UNICAMP

# Third Workshop on

# Nonlinear Dispersive Equations

**08/11/2017 to 10/11/2017**

**IMECC-UNICAMP, Campinas, Brazil**

## Scientific Committee

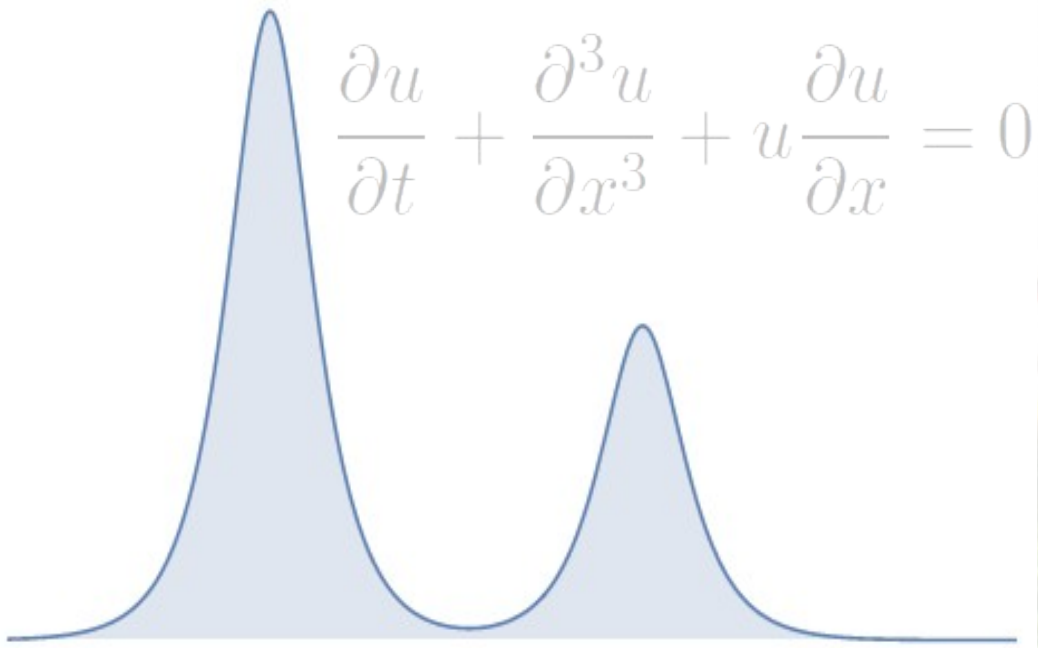
**Jerry Bona - UIC, USA**

**Thierry Cazenave - Paris VI, France**

**Márcia Scialom - UNICAMP, Brazil**

**Gustavo Ponce - UCSB, USA**

**Jean-Claude Saut - Paris-Sud, France**




## Organizing Committee

**Jaime Angulo - USP**

**Felipe Linares - IMPA**

**Mahendra Panthee - UNICAMP**

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IMECC

# Third Workshop on Nonlinear Dispersive Equations

## 08 to 10 November 2017

## IMECC-UNICAMP, Campinas, Brazil

## Scientific Program

| Day/Time | 08/11 Wednesday | 09/11 Thursday | 10/11 Friday |
|---|---|---|---|
| 8:00-9:00 | Registration / Opening | - | - |
| 9:00-9:40 | G. Ponce | L. Vega | J. Bona |
| 9:45-10:25 | L. Fanelli | C. Muñoz | P. Isaza |
| 10:30-10:50 | Coffee | Coffee | Coffee |
| 10:55-11:25 | F. Natali | N. Goloshchapova | J. M. Jiménez |
| 11:30-12:00 | R. Capistrano | D. Pilod | L. Farah |
| 12:00-14:00 | Lunch | Lunch | Lunch |
| 14:00-14:40 | M. Ohta | S. Vento | S. Roudenko |
| 14:45-15:15 | M. Cavalcante | C. Guzman | M. Alejo |
| 15:20-15:50 | A. Corcho | X. Carvajal | A. Pazoto |
| 15:55-16:25 | Coffee / Poster | Coffee / Poster | Coffee |
| 16:25-16:45 | L. Esquivel | A. Kumar | - |
| 16:50-17:10 | M. Hayashi | T. Andrade | - |
| 20:00-23:00 | Football Match | Dinner | |

