Women in nonlinear dispersive PDEs

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Overview of the Field

Nonlinear dispersive partial differential equations is one of the vast research areas in the field of partial differential equations. It is perhaps one of the most challenging and exciting directions of scientific pursuit simply because of the complexity of the subject and the endless breadth of applications. Dispersive PDE's encompass nonlinear wave and Schrödinger equations including problems with geometric flavour, classical dispersive problems such as the Korteweg–De Vries (KdV) equation, as well as systems arising in the study of water waves. Such models have been the focus of extensive research over the past decades. This is in part due to their undeniable significance in the physical description of nature ranging from the dynamics of ocean waves to general relativity, but also due to their rich mathematical structure caused by their inherently nonlinear nature. From an analytic point of view, for a large class of problems classical questions concerning local-wellposedness and the behavior of solutions for small initial data are fairly well-understood by now. However, despite recent progress, much less is known concerning *global dynamics of solutions for large initial data*. Central questions include *the formation of singularities* in finite or infinite time, the existence of *multi-solitons* and the famous *soliton resolution conjecture*, as well as the description of *thresholds between different stable dynamical regimes*. Above these questions, there is the pressing and overarching problem of *generic behaviour* which naturally introduces a *probabilistic point of view*. Moreover, in the investigation of global nonlinear dynamics, *reliable numerical simulations* have proven to be indispensable.

In recent years, some major developments in all of these branches have emerged and further ideas are now surfacing. Naturally, this includes many important contributions by female mathematicians. However, as the field of nonlinear dispersive PDEs itself is fragmented into smaller communities, both thematically and geographically, women are usually heavily underrepresented at regular meetings and conferences.

The workshop gathered world-leading female experts and young researchers working - both theoretical and numerically - on the analysis of dispersive PDEs in order to foster scientific exchange on the most important open questions in the field. With this workshop, we hoped we inspired women, non-binary mathematicians and people of other minorities to share their mathematical achievements, as well encouraged an open, welcoming, and inclusive work environment for everybody.

Organization and scope of the workshop

Scientific content of the workshop

The goal of the workshop was to bring together women of all career levels in order to share scientific progress from different sub-areas of the field. Thematically, the topics of the talks roughly can be gathered into four categories:

- **Well-posedness of dispersive PDEs - Low regularity and probabilistic aspects**
- **Fluid dynamics**
- **Global dynamics and singularity formation**
- **Numerical aspects and modelling**

The workshop's schedule reflects our effort to offer a well-balanced mixture of talks by established and early career researchers and to provide a loose structure navigating through the above topics that emerged during the workshop, while meeting at the same time the circumstances of the hybrid character of the event. In addition to regular lectures, Ph.D. students presented their work in a poster session with short talks. Below, we give a detailed summary of the content and the scientific highlights within each sub-area.

Women in ...

In the last decades, at vast effort has been taken to increase the number of women in mathematics and natural sciences and to remove impediments female researchers might face during their career. However, women are still underrepresented in most mathematical fields and despite some progress, the situation has not improved significantly. Today, the topic is still controversial, many questions are hard to address globally due to political and sociological differences and discussions are often driven by particular personal experiences. In order to provide a common ground for discussions, we were happy to have had as an external speaker Prof. Maria Vlasiou (University of Twente), who represents the Netherlands at the European Women in Mathematics and the Committee for Women in Mathematics of the International Mathematical Union, among many other activities. In her inspiring talk on *Women in Academia: challenges and best practices* she provided a quantitative perspective based on data and scientific studies from different countries over the past years. Most interestingly, she showed that for every study that confirms the positive effect of a certain measure (such as the quota), yet another study can be found that demonstrates the contrary. This of course is rather raising questions than giving final answers and triggered many fruitful discussions among participants. However, the only measure that seems to be successful beyond doubt is mentoring of students and young researchers. During the workshop, we were glad to observe that mentoring happened naturally by the interaction of workshop participants of different career levels.

