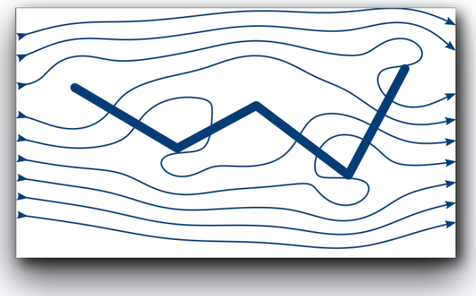
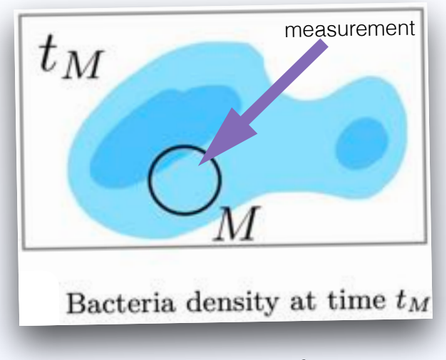
Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Mathematical Fluid Mechanics
Christian Klingenberg



areas of research:



measurements for a model of bacterial growth

- *completing PDE models using measurements, inverse problems, machine learning numerics*

numerics of partial differential equations

- *structure preserving numerical schemes for Euler and MHD - applications in astrophysics*

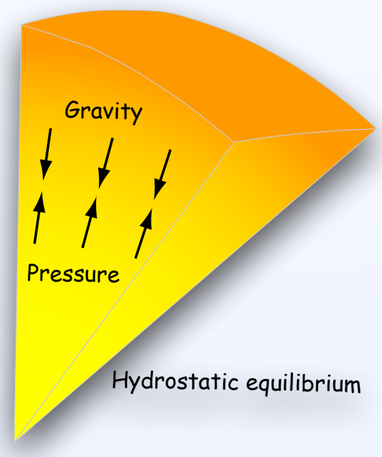
numerical *simulation of an evolving galaxy*

- *kinetic and plasma theory and numerics*

theory of partial differential equations

- *theory of hyperbolic conservation laws*

shock formation



Boltzmann

$$\partial_t \rho + \nabla \cdot (\rho \mathbf{u}) = 0,$$
$$\partial_t (\rho \mathbf{u}) + \nabla \cdot (\rho \mathbf{u}\mathbf{u}) + \nabla P = \rho \mathbf{a},$$
$$\partial_t (\rho E) + \nabla \cdot (\rho E \mathbf{u} + P\mathbf{u}) = \rho \mathbf{u} \cdot \mathbf{a},$$

the Euler equations of compressible gas dynamics w. gravity

get to know our research

- by joining my seminars:

- *Seminar angewandte Analysis (Bachelor)*
- *Seminar angewandte Analysis und numerische Mathematik (Master)*
- *Oberseminar mathematische Strömungsmechanik* (open to all students)

- by attending my courses

- *WS 22/23: Mathematics of Machine Learning (Master)*

visitors to our work group

Michael Dumbser (Italy)
Alexander Kurganov (China)
Eduard Feireisl (Prague)
Praveen Chandrashekar (India)
Philippe Helluy (Strasbourg)
Nils-Henrik Risebro (Oslo)
Gabriella Puppo (Italy)

the workgroup

professors closely associated with us:

Fritz Röpke (astrophysics)
Qin Li (Madison, Wisc. USA)
Lukas Einkemmer (Innsbruck, Österreich)
Matthias Maier (Texas A&M, USA)

postdoc:

Marlies Pirner

doctoral students:

Lena Baumann
Claudius Birke
Kathrin Hellmuth
Eva Horlebein
Jayesh Badwaik

writing their Master thesis:

Christine Barko
Moritz Beck
Yu-Chen Cheng
Gerhard Dill
Amelie Gehring
Kaja Jurak
Luis Kaiser
Veronika Mayerhofer
Sebastian Schmidt
Marius Volpert

writing their Bachelor thesis:

Sophie Lauer
Christopher Schäfer
Tim Winkler

topics of recent and of ongoing theses

doctoral theses:

Lena Baumann: An efficient numerical approach applied to inverse problems for kinetic equations
Jayesh Badwaik: moving mesh method in 2d & uncertainty quantification
Claudius Birke: ideal magnetohydrodynamics, low Mach & well-balanced schemes, astrophysical applications - joint project with Fritz Röpke (Heidelberg)
Kathrin Hellmuth: determine coefficients of PDE models by using measurements, inverse problems
Eva Horlebein: convergence of approximate solutions to the compressible multi-dimensional Euler equations
Sandra Warnecke: Numerical schemes for multi-species BGK equations based on a variational procedure
Farah Kanbar: Asymptotic and Stationary Preserving Schemes for Kinetic and Hyperbolic Partial Differential Equations
Andrea Thomann: Numerical methods for all-speed flows for the Euler equns.

Master theses:

Christine Barko: modeling flow in a Tokamak: the semi-Lagrange method for kinetic equations
Veronika Mayerhofer: modeling flow in a network of channels, uncertainty quantification (jointly with Ulrik Fjordholm, Oslo)
Kaja Jurak: the inverse problem for chemotaxis with birth and death rates in the Bayesian setting
Marius Volpert: implementing an invariant domain preserving algorithm for the Euler equations that is low Mach
Luis Kaiser: numerical wave propagation aided by machine learning
Claudia Knorr: On numerical methods for astrophysical flow" (numerical parameter study with the astrophysics code by Fritz Röpke)
Carolin Apfel (als Praktikantin bei der Deutschen Bank): *Stochastische Modelle zur Bewertung von Zinsderivaten*

Bachelor theses:

Sophie Lauer: singuläre Grenzwerte der kompressiblen Eulergleichungen
Christopher Schäfer: gage-gravity duality: anti-de Sitter / conformal field theory correspondence
Nadia Jammal: *On modeling Tsunami waves*

for more information, visit my homepage:

Oct 2022