# NEWSLETTER

## *of the* Work Group Mathematical Fluid Mechanics

*Newsletter no. 8 (2024)*

## Simon Markfelder's paper accepted

The paper *D. W. Boutros, S. Markfelder, E. S. Titi: "Nonuniqueness of generalised weak solutions to the primitive and Prandtl equations"* (see also *here*) has been accepted for publication in the Journal of Nonlinear Science by Springer Verlag.

In this paper solutions to systems of multi-dim. equations coming from geophysical models are shown to ***not*** conserve energy for a generalized notion of weak solutions.

## Paper with Yunguang Lu accepted

The article *Yun-guang Lu, Christian Klingenberg, Xiangxing Tao "Global Existence of Entropy Solutions for Euler Equations of Compressible Fluid Flow"* has been accepted for publication by Mathematische Annalen (Springer Verlag).

Existence of global weak entropy solutions to the Cauchy problem for the Euler equations of one-dim. compressible fluid flow is shown. The method of artificial viscosity coupled with the theory of compensated compactness is used, where four families of Lax entropy-entropy flux pair are constructed by means of the classical Fuchsian equation.

The Journal *Mathematische Annalen* is a venerable journal whose managing editor at one time was David Hilbert.

## Our visit to Shanghai

The *19th Conference on Hyperbolic Problems: Theory, Numerics and Applications (HYP 2024)* took place July 1 - 5, 2024 in Shanghai at Shanghai Jiao Tong University. Lena Baumann, Kathrin Hellmuth and myself traveled there.

Kathrin and myself went the week before to visit Shi Jin's Institute of Natural Sciences at the same university. There we worked with Min Tang and Hepeng Zhang on designing experiments for moving algae, so that we can determine the collision kernel of a kinetic model of these algae. During that week we met other visitors of the institute, like Benoit Perthame.

For the 2nd week Lena joined us for HYP2024. All three of us gave contributed presentations of our work that were well attended. A number of lectures of the conference were excellent, covering the whole breadth of the field of hyperbolic equations, making this a worthwhile conference.

Visit to Yuyuan Garden in Shanghai (*see here*) with Lean Baumann and Kathrin Hellmuth

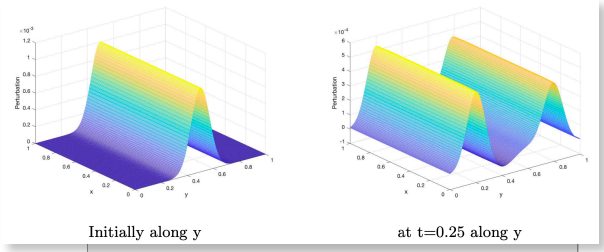
## Jan Giesselmann will visit us

*Jan Giesselmann* from Darmstadt University will visit us on Thursday, August 29 for the whole day. He works on the numerical analysis of conservation laws.

## Paper with Yu-Chen Cheng submitted

The article *Yu-Chen Cheng, Christian Klingenberg, Rony Touma: "A Well-Balanced Method for an Unstaggered Central Scheme, the two-space Dimensional Case"* has been submitted for publication.

This article introduces 2-dim. well-balanced central scheme by combining the Kurganov-Tadmor scheme with the so-called deviation method.

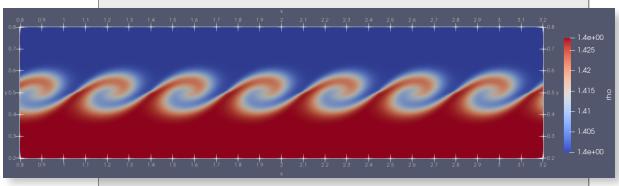



Simulation of a 2-d unidirectional small perturbation of a background equilibrium that is kept well balanced on a 200 × 200 grid

## Marius Volpert submitted his Master thesis

Marius Volpert has submitted his Master thesis *"Adapting an invariant domain preserving numerical scheme for the Euler equations to low Mach numbers"*

He has modified the DEAL II implementation of the Guermond finite element scheme for the 2-d Euler equations so that it can handle low Mach flow. He achieved this using an IMEX approach.



Simulation of a Kelvin-Helmholtz instability at Mach number $10^{-2}$ by Marius Volpert using his 1st order IMEX implementation of Guermond's method.

## Leon Jakobi submitted his Bachelor thesis

Leon Jakobi has submitted his Bachelor thesis "Finite-Volume Methods for the Shallow-Water Equations". In this thesis he gives a nice introduction into the derivation of shallow water models and its numerical discretization.

## Upcoming scientific conferences

Click on the links and check where you might want to participate.

- July 8 - 11, 2024: *Modern Perspectives in Applied Mathematics: Theory and Numerics of PDEs* in Zürich, organized by Sid Mishra

- Aug. 26 - 30, 2024: *11th International Conference on Multi-Material Fluid Flow (MultiMat 2024)* in Colorado, USA, organized by the Lawrence Livermore National Laboratory, USA

- Sept. 9 - 13, 2024: *Conference on high-order nonlinear numerical methods for evolutionary PDEs* (HONOM2024) on the Crete Island, Greece, organized by Elena Gaburro

- Sept. 25 - 27, 2024: *Annual Meeting of the German-Speaking Inverse Problems Society 2024*, in Siegen (Germany)

- Nov. 4 - 7, 2024: "Numerical Methods for the Kinetic Equations of Plasma Physics" in Garching, Germany, organized by Eric Sonnendrücker

- March 3 - 7, **2025**: *SIAM Conference on Computational Science and Engineering (CSE25)*, in Fort Worth, Texas, USA

- June 9 - 13, 2025: *Numerical methods for hyperbolic problems 2025* (NumHyp25), in Darmstadt, organized by Jan Giesselmann and others

- Sept. 14 - 20, 2025: Hirschegg Workshop, in the Kleinwalsertal, Austria, organized by Gerald Warnecke and others

- fall of 2025: SIAM Conference on Analysis of Partial Differential Equations (PD25), somewhere in the USA

- sometime in **2026**: Finite Volume and Complex Applications 11, in Münster, Germany

## NumKin24

The workshop "Numerical Methods for the Kinetic Equations of Plasma Physics", will be held November 4 - 7 in Garching and is run by Eric Sonnendrücker.

## NumHyp25

The bi-yearly NumHyp (*Numerical Methods for Hyperbolic Problems*) is a mainly European conference. The next one will take place June 9 - 13, 2025 in Darmstadt, Germany, organized by Jan Giesselmann and others.

## Hyunju Kwon will visit us

In late October *Hyunju Kwon* from the ETH Zürich plans to visit us. She works on the theory of multidimensional conservation laws.