Additional online discussion meetings

In order to guarantee the chance of vivid discussions for the online participants as well (who are unfortunately missing out on discussions within the coffee, lunch and dinner breaks), we organized additional Zoom meetings. Due to the large amount of online participants located in Europe and the rather big time difference, these meetings took place around 12-13 pm Central European Time (CET) on four of the workshop days. The meetings were moderated by the one organizer who was participating remotely. They were structured so that they closely followed the same mathematical discussions as the on-site program. Versions of the talks highlighting possible venues of support for early career researchers were also present in the schedule of these on-line meetings. Specifically, the following discussion sessions were offered in addition to the regular schedule:

- Tuesday, 12-13 pm CET: Meet & Greet

- Wednesday, 12-13 pm CET: Research discussion on bridging the gap: theoretical and numerical analysis of nonlinear dispersive PDEs (what can we learn from PDE theory to improve numerical methods, can numerical simulations help to push forward the theory? What are the open problems, challenges in the various fields?)
- Thursday, 12-13 pm CET: Women in math and career development: advice for (early career) female mathematicians.
- Friday, 12-13 pm CET: Research discussion (continued)

Within these discussions the exchange of ideas between mathematicians in both theoretical and numerical analysis of nonlinear dispersive PDEs lead to highly interesting new directions on the interface of these two areas, such as for instance in the reliable simulation of blow up phenomena with cutting edge PDEs techniques.

Scientific topics and highlights

The workshop featured lectures of one hour within a broad spectrum of topics. All speakers enthusiastically communicated their results. Their talks usually started with a general introduction into the specific field of research. In addition, Ph.D. students had the chance to present their results in a poster session with short talks of 15 min each.

We summarize the content of the lectures (partially based on the abstracts provided by the participants), include references and outline the scientific highlights. Thereby talks can be grouped into four categories that emerged during the workshop. Talks by postdocs are indicated by a bullet (•), poster presentations by Ph.D. students by a start ($*$). The order of the talks within each section follows the schedule of the workshop.

Well-posedness of dispersive PDEs - Low regularity and probabilistic aspects

This portion of the workshop featured talks by Monica Visan, Maria Ntekoume, Hajer Bahouri, Akansha Sanwal, and Katie Marsden. Brief discussion of their work is detailed below.

Monica Visan (University of California) reported on an yet another interesting application of the method *second generation of commuting flows* introduced in joint works with collaborators (B. Harrop-Griffiths, R. Killip, M. Ntekoume), see [8]. The method is meant to provide a recipe for achieving low regularity well-posedness results for complete integrable PDEs. The focus was on the well-posedness of the derivative nonlinear Schrödinger equation

$$i\partial_t u + \partial_x^2 u = -i\partial_x(|u|^2 u)$$

on the line. The speaker gave a broad description of some inherent instabilities which have hindered the study of this equation. The global well-posedness result was discussed in the natural scale-invariant space due to this innovative method.

Hajer Bahouri (Sorbonne University) presented her recent work on the spectral properties of the sublaplacian $-\Delta_G$ on the Engel group, which is the main example of a Carnot group of step 3. The author developed a new approach to the Fourier analysis on the Engel group in terms of a frequency set. This enabled her to give fine estimates on the convolution kernel satisfying $F(-\Delta_G)u = u * k_F$, for suitable scalar functions F, and in turn to obtain proofs of classical functional embeddings, via Fourier techniques. This analysis requires a summability property on the spectrum of the quartic oscillator, which the author obtained by means of semiclassical techniques and which is of independent interest; see [1].

Akansha Sanwal (•) (University of Innsbruck) presented recent result obtained jointly with Robert Schippa, [14] on the well-posedness of the fractional Kadomtsev–Petviashvili equation (fKP-I) equation

$$\partial_t u - D^\alpha \partial_x u - \partial_x^{-1}\partial_y^2 u = u\partial_x u.$$

In the case of strong dispersion, more precisely for $\frac{5}{2} < \alpha < 4$, global well-posedness is obtained in $L^2(\mathbb{R}^2)$ for real valued initial data. This is achieved by exploiting transversality in the resonant case via bilinear Strichartz estimates and the nonlinear Loomis-Whitney inequality. For small dispersion, it was proved that the initial value problem cannot be solved by Picard iteration. However, frequency-dependent time localisation can be used to prove local well-posedness for $2 < \alpha \leq \frac{5}{2}$ in the anisotropic Sobolev space $H^{s,0}(\mathbb{R}^2)$.

