NEWSLETTER

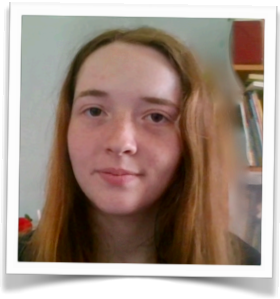
of the Work Group Mathematical Fluid Mechanics

Newsletter no. 5 (2021)

Series of internal seminars begins with lecture by Claudius Birke

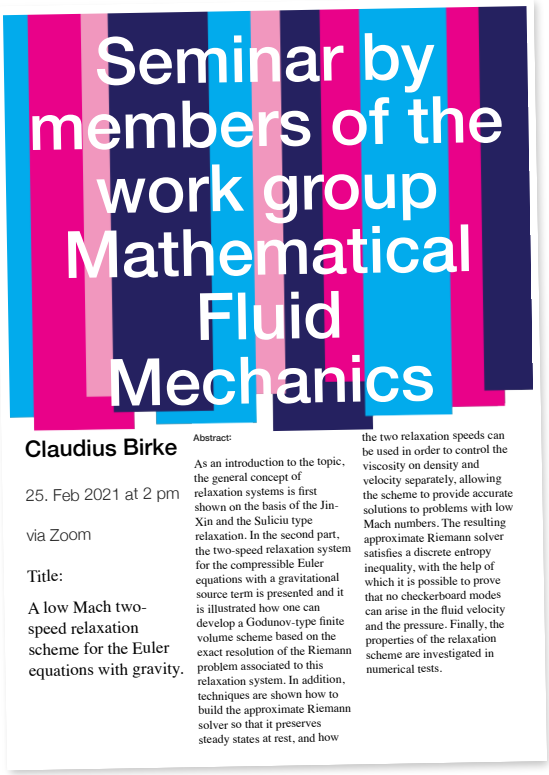
We have not had seminars by member of our work group since the Oberseminar series "*Hyperbolic Problems …*" began in September 2020. I would like to rectify that. On Thursday, Feb. 25 at 2 pm Claudius Birke will begin with a lecture on his work. I hope eventually most members of the work-group will have a chance to give a seminar lecture.

Eva Horlebein receives PhD scholarship by the Studienstiftung



Eva Horlebein had applied to the *Studienstiftung des deutschen Volks* to be accepted as a PhD fellow. After having passed two rounds of discussions with mathematics professors chosen by the Studienstiftung, she has now been accepted with a PhD scholarship.

Back when she applied for the Studienstiftung, she had also applied for and then in January was awarded a PhD stipend by the Heinrich Böll Stiftung. Eva will now relinquish this in favor of the Studienstiftungs stipend.



Seminar by members of the work group Mathematical Fluid Mechanics

Claudius Birke

25. Feb 2021 at 2 pm

via Zoom

Title:

A low Mach two-speed relaxation scheme for the Euler equations with gravity.

Abstract:

As an introduction to the topic, the general concept of relaxation systems is first shown on the basis of the Jin-Xin and the Suliciu type relaxation. In the second part, the two-speed relaxation system for the compressible Euler equations with a gravitational source term is presented and it is illustrated how one can develop a Godunov-type finite volume scheme based on the exact resolution of the Riemann problem associated to this relaxation system. In addition, techniques are shown how to build the approximate Riemann solver so that it preserves steady states at rest, and how the two relaxation speeds can be used in order to control the viscosity on density and velocity separately, allowing the scheme to provide accurate solutions to problems with low Mach numbers. The resulting approximate Riemann solver satisfies a discrete entropy inequality, with the help of which it is possible to prove that no checkerboard modes can arise in the fluid velocity and the pressure. Finally, the properties of the relaxation scheme are investigated in numerical tests.

Paper featured

In G. Bae, C. Klingenberg, M. Pirner, S. Yun: *BGK model of the multi-species Uehling Uhlenbeck equation published in Kinetic & Related Models, 2021, 14 (1)* a kinetic model is proposed for quantum particles. This involves a generalized Maxwellian that makes existence proofs quite difficult. In this paper a multi-species model is discussed.

$$\frac{1}{e^{m_2 a(x,t)\left|\frac{p}{m_2}-b(x,t)\right|^2+c_2(x,t)}\pm 1}$$

The Maxwellian for Fermions (+) and Bosons (-). Notice the ± 1 is added to a more or less usual Maxwellian (here the p is almost like velocity).

Upcoming scientific conferences

I try to keep this list up-to-date. I encourage you to click the links and check, where you may want to participate.

2021:

- March 1 - 5: Oberwolfach: *Hyperbolic Balance Laws: modeling, analysis, and numerics*, organized among others by Remi Abgrall and Maria Lukacova

- March 1 - 5, *SIAM Conference on Computational Science and Engineering*, online

-March 22- 26: *Kinetic Equations: From Modeling, Computation to Analysis*, in Marseille, France, organized by Shi Jin (still in its planning stage)

- April: *Nils-Henrik Risebro's birthday conference* in Oslo, Norway (still in its planning stage)

- May 24 - 28: *The Legacy of Carlo Cercignani: from Kinetic Theory to Turbulence Modeling* Milan, Italy, organized among others by Tommaso Ruggeri

- June 21 - 24: *SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS21)*, in Milan, (still in its planning stage)

- July 2: *18th International Conference on Hyperbolic Problems, Theory, Numerics, Applications* - Part 1 (formerly HYP 2020), one day online with lectures by Dafermos and others

- July 5 - 9: *THE BOLTZMANN EQUATION: IN THE TRAIL OF TORSTEN CARLEMAN*, near Stockholm, Sweden

- July 12 - 16: *International Conference on Spectral and Higher Order Methods* ICOSAHOM 2020, Vienna (online only), Wasilij and myself plan to run a mini-symposium there

- fall: Special program on Numerical Methods for Nonlinear Hyperbolic PDEs; at SUSTech, Shenzhen, China: organized by Alex Kurganov (still in its planning stage)

2022:

- some time in spring: *HIGH ORDER NONLINEAR NUMERICAL METHODS FOR EVOLUTIONARY PDEs: THEORY AND APPLICATIONS (HONOM)* in Braga, Portugal, organized by Raphael Loubère und Stephane Clain

- end of May: *Sharing Higher-order Advanced Research Know-how on Finite Volume (SHARK-FV)* in Portugal, organized by Raphael Loubère und Stephane Clain (still in its planning stage)

- June 20 - 25: HYP2022:*18th International Conference on Hyperbolic Problems, Theory, Numerics, Applications* - Part 2 (formerly HYP 2020), in Malaga, Spain, organized by Carlos Pares

- July 18 - 22, 2022: *When Kinetic Theory meets Fluid Mechanics*, Zürich

- Sept. 5 - 9, 2022: *10th International Conference on Numerical Methods for Multi-Material Fluid Flow (MULTIMAT 2021)* in Zürich, organized by Remi Abgrall