# Third Workshop on Nonlinear Dispersive Equations

## 08 to 10 Nvember 2017

## IMECC–UNICAMP, Campinas, Brazil

## Day -1: Tuesday, 8th November

## Auditório – Hebe Biagioni

| **Time** | **Speaker** | **Title** |
|---|---|---|
| 8:00-9:00 | Organizers | Registration / Opening |
| | **Chair** | **Felipe Linares** |
| 9:00-9:40 | G. Ponce | On Special Properties of Solutions to the Camassa-Holm equation |
| 9:45-10:25 | L. Fanelli | About the spectrum of non self-adjoint Schrödinger Hamiltonians |
| 10:30-10:50 | | COFFEE BREAK |
| | **Chair** | **Ademir Pazoto** |
| 10:55-11:25 | F. Natali | Orbital Stability of Periodic Traveling-wave solutions for the Log-KdV Equation |
| 11:30-12:00 | R. Capistrano | General Boundary Value Problems of the Kortweg-de Vries Equation on a Bounded Domain |
| 12:00-14:00 | | LUNCH BREAK |
| | **Chair** | **Jaime Angulo** |
| 14:00-14:40 | M. Ohta | Strong instability of standing waves for nonlinear Schrödinger equations with a partial confinement |
| 14:45-15:15 | M. Cavalcante | The KdV equation in unbounded domains |
| 15:20-15:50 | A. Corcho | On a nonlinear Schrödinger system arising in quadratic media |
| 15:55-16:25 | | COFFEE BREAK/**Poster Session** |
| | **Chair** | **Didier Pilod** |
| 16:25-16:45 | L. Esquivel | A forced fractional Schrdinger equation with a Neumann boundary condition |
| 16:50-17:10 | M. Hayashi | Global existence of solutions for the derivative nonlinear Schrödinger equation |
| 20:00-21:30 | **Football Match:** | **Escola de Futebol Boca Juniors** **Rua Carlos Martins 17, Barão Geraldo** (starts at 20:30) |

# Third Workshop on Nonlinear Dispersive Equations

## 08 to 10 November 2017

## IMECC–UNICAMP, Campinas, Brazil

## Day -2: Thursday, 9th November

## Auditório – Hebe Biagioni

| **Time** | **Speaker** | **Title** |
|---|---|---|
| | **Chair** | **Luis Gustavo Farah** |
| 9:00-9:40 | L. Vega | 1-d Cubic NLS with several Dirac deltas as inital condition: Talbot effect and Intermittency |
| 9:45-10:25 | C Muñoz | Scattering in the energy space for Boussinesq equations |
| 10:30-10:50 | | COFFEE BREAK |
| | **Chair** | **Luca Fanelli** |
| 10:55-11:25 | N. Goloshchapova | Instability of excited states of the nonlinear Schrödinger equation (NLS) with the $\delta$-interaction on a star graph |
| 11:30-12:00 | D. Pilod | Well-posedness for low dispersion fractional KdV and KP equations |
| 12:00-14:00 | | LUNCH BREAK |
| | **Chair** | **Fabio Natali** |
| 14:00-14:40 | S. Vento | Energy methods for KdV type equations with fractional dispersion |
| 14:45-15:15 | C. Guzman | On the 3D cubic inhomogeneous nonlinear Schrödinger equation |
| 15:20-15:50 | X. Carvajal | Well-posedness for coupled systems of KdV and mKdV type equations |
| 15:55-16:25 | | COFFEE BREAK/**Poster Session** |
| | **Chair** | **Adan Corcho** |
| 16:25-16:45 | A. Kumar | Singular vs global solutions in generalized Hartree equation |
| 16:50-17:10 | T. Andrade | Orbital stability of one-parameter periodic traveling waves for dispersive equations and applications |
| 20:00-23:00 | **Dinner** | **Estância Grill**<br>**Av. Albino J. B. de Oliveira 271, Barão Geraldo** |