Maria Ntekoume (•) (Rice University) continued on the topic of Monica's talk (see [8]) emphasising more properties of the completely integrable model in discussion. Until recently the well-posendess of the equation below $H^{\frac{1}{2}}$ was not known. From the talk we learned that the problem is well-posed in the critical space L^2 on the line. In doing so the speaker highlighted several recent results that led to their result.

Katie Marsden ($*$) (EPFL) presented her current studies on the energy critical nonlinear Schrödinger equation with randomised initial data in dimensions $d > 6$. The result discussed the probabilistic well-posedness theory namely the almost surely globally well-posed with scattering for the randomised super-critical Cauchy problem in the Sobolev space $H^s(\mathbb{R}^d)$ whenever $s > \max\left\{\frac{4d-1}{3(2d-1)}, \frac{d^2+6d-4}{(2d-1)(d+2)}\right\}$; for reference see [12]. The key ingredient was the randomisation which in this case was based on a decomposition of the data in physical space, frequency space and the angular variable. Such result extends previously known results in dimension 4, [15]. The main difficulty in the generalisation to high dimensions was the non-smoothness of the nonlinearity.

Fluid dynamics

This portion of the workshop featured talks by Anna Mazzucato, Sylvie Monniaux, Helena Nussenzveig Lopes, Susanna Haziot, Anne-Laure Dalibard, and Mihaela Ignatova. The talks were about solutions to nonlinear PDEs in various settings where wave interactions take on a very different character on long time scales due to the lack of dispersion. These problems came strongly motivated in part by the fluid dynamics realms of open questions. For brevity we give below an outline of their work.

Anna Mazzucato (Penn State University) discussed about "Irregular transport and loss of regularity for transport equations". The comprehensive picture presented by the speaker included an overview of the broader area in which new recent results in the analysis of irregular transport, with non-Lipschitz vector fields, and its applications to kinetic theory, advection of active and passive scalars, fluid mechanics, and related areas have emerged. The work, which was joint work with collaborators (Gianluca Crippa, Tarek Elgindi, and Gautam Iyer) focused namely on recent results concerning examples of loss of regularity for solutions to linear transport equations with advecting field in Sobolev spaces below the Lipscitz class, see [4]. It was very well described how this loss is generic and can be made instantaneous and total (that is, there exists smooth initial data for which the solution leaves instantaneously any Sobolev space of positive order). Potential applications and limiting properties of these methods were also outlined.

Sylvie Monniaux (Aix-Marseille University) presented her recent work and results obtained with collaborators (Matthias Hieber, Hideo Kozono and Patrick Tolksdorf) about how to construct a solution to the Keller-Segel-Navier-Stokes system in critical spaces via weighted maximal regularity. One of the problems in doing so was reported as being the fact that, in Lipschitz domains (in dimensions 2 or 3), the Stokes operator has regularising properties only in a small range of spaces.

Helena Nussenzveig Lopes (Universidade Federal do Rio de Janeiro) reported on very recent work done with collaborators (Fabian Jin, Samuel Lanthaler, Milton C Lopes Filho and Siddhartha Mishra) that settled the necessary and sufficient conditions on the regularity of the external force for energy balance to hold for weak solutions of the 2D incompressible Euler equations. The problem was motivated by turbulence modeling and the result should be contrasted with the existence of wild solutions in 3D.

Susanna Haziot (•) (Brown University) presented her current findings pertaining to the Muskat equation.

This equation models the interaction of two incompressible fluids with equal viscosity propagating in porous medium, governed by Darcy's law. In this talk, the speaker investigated the small data critical regularity theory for this equation, and in particular, the desingularization of interfaces with small moving corners.

