

Wolfgang Pauli Institut (WPI) jointly with **research platform MMM**
„Mathematics-Magnetism-Materials“ & **Fak. Mathematik, Universität Wien**

PAULI Symposium on *Mathematics for Meteorology*

Time: Tuesday, 24. June 2025, 10h – 12h, and 14h15 – 16h00

Place: Skylounge, 12th floor, Oskar-Morgenstern-Platz 1, 1090 Wien

0) 10h00 – 10h05 : **Welcome** : Norbert J **Mauser** (U.Wien & WPI)

Introduction : Rupert **Klein** (FU Berlin & WPI)

1) 10h05 – 10h55 : **Peter Spichtinger** (Inst. Atmospheric Physics, U. Mainz)

"Ice clouds as nonlinear oscillators"

Abstract Ice clouds are, as all clouds, important components of the Earth-Atmosphere system, e.g., influencing the energy budget of the system via interaction with radiation. However, our understanding of ice clouds in the low temperature regime ($T < 235\text{K}$) is still limited. For investigating ice clouds in a mathematically consistent way, we derive a three dimensional system of ordinary differential equations and use methods from theory of dynamical systems to analyze this system. Surprisingly, the system results into a nonlinear oscillator with two Hopf bifurcations and some other symmetries. Although the model is quite simple, the agreement with real measurements is quite good, so it might be used for further investigations, e.g., in terms of coupled oscillators or nonlinear forcings.

.) 10h55 – 11h10 : **CoffeeTea & Cake**

2) 11h10 – 12h : **Edriss Titi** (DAMTP, U. Cambridge)

"The Navier-Stokes, Euler and Other Related Geophysical Equations"

Abstract In this talk I will present the most recent advances concerning the questions of global regularity of solutions to the three-dimensional Navier–Stokes and Euler equations of incompressible fluids. Furthermore, I will also present recent global regularity (and finite time blow-up) results concerning certain three-dimensional geophysical flows, including the three-dimensional viscous (non-viscous) “primitive equations” of oceanic and atmospheric dynamics.

3) 14h15 – 15h15: WPI Seminar room, 8th floor: PhD Defense **Daniel Bäumer** (U. Wien)

"Asymptotic PDE models of intermediate complexity for large-scale dynamics of a moist atmosphere"

.) 15h30 – 16h... : **Champaign/Beer & Cake/Tapas**

Short biographies:

Peter Spichtinger studied mathematics and physics in Augsburg and received his doctorate in 2004 in meteorology/physics at the LMU Munich, being a PhD student at the *German Aerospace Centre (DLR)*. After a short period as a postdoc at DLR, he then spent five years as a postdoc and lecturer at ETH Zurich in the group of Ulrike Lohmann, partly as a *Marie-Curie fellow* of the European Commission. In 2010 he became professor for theoretical cloud physics at the Johannes Gutenberg University in Mainz. Currently, he is spokesperson of the interdisciplinary *Mainz Institute of Multiscale Modeling (M³ODEL)*, a top-level research area of the university.



His research interests are centered around theoretical investigations of water vapor and clouds, mainly for clouds containing ice particles; the consistent formulation of cloud processes, and thus approaching towards a general theory of clouds is a major goal of his research.

In his interdisciplinary research group very different methods are used, e.g. techniques from mathematics (asymptotic analysis and dynamical systems theory), physics (classical field theories), and also computer sciences (machine learning).

Edriss S. Titi received his doctorate in 1986 under the supervision of Ciprian Foias. Currently he holds the *Nonlinear Mathematical Sciences Professorial Chair* at the Univ. of Cambridge, UK; he is a *University Distinguished Professor* and the *Arthur Owen Professor of Mathematics* at Texas A&M Univ.; moreover he is Professor of Computer Science and Applied Mathematics at the Weizmann Institute of Science in Israel.

Titi's research in applied and computational mathematics lies at the interface between rigorous applied analysis and physical applications. Specifically, in studying the Euler and the Navier-Stokes and other related nonlinear partial differential equations. The applications include fluid mechanics, oceanic and atmospheric dynamics and their coupling with moisture micro-physics in clouds formation, turbulence, chemical reactions, nonlinear fiber optics, control theory and data assimilation for weather and climate prediction.



Titi is a Fellow of the AMS and of the SIAM, the *John Simon Guggenheim Memorial Foundation*, USA; and the *Institute of Physics*, UK. He is the recipient of many international scientific awards including the *Stanislaw M. Ulam Distinguished Scholar*, the *Humboldt Research Award for Senior U.S. Scientists*, Germany, the *Einstein Visiting Fellow*, Germany and the *Gaspard Monge Distinguished Professorship*, France. He is also a co-recipient of the *SIAM Prize on Best Paper in Partial Differential Equations* (2009), and the *2020 International Consortium of Chinese Mathematicians Best Paper Award (Gold Medal)*.