations is an essential ingredient of modern computational astrophysics.

Hauptvortrag SYNU 1.3 Do 17:30 HS 2

Black Holes on the Computer — •Thomas Baumgarte — Bowdoin College, Brunswick, ME 04011, USA — Max-Planck-Institut für Astrophysik, Karl-Schwarzschild-Str. 1, 85748 Garching, Germany

In this talk I will provide a broad overview of some recent developments in numerical relativity. I will highlight some of the great successes of the field, including simulations of coalescing black holes, will review some of the methods and techniques used in these simulations, and will discuss some new advances and approaches.

Hauptvortrag SYNU 1.4 Do 18:00 HS 2

Astrophysical simulations of gas dynamics with ionising radiation transport — •Jonathan Mackey — Argelander-Institut für Astronomie, Universität Bonn, Bonn, Deutschland

I will introduce the code "PION" developed for astrophysical magnetohydrodynamics with radiative transfer of ionising photons. Both implicit and explicit time-integration algorithms have been implemented in PION, and their relative strengths and weaknesses will be demonstrated. The accuracy and convergence rates of the different algorithms are quantified. The explicit algorithm is more efficient than the implicit algorithm and its parallel scaling is significantly better, running with >50 per cent efficiency on hundreds of cores. I will show results obtained with PION from 3D simulations of the dynamics of photoionised regions around massive stars moving supersonically through their surroundings. The results are compared to the surroundings of the nearby runaway massive star Zeta Ophiuchi.