# Third Workshop on Nonlinear Dispersive Equations

## 08 to 10 November 2017

## IMECC–UNICAMP, Campinas, Brazil

## Day -3: Friday, 10th November

## Auditório – Hebe Biagioni

| **Time** | **Speaker** | **Title** |
|---|---|---|
| | **Chair** | **Gustavo Ponce** |
| 9:00-9:40 | J. Bona | Further Results on Higher-order Models for Water Waves |
| 9:45-10:25 | P. Isaza | On optimal exponential decay properties of solutions to the Korteweg-de Vries equation |
| 10:30-10:50 | | COFFEE BREAK |
| | **Chair** | **Claudio Muñoz** |
| 10:55-11:25 | J. M. Jiménez | On the unique continuation property of solutions of the three-dimensional Zakharov-Kuznetsov equation |
| 11:30-12:00 | L. Farah | Instability of solitons in KdV and ZK equations |
| 12:00-14:00 | | LUNCH BREAK |
| | **Chair** | **Felipe Linares** |
| 14:00-14:40 | S. Roudenko | Blowup in the 2d critical Zakharov-Kuznetsov equation |
| 14:45-15:15 | M. Alejo | Nonlinear stability of Gardner breathers |
| 15:20-15:50 | A. Pazoto | Boundary controllability of a coupled system of KdV-type equations |
| 16:00- | | **Closing Session**/Farewell Coffee |

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# Third Workshop on Nonlinear Dispersive Equations
## 08 to 10 November 2017
## IMECC–UNICAMP, Campinas, Brazil

## Abstracts - Conference Talks

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(1) Miguel Alejo, UFSC, Brazil, *miguel.alejo@ufsc.br*

**Title**: Nonlinear stability of Gardner breathers

**Abstract**: In this talk I will show how to generalize our stability results for mKdV breathers for the case of Gardner breather solutions, by using strongly the integrable character of the PDE and obtaining their variational characterization.

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(2) Thiago Pinguello de Andrade, UTFPR, Brazil, *thiagoandrade@utfpr.edu.br*

**Title**: Orbital stability of one-parameter periodic traveling waves for dispersive equations and applications

**Abstract**: In this work we study the orbital stability of periodic traveling waves for two classes of nonlinear dispersive models. The first one includes the generalized Korteweg-de Vries (KdV) equation,

$$u_t - \mathcal{M}u_x + (f(u))_x = 0, \tag{0.1}$$

and the second one includes the Benjamin-Bona-Mahony (BBM) equation,

$$u_t + \mathcal{M}u_t + (f(u))_x = 0. \tag{0.2}$$

By adapting the classical theory developed by Grillakis, Shatah and Strauss, we bring to the light the orbital stability of a series of periodic waves for several models. Among them, that waves which have the form

$$\phi_k(x) = \frac{a\mathrm{DN}^2\left(bx, k\right)}{\left(1 + \beta^2\mathrm{SN}^2\left(bx, k\right)\right)} \tag{0.3}$$

for KdV, Gardner and BBM models.

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(3) Jerry Bona, UIC, Chicago, USA, *jbona@uic.edu*

**Title**: Further Results on Higher-order Models for Water Waves

**Abstract**: The lecture will discuss theoretical work on and numerical simulations of the higher-order, unidirectional models for water waves recently derived by Carvajal, Panthee, Scialom and the speaker. This will include questions about solitary waves as well as growth conditions on the norms of solutions in higher-order Sobolev spaces.

