Thematic Einstein Semester

ENERGY-BASED MATHEMATICAL METHODS FOR REACTIVE MULTIPHASE FLOWS

Winter Semester 2020/21

Technische Universität Berlin &
Weierstrass Institute

Organized by
Volker Mehrmann, Alexander Mielke,
Dirk Peschka, Marita Thomas,
Barbara Wagner

Supported by the Einstein Foundation Berlin

Berlin Mathematics Research Center
MATH+

Kick-off Conference
Energy-based mathematical methods for reactive multiphase flows
October 26–30, 2020
TU Berlin
Save the date!

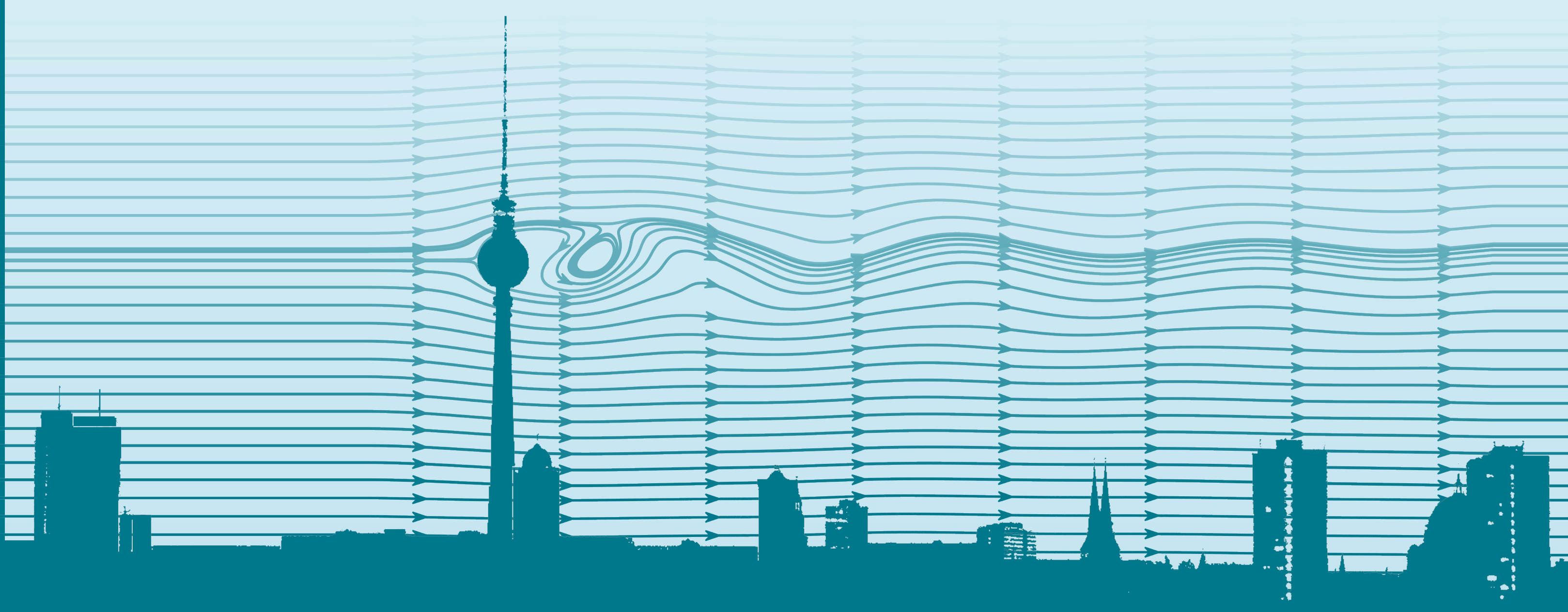
Student Compact Course
October 12–23, 2020
TU Berlin / WIAS

TES–BMS Semester
Integration into BMS semester via jour fixe and student projects
Winter Semester 2020/2021
TU Berlin / WIAS
Limited number of scholarships available!

Closing Conference
February 22–26, 2021
TU Berlin / WIAS
Save the date!

Several Smaller 3-day Workshops
Jointly with SPP 2171, SFB 1114, SPP 1984
Dates to be announced

For more details visit: **www.wias-berlin.de/events/TESenergy**



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Since the early works of Lagrange and Hamilton for classical mechanics and Rayleigh and Helmholtz for dissipative processes, energetic variational methods for fluids and solids have been developed extensively. The relation to underlying microscopic stochastic models was pioneered by Onsager leading to his celebrated reciprocal relations. However, most systematic developments concerned either purely conservative Hamiltonian systems or purely dissipative gradient systems. In the last two decades, a unification of these two extremes was addressed by developing concepts for systems combining both systems. More recently, these topics evolved into mathematical theories such as GENERIC and port-Hamiltonian structures. Corresponding thermodynamical structures are advantageous from the modeling point-of-view and for the design of efficient numerical schemes. However, different communities have developed own languages and specific mathematical methods that are not always accessible for non-experts.

This Thematic Einstein Semester will bring together scientists from different communities to develop synergies between the different approaches. The mathematical community could contribute (to) the structural analysis of flowing systems concerning, for example, the geometry of thermodynamic systems, functional analytical frameworks for partial differential equations, description of bulk-interface coupling, connection to microscopic/stochastic models, construction of structure-preserving numerical schemes, model reduction or modular modeling. Communication with applied material research communities in mathematics, physics and engineering will cover diverse material systems such as, for example, reactive flows, porous medium flow, hydrogels, electrolytes, colloidal and non-colloidal suspensions, nematic materials, and beyond, where thermodynamic descriptions play an important role.