Anne-Laure Dalibard (Sorbonne University) gave a talk devoted to the study of the equation

$$uu_x - u_{yy} = f$$

in the domain $(x_0, x_1) \times (-1, 1)$, in the vicinity of the shear flow profile $u(x, y) = y$. This equation serves as a toy model for more complicated fluid equations such as the Prandtl system. The difficulty was reported to lie in the fact that one is, in general, interested in changing sign solutions. Hence the equation is forward parabolic in the region where $u > 0$, and backward parabolic in the region where $u < 0$. The line $u = 0$ is a free boundary and an unknown of the problem. The author together with collaborators (Frédéric Marbach and Jean Rax) proved that even when the data (i.e. the source term f or the boundary data) are smooth, existence of strong solutions of the equation fails in general; more details in [5]. This phenomenon is already present at the linear level, and linked to the existence of singular profiles for the homogeneous linearized equation. In fact, the result obtained proved that strong solutions exist (both for the linearized and for the nonlinear system) if and only if the data satisfy a finite number of orthogonality conditions, whose purpose is to avoid the presence of singular profiles in the solution. A key difficulty in their work was to cope with these orthogonality conditions during the nonlinear fixed-point scheme. In particular, this led to the proof of the stability of these solutions with respect to the underlying base flow.

Mihaela Ignatova (Temple University) reported on her joint work with Jingyang Shu about the analysis of the Boussinesq equations, [10]. These are a member of a family of models of incompressible fluid equations, including the 3D Euler equations, for which the problem of global existence of solutions is open. The Boussinesq equations arise in fluid mechanics, in connection to thermal convection and they are extensively studied in that context. Formation of finite time singularities from smooth initial data in ideal (conservative) 2D Boussinesq equations is an important open problem, related to the blow up of solutions in 3D Euler equations. The Voigt Boussinesq is a conservative approximation of the Boussinesq equations which has certain attractive features, including sharing the same steady solutions with the Boussinesq equations. In her talk which included a brief description of issues of local and global existence, well-posedness and approximation in the incompressible fluids equations, the speaker presented a global regularity result for critical Voigt Boussinesq equations.

Global dynamics and singularity formation

This portion of the workshop featured talks by Svetlana Roudenko, Valeria Banica, Annalaura Stingo, Gabriele Brüll, Susana Guitierrez, and Xueying Yu. The lectures covered recent results on the existence and stability of solitons with a focus on fractional dispersive equations. Furthermore, global regularity and the existence of finite-time blow-up solutions has beed discussed for various different geometric models. We give below an outline of the work discussed.

Svetlana Roudenko (Florida International University) gave a talk on the existence and stability of solitary waves of the fractional Korteweg-de Vries (KdV) family of equations including higher dimensional generalisations. The classical KdV equation is a well-studied dispersive PDE, which originally arises as a one-dimensional model in the description of shallow water waves. Allowing for solitary wave solutions, it gave rise to the soliton resolution conjecture, which now is believed to be a rather general principle in dispersive PDEs. Various generalisations of this equation have been introduced since, including higher dimensional models with various applications. In the recent years, there was rising interest in fractional versions of the KdV equation, where the dispersion operator is replaced by a fractional derivative. After a thorough introduction into this huge field of research, Svetlana addressed, among other things, recent results on the existence and stability/instability of solitary waves fractional models within KdV family in $d \geq 1$, in the subcritical and supercritical regime, obtained in joint work with Oscar Riaño [13].

Valeria Banica (Sorbonne University)) reported on recent results obtained with collaborators (Renato Lucá, Nikolay Tzvetkov and Luis Vega), see [2]. Their work concerns blow-up for the one-dimensional cubic nonlinear Schrödinger equation (NLS). The global well-posedness of the model is known in $H^s(\mathbb{R})$ for $s > s_c$ with $s_c = -1/2$ denoting the critical regularity (only for $s \geq 0$ the flow map is uniformly continuous on bounded sets of $H^s(\mathbb{R})$). For $s < s_c$ the initial value problem is ill-posed in the Hadamard sense due to norm inflation with loss of regularity. By identifying a particular functional analytic framework from which solutions exit in finite time, blow-up is demonstrated at the boarderline regularity. The proof relies on a reformulation of the problem within the considered class of solutions to the study of large-time solutions of a periodic, non-autonomous cubic Schrödinger equation, by using a pseudo-conformal transformation. The results obtained for the cubic NLWs are applied to obtain a criterion for generating finite-time singularities through the binormal flow, which is a model for one vertex filaments in 3D fluids. The connection between these two models was explained in detail in the talk.

