Eighth Itinerant Meeting in PDEs

BCAM-BASQUE CENTER FOR APPLIED MATHEMATICS
Mazarredo 14, Bilbao, Basque Country, Spain
www.bcamath.org

January 11-13, 2017

Invited Speakers:

PETER BLUE (University of Edinburgh)
DAVID DOS SANTOS FERREIRA (CNRS)
ERIC DUMAS (Université Grenoble)
ALBERTO ENCISO (ICMAT)
PHILIPPE GRAVEJAT (Université de Cergy-Pontoise)
DANIEL HAN-KWAN (Centre de Mathématiques Laurent Schwartz)
JULIEN SABIN (Université Paris-Sud)
FRANCK SUEUR (Institute of Mathematics of Bordeaux)
BENJAMIN TEXIER (Université Paris-Diderot)

Scientific Committee:

Luca FANELLI (Università di Roma), David LANNES (Université Bordeaux), Frabice PLANCHO (Université Nice), Frederic ROUSSET (Paris XI, Orsay), Luis VEGA (BCAM, Bilbao) and Nicola VISCI GLIA (Università di Pisa)
## PROGRAM

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<th>Day</th>
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<th>Event</th>
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<tr>
<td>11 January 2017</td>
<td>12:45</td>
<td>Lunch in BCAM</td>
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<tr>
<td></td>
<td>14:30-15:00</td>
<td>Opening of the meeting</td>
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<tr>
<td></td>
<td>15:00-15:50</td>
<td>Peter BLUE &quot;Hidden symmetries and decay of fields outside black holes&quot;</td>
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<td>15:50-16:10</td>
<td>Coffee Break</td>
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<td></td>
<td>16:10-17:00</td>
<td>David DOS SANTOS FERREIRA &quot;Complex geometrical optics and elliptic boundary inverse problems&quot;</td>
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<tr>
<td>12 January 2017</td>
<td>09:30-10:20</td>
<td>Eric DUMAS &quot;Hysteresis for the Landau-Lifshitz model&quot;</td>
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<td>10:20-11:10</td>
<td>Alberto ENCISO &quot;High-frequency Beltrami fields with applications to the Euler and Navier-Stokes equations&quot;</td>
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<td>11:10-11:45</td>
<td>Coffee Break</td>
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<td>11:45-12:35</td>
<td>Philippe GRAVEJAT &quot;Asymptotic stability for solitons of the Gross-Pitaevskii and Landau-Lifshitz equations&quot;</td>
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<td>13:00-15:30</td>
<td>Lunch at “Kafe Antzokia” Restaurant</td>
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<tr>
<td></td>
<td>15:30-16:20</td>
<td>Daniel HAN-KWAN &quot;On the Vlasov-Navier-Stokes system&quot;</td>
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<td>16:20-17:10</td>
<td>Julien SABIN &quot;Maximizers for the Stein-Tomas inequality&quot;</td>
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<td>20:30</td>
<td>Dinner at “Viejo Zortzi” Restaurant</td>
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<tr>
<td>13 January 2017</td>
<td>09:30-10:20</td>
<td>Franck SUEUR &quot;Controllability of the Navier-Stokes equations&quot;</td>
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<td>10:20-11:10</td>
<td>Benjamin TEXIER &quot;Space-time resonances and high-frequency instabilities in the two-fluid Euler-Maxwell system&quot;</td>
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<td>11:10-11:45</td>
<td>Coffee break</td>
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<td>From 11:45</td>
<td>Open session / closing</td>
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## Lunches & Dinner

<table>
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<tr>
<td>11 January 2017</td>
<td>12:45</td>
<td>LUNCH</td>
<td>BCAM A. Mazarredo, 14 Bilbao</td>
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<td></td>
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<td>(finger buffet)</td>
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<tr>
<td>12 January 2017</td>
<td>13:00</td>
<td>LUNCH</td>
<td>Kafe Antzokia Restaurant San Vicente, 2 Bilbao</td>
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<tr>
<td>12 January 2017</td>
<td>20:45</td>
<td>DINNER</td>
<td>Viejo Zortzi Restaurant Licenciado Poza, 54 Bilbao</td>
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Abstract

I will discuss energy and Morawetz (or integrated local decay) estimates for fields outside black holes, in particular the Vlasov equation. This builds on earlier work for the wave and Maxwell equation. Much of the work on these problems in the last decade has used the vector-field method and its generalisations. One generalisation has focused on using symmetries, differential operators that take solutions of a PDE to solutions. In this context, a hidden symmetry is a symmetry that does not decompose into first-order symmetries coming from a smooth family of isometries of the underlying manifold. In this talk, I will build on applications of the vector-field method to the Vlasov equation to prove an integrated energy decay for the Vlasov equation outside a very slowly rotating Kerr black hole, and I will discuss some new features of the symmetry algebra for the Vlasov equation, which illustrate the difficulties in passing to pointwise-decay estimates for the Vlasov equation in this context.