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(4) Roberto Capistrano–Filho, Universidade Federal de Pernambuco, Brazil, *capistranofilho@dmat.ufpe.br*

**Title**: General Boundary Value Problems of the Kortweg-de Vries Equation on a Bounded Domain*

**Abstract**: In this talk we consider the initial boundary value problem of the Korteweg-de Vries equation posed on a finite interval

$$u_t + u_x + u_{xxx} + uu_x = 0, \qquad u(x,0) = \phi(x), \qquad 0 < x < L,\ t > 0 \tag{0.4}$$

subject to the nonhomogeneous boundary conditions,

$$B_1 u = h_1(t), \qquad B_2 u = h_2(t), \qquad B_3 u = h_3(t) \qquad t > 0 \tag{0.5}$$

where

$$B_i u = \sum_{j=0}^{2} \left( a_{ij} \partial_x^j u(0,t) + b_{ij} \partial_x^j u(L,t) \right), \qquad i = 1,2,3,$$

and $a_{ij},\ b_{ij}$, with $i = 1,2,3$ and $j = 0,1,2$, are real constants. Under some general assumptions imposed on the coefficients $a_{ij}$ and $b_{ij}$, the IBVPs (0.4)-(0.5) is shown to be locally well-posed in the space $H^s(0,L)$ for any $s \geq 0$ with $\phi \in H^s(0,L)$ and boundary values $h_j, j = 1,2,3$ belonging to some appropriate spaces with optimal regularity.

*This a joint work with Bingyu Zhang of University of Cincinnati and Shuming Sun of Virginia Tech.

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(5) Xavier Carvajal , UFRJ, Brazil, *carvajal@im.ufrj.br*

**Title**: Well-posedness for coupled systems of KdV and mKdV type equations*

**Abstract**: We consider initial value problems (IVPs) associated to two different systems consisting Korteweg-de Vries (KdV) and modified Korteweg-de Vries (mKdV) type equations and prove local well-posedness results for the given data in certain low regularity Sobolev spaces.

*Joint work with Mahendra Panthee from Unicamp, Campinas.

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(6) Marcio Cavalcante, UFAL, Maceio, Brazil, *marciocavalcante1988@gmail.com*

**Title**: The KdV equation in unbounded domains

**Abstract**: In this talk we discuss about some recent results obtained forthe Korteweg-de Vries equation on the half-line and on the metric star graph. For the KdV on star graphs we obtain local-well posedness for the cauchy problem for two classes of boundary conditions. While for the positive half-line problem, in a joint work with C. Muoz (U. de Chile), we obtain a result of stability of solitons by assuming homogeneous boundary conditions. In both problems we discuss the reasons for the choices of the boundary conditions considered.

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(7) Adan Corcho, IM-UFRJ, Brazil, *adan.corcho@gmail.com*

**Title**: On a nonlinear Schrödinger system arising in quadratic media*

**Abstract**: We consider the quadratic Schrödinger system

$$\begin{cases} iu_t + \Delta_{\gamma_1} u + \overline{u}v = 0 \\ 2iv_t + \Delta_{\gamma_2} v - \beta v + \frac{1}{2}u^2 = 0, \quad t \in \mathbb{R},\, x \in \mathbb{R}^d \times \mathbb{R}, \end{cases}$$

in dimensions $1 \leq d \leq 4$ and for $\gamma_1, \gamma_2 > 0$, the so-called elliptic-elliptic case. We show the formation of singularities and blow-up in the $L^2$- critical and supercritical

cases using the dynamic coming from the Hamiltonian structure. Furthermore, we derive some stability and instability results concerning the ground state solutions of this system.

*This a joint work with S. Correia (CMAF-CIO and FCUL, Universidade de lisboa), F. Oliveira (Mathematics Department and CEMAPRE ISEG, Universidade de Lisboa) and J. D. Silva (IST, Lisboa)

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(8) Liliana Esquivel, IM-UFRJ, Brazil, *liliane.esquivel@gmail.com*

**Title**: A forced fractional Schrdinger equation with a Neumann boundary condition

**Abstract**: We study the initial-boundary value problem for the nonlinear fractional Schrdinger equation

$$\begin{cases} u_t + i\left(u_{xx} + \frac{1}{2\pi}\int_0^\infty \frac{\text{sign}(x-y)}{\sqrt{|x-y|