Gabriele Brüll (•) (Lund University) presented recent on traveling waves for the fractional Kadomtsev–Petviashvili equation (fKP or fKP-1)

$$\partial_x(\partial_t u + u\partial_x u - D^\alpha \partial_x u) - \partial_y^2 u = 0,$$

for $u = u(t, x, y)$ with $\frac{1}{3} < \alpha \leq 2$; this work is joint Handan Borluk and Dag Nilsson [3]. This model can be viewed as the two dimensional generalization of the fractional KdV (fKdV) equation. Solitary wave solution of the fKdV solve the fKP equation and are referred to as line solitons. For the classical KP-I equation, it is known that line solitons are unstable. In the talk, linear instability of the line soliton for the fKP-I equation was demonstrated by using a criterion due to F. Rousset and N. Tzvetkov. Furthermore, numerical experiments were shown which support the instability result for the fractional KP-I equation and suggest transverse stability for the fractional KP-II equation (for which the y-derivatives in the above equation come with a positive sign). Moreover, the existence and properties of fully localized solitary solutions for the fractional KP-I equation have been discussed during the talk.

Annalaura Stingo (•) (Ecole Polytechnique) reported on ongoing work with her collaborators (Cecile Huneau and Zoe Wyatt) concerning Kaluza-Klein theories, which represent a classical mathematical approach to the unification of general relativity with electromagnetism . In these theories, general relativity is considered in 1+3+d dimensions with the space-time factorizing as $\mathbb{R}^{1+3} \times K$ with K a compact d-dimensional manifold (the internal space). In the simplest case $K = \mathbb{S}^1$ gravity is compactified on a circle to obtain at low energies a $(3+1)$-dimensional Einstein-Maxwell-Scalar systems. The talk addressed the problem of the classical global stability of Kaluza-Klein theories, which is still an open problem in the three dimensional case (despite known positive result for $\mathbb{R}^{1+n}$ with $n \geq 9$). By using wave coordinates, the problem can be reformulated as a system of quasilinear wave equations. By studying toy models within this class, mathematicals mechanisms can be identified underlying the stabilty problem, see also [9].

Susana Guitierrez (University of Birmingham) talked about self-similar solutions of the Landau-Lifshitz-Gilbert (LLG) equation. This system emerges in the description of the dynamical behaviour of spin vectors in ferromagnetic materials and is given by

$$\partial_t m = \beta m \times \Delta m - \alpha m \times (m \times \Delta m)$$

for $m = (m_1, m_2, m_3) : \mathbb{R}^d \times I \to \mathbb{S}^2 \subset \mathbb{R}^3$ and parameters $\alpha \in [0, 1], \beta = \sqrt{1 - \alpha^2}$. From a mathematical point of view, the system includes two prominent limiting cases, which is on the one hand the heat flow of harmonic maps into the 2-sphere ($\alpha = 1$, $\beta = 0$), and on the other hand the Schrödinger map equation (for $\alpha = 0$, $\beta = 1$). In view of the scale invariance of the LLG equation, it is reasonable to look for self-similar, which can be grouped into expanders and shrinkers, where the latter provide examples for the formation of singularities in finite time. This talk addressed the existence, the properties and the dynamical behaviour of shrinkers in the one-dimensional case, i.e., for $d = 1$. Thereby, a novel geometric a approach was used, which relies on the identification of a self-similar profile with the tangent of a curve in $\mathbb{R}^3$ and the reformulation of the problem in terms of a Serret-Frenet equations, see the joint work [7] with André de Laire for more details. In addition the Cauchy problem for the LLG-equation was discussed including global well-posedness for initial data being small in the BMO norm.