This is joint work with L. Andersson and J. Joudioux.

References


Abstract

Ferromagnets are known to exhibit "memory effects", when they are submitted to some time varying magnetic field. L. Landau and E. Lifshitz built in 1935 a model aiming at describing the time evolution of the magnetization of such a ferromagnetic medium, and in particular the movements of the 'walls' where rapid changes in this magnetization occur. In this joint work with Elise Fouassier and Stéphane Labbé, we show through two-scale analysis (with some slowly-varying applied magnetic field) that the Landau-Lifshitz model also takes hysteresis into account.
Eric Dumas
Hysteresis for the Landau-Lifshitz model
eric.dumas@univ-grenoble-alpes.fr

Institut Fourier
Université Grenoble Alpes, Grenoble, France

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8th Itinerant Meeting in PDEs

Abstract

Ferromagnets are known to exhibit "memory effects", when they are submitted to some time varying magnetic field. L. Landau and E. Lifshitz built in 1935 a model aiming at describing the time evolution of the magnetization of such a ferromagnetic medium, and in particular the movements of the 'walls' where rapid changes in this magnetization occur. In this joint work with Elise Fouassier and Stéphane Labbé, we show through two-scale analysis (with some slowly-varying applied magnetic field) that the Landau-Lifshitz model also takes hysteresis into account.
Abstract

Beltrami fields, that is, vector fields on \( \mathbb{T}^3 := (\mathbb{R}/2\pi \mathbb{Z})^3 \) satisfying
\[
\nabla \times u = \lambda u
\]
for some nonzero constant frequency \( \lambda \), are the most important class of stationary solutions to the 3D Euler equations with periodic boundary conditions. Notice that these fields also satisfy the Helmholtz equation \( \Delta u + \lambda^2 u = 0 \).

Our objective will be to exploit the high-frequency behavior of the Beltrami field equation to shed some light on two important physical phenomena that appear in fluid mechanics. Firstly, we will prove the existence of knotted vortex structures in (high-frequency) Beltrami fields, the study of which goes back to Lord Kelvin. These structures have long been considered as an indicator of complex behavior in the Lagrangian theory of turbulence. Secondly, we will utilize high-frequency Beltrami fields to construct rigorous scenarios of vortex reconnection for the Navier–Stokes equations.

References


Abstract

We describe recent results about the asymptotic stability of dark solitons for the Gross-Pitaevskii and Landau-Lifshitz equations. This property is proved following the strategy introduced by Martel and Merle for the Korteweg-de Vries equation: The construction of an asymptotic profile using orbital stability, its qualitative analysis relying on monotonicity formulae, and its classification by Liouville type theorems.

This is joint work with Fabrice Béthuel (University Pierre and Marie Curie), André de Laire (University of Lille Nord de France) and Didier Smets (University Pierre and Marie Curie), and by Yakine Bahri (Nice Sophia Antipolis University).
Abstract

The talk will bear on the Vlasov-Navier-Stokes system in a 2D box with partially absorbing conditions. This can be seen as a rough model for the propagation of a spray of in a human lung. We will prove the existence and stability of regular stationary states. The analysis is based on the propagation of geometric control conditions that allow to drive the dynamics. This is joint work with O. Glass and A. Moussa.
Abstract

We give a necessary and sufficient condition for the precompactness of all optimizing sequences for the Stein-Tomas inequality. In particular, if a well-known conjecture about the optimal constant in the Strichartz inequality is true, we obtain the existence of an optimizer in the Stein-Tomas inequality. Our result is valid in any dimension. This a joint work with Rupert Frank (Caltech) and Elliott Lieb (Princeton).
Abstract

In this work in collaboration with J.-M. Coron and F. Marbach, we consider the incompressible Navier-Stokes equations in a smooth bounded domain, either in 2D or in 3D, with a Navier slip-with-friction boundary condition (also sometimes referred to as Robin conditions) except on a part of the boundary. This under-determination encodes that one has control over the remaining part of the boundary. We prove that for any initial data, for any positive time, there exists a weak Leray solution which vanishes at this given time.
Benjamin Texier
Space-time resonances and high-frequency instabilities in the two-fluid Euler-Maxwell system
benjamin.texier@imj-prg.fr
Université Paris-Diderot
Institut de Mathématiques de Jussieu-Paris Rive Gauche, UMR CNRS 7586 bâtiment Sophie Germain,
bureau 723, 5 rue Thomas Mann. 75205 Paris cedex 13

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Abstract

We show that space-time resonances induce high-frequency instabilities in the two-fluid Euler-Maxwell system. This implies in particular that the Zakharov approximation to Euler-Maxwell is unstable if in the Schrödinger equation satisfied by the envelope of the WKB electrical field the group velocity does not vanish. Our analysis further shows that time resonances may fail to induce fast instabilities, even in the case of incompatible nonlinearities, in the presence of fast transverse variations of the WKB profile. This is joint work with Eric Dumas (Grenoble) and Lu Yong (Nankai).
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NOTES