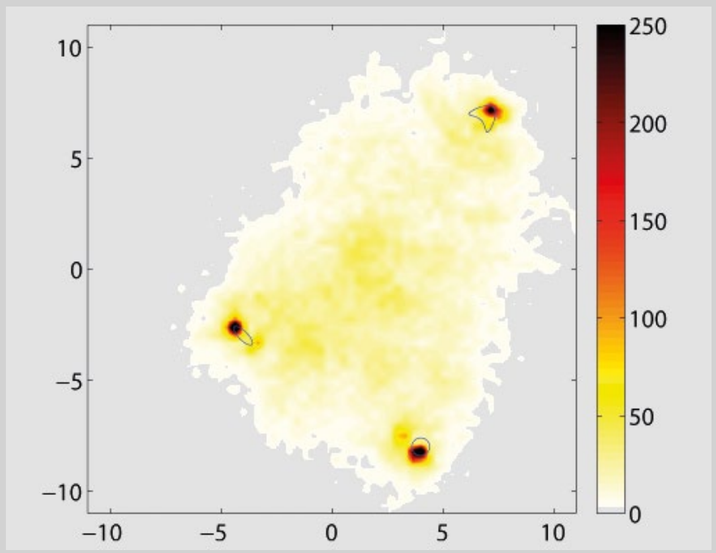

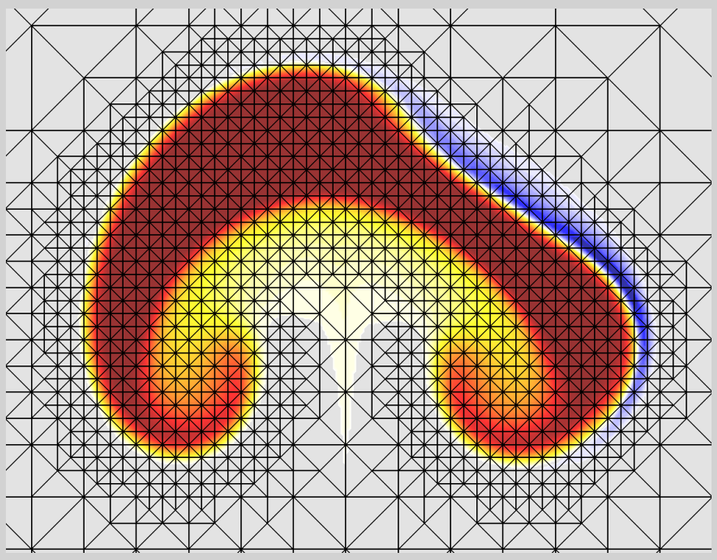

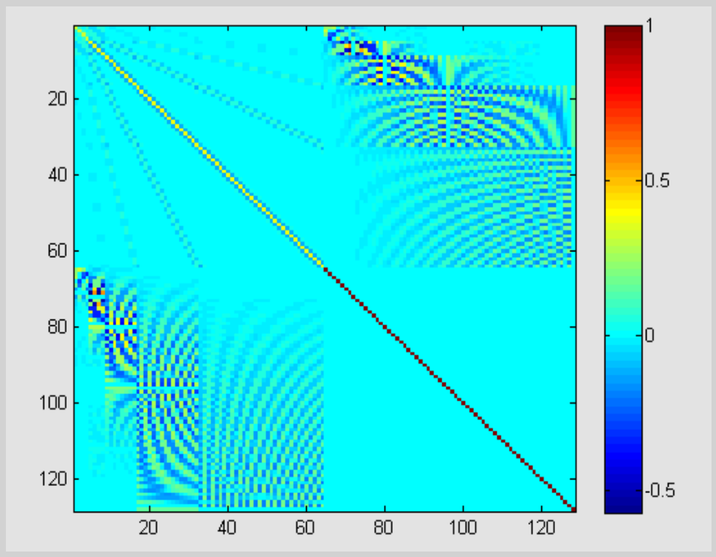

Oberseminar Numerik

Prof. Dr. Alexander Kurganov
(Southern University of Science and Technology, Shenzhen, China)

am 20.11.24
um 10:15 Uhr
im Hilbertraum (Raum 05-426)
Staudingerweg 9, 55128 Mainz

„Locally Divergence-Free Path-Conservative Central-Upwind Schemes for Ideal and Shallow Water Magnetohydrodynamics “

Abstract:

I will present semi-discrete path-conservative central-upwind (PCCU) schemes for ideal and shallow water magnetohydrodynamics (MHD) equations. These schemes possess several important properties: they locally preserve the divergence-free constraint, they do not rely on any (approximate) Riemann problem solver, and they robustly producehigh-resolution and non-oscillatory results. The derivation of the schemes is based on the Godunov-Powell nonconservative modifications of the studied MHD systems. The local divergence-free property is enforced by augmenting the modified systems with the evolution equations for the corresponding derivatives of the magnetic field components. These derivatives are then used to design a special piecewise linear reconstruction of the magnetic field, which guarantees a non-oscillatory nature of the resulting scheme. In addition, the proposed PCCU discretization accounts for the jump of the nonconservative product terms across cell interfaces, thereby ensuring stability.

I will also discuss the extension of the proposed schemes to magnetic rotating shallow water equations. The new scheme is both well-balanced and exactly preserves the divergence-free condition of the magnetic field. The well-balanced property is enforced by applying a flux globalization approach within the PCCU scheme. As a result, both still- and moving-water equilibria can be exactly preserved at the discrete level. The proposed PCCU schemes are tested on several benchmarks. The obtained numerical results illustrate the performance of the new schemes, their robustness, and their ability not only to achieve high resolution, but also preserve the positivity of computed quantities such as density, pressure, and water depth. The talk is based on joint works with Alina Chertock (North Carolina State University, USA), Michael Redle (RWTH Aachen University, Germany),Kailiang Wu (Southern University of Science and Technology, China) and Vladimir Zeitlin (Sorbonne University, France).

Hierzu sind alle herzlich eingeladen.

AG Numerik
Institut für Mathematik
Staudingerweg 9
55128 Mainz

Sekretariat:
burkertb@mathematik.uni-mainz.de

TRR 146

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

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