Xueying Yu (•) (University of Washington) talked about uniqueness properties of solutions to the linear generalized fourth-order Schrödinger equations posed in any dimension with bounded real-valued potentials of the following form

$$i\partial_t u + \sum_{j=1}^{d} \partial_{x_j}^4 u = V(x)u.$$

The speaker showed that a solution with fast enough decay in certain Sobolev spaces at two different times has to be trivial. The work presented is jointly with Zachary Lee and can be seen [11].

Numerical aspects and modelling

This portion of the workshop featured talks by Mechthild Thalhammer, Fatima Zohra Goffi, and Karolina Kropielnicka. The first and the third talk addressed numerical issues with broad applications. The second talk added to the workshop the interesting and interdisciplinary problem of mathematical modelling of dispersive phenomena.

Mechthild Thalhammer (University of Innsbruck) discussed the numerical treatment of the Landau equation. The latter is fundamental when applying Hamiltonian operator splitting methods to multi-species Vlasov-Maxwell-Landau systems. The main numerical challenge lies in the computation of the three dimensional case with Coulomb interaction, which is the most relevant case in physics. In the talk, which is based on joint work with J. A. Carrillo, novel approaches for the evaluation of the Landau collision operator based on efficient Fourier techniques were introduced and compared. The new approach in particular allows to greatly reduce computational efforts thanks to pre-computations which are independent of the density function. The new approach allows for mass conserving in the time integration of the Landau equation. Numerical experiments underlined the favorable behaviour of the new method.

Fatima Zohra Goffi (•) (Karlsruhe Institute of Technology) presented results on the mathematical description of wave propagation in meta-materials that have been obtained with her collaborators (Andrii Khrabustovskyi, Ramakrishna Venkitakrishnan, Carsten Rockstuhl and Michael Plum), see [6]. The propagation of electromagnetic waves in meta-materials is described as strong dispersion. This can be seen through the propagation of multiple modes one can observe when taking into consideration a constitutive relation of nonlocal type. This later links the exciting electric field to the electric displacement by considering the effect of the surrounding neighbourhood of the observation point. In the talk it was shown that the spatially nonlocal characterisation of the material law serves for deriving additional effective material parameters. These effective parameters translate the nonlocal effects produced in the response of meta-materials to the exciting electric field.

Karolina Kropielnicka (Polish Academy of Sciences) gave an overarching exposition on numerical methods for highly oscillatory Klein–Gordon type equations. Numerically, the main difficulty thereby stemmed from the time dependent mass term which in physical applications might be highly oscillatory. Karolina showcased the failure of classical methods in this setting: classical splitting and Gautschi type methods can not capture the highly oscillatory nature of the problem which leads to large errors and huge computational costs as the discretisation parameters have to be adapted to the highest frequency. In order to overcome this numerical burden, Karolina introduced a new approach which allows to treat time dependent mass terms reaching from highly oscillatory up to slowly varying regimes. The idea is based on operator splitting methods, integrating the highly oscillatory phases exactly. This leads to a new class of scheme with much higher accuracy than classical schemes. Results of these investigations were obtained with Karolina Lademann, Katharina Schratz, Mrissa Condon and Rafal Perczynski.

Conclusion and Feedback

We share BIRS's dedication to equity, diversity, and inclusiveness. The workshop's organizers carefully selected and recruited a diverse selection of participants, both within the group of workshop members and the group of postdocs and graduate students. The selection of speakers also reflected similar considerations; indeed, early-career mathematicians comprised a substantial portion of the speakers.

The mathematical content of the workshop touched on many nowadays vibrant and hot topics in PDEs, and the breath of novelty was impressive. It was the perfect time to organize this workshop in part due to the high amount of new emerged works which produced substantial progress in a series of conjectures.

As described above, the workshop featured a rather broad spectrum of topics. Thus, during an intensive week of talks and common social activities, experts from different fields had the chance to learn from each other and discuss new scientific directions. The rather small size of the workshop, in addition to the online meetings, provided a great environment for personal interaction between different generations of female mathematicians. Many of the attendees expressed their gratitude for having a well-designed workshop that combined the on-site and online organization in a perfect mathematical and social experience. In comparison with only in-person programs, the new format had the advantage of accommodating more mathematicians, broadening not only the mathematical interactions but also the social interactions. This workshop opened new collaborations among the participants, and we expect to hear soon from them via upcoming publications.

The feedback we, the organizers, received from the participants was beyond our expectations; many of the participants strongly emphasized their gratitude and the positive effects of their participation. In short everyone hopes we will continue this tradition to meet in Banff regularly, every 2-3 years. We are looking forward to have such an amazing ongoing event as we felt that the format and the scientific scope of the workshop met perfectly our goals and the participants' expectations.

Some of the feedback we received is displayed below.

" I didn't get a chance to thank you in person on Friday morning for inviting me to the conference. I think everybody agrees it was a very successful event. I learned a lot, met some interesting people ! "

" I want to thank you for the invitation to give a talk and for a wonderful conference! It was great meeting you and I hope to see you again in Banff ! "

" This is one of the best conferences I have attended after the pandemic ! I have learned a lot from the speakers. It was so easy to talk to all of the participants ! Thank you for the effort you out in organizing this conference; it was just great ! "

" This conference was a fantastic concept! Please hold more of these events. Personally, I felt less frightened than I had in previous conferences, and as a result, I asked more questions than I had ever asked in previous conferences. When I spoke with other participants, I realized that some of them felt the same way. "

Acknowledgement

We have benefited in our attempt to have a successful conference from the experience of BIRS, to which we extend our sincere thanks and deep gratitude. The success of the workshop is in equal part due to them, as they showed amazing generosity and professionalism in all the actions they took, from prompt email responses, to an outstanding on-site technical support, to incredible fitness center, lodging and food amenities, to great outdoor views and helpful staff members.

List of Participants

On-site

Banica, Valeria (Sorbonne Université)
Byars, Allison (UW Madison)
Goffi Fatima Zohra (Karlsruhe Institute of Technology)
Gutierrez, Susana (University of Birmingham)
Haziot, Susanna (Brown University)
Ifrim, Mihaela (University of Wisconsin Madison) - organizer
Kropielnicka, Karolina (Polish Academy of Sciences)
Marsden, Katie (EPFL)
Mazzucato, Anna (Penn State University)
Monniaux, Sylvie (Aix Marseille Université)
Ntekoume, Maria (Rice University)
Birgit Schoerkhuber (University of Innsbruck) - organizer
Stingo, Annalaura (Ecole Polytechnique)
Visan, Monica (UCLA)

Online

Alama Bronsard, Yvonne (Sorbonne Université, LJLL)
Bahouri, Hajer (Sorbonne université)
Brüll, Gabriele (Lund University)
Charlotte, Perrin (I2M in Marseille)
Chirilus-Bruckner, Martina (Leiden University)
Czubak, Magdalena (University of Colorado Boulder)
Dalibard, Anne-Laure (Sorbonne université)
Geyer, Anna (TU Delft)
Huang, Kaiyi (University of Wisconsin Madison)
Ignatova, Mihaela (Temple University)
Ivanovici, Oana (CNRS & Sorbonne Université)
Kaltenbacher, Barbara (University of Klagenfurt)
Kistner, Sarah (Innsbruck University)
Lasiecka, Irena (University of Memphis)
Liao, Xian (Karlsruhe Institute of Technology)
Nussenzveig Lopes, Helena (Universidade Federal do Rio de Janeiro)
Park, Jaeun (N/A)
Perelman, Galina (Paris-Est-Creteil University)
Pocovnicu, Oana (Heriot-Watt University, Edinburgh, UK)
Roudenko, Svetlana (Florida International University)
Sanwal, Akansha (Universität Innsbruck)
Schönlieb, Carola (University of Cambridge)
Katharina Schratz (Sorbonne University) - organizer
Strani, Marta (Ca Foscari University of Venice)
Thalhammer, Mechthild (Leopold-Franzens Universität Innsbruck)
Trichtchenko, Olga (University of Western Ontario)
Vlasiou, Maria (University of Twente)
Wroblewska-Kaminska, Aneta (Institute of Mathematics, Polish Academy of Sciences)
Yu, Xueying (University of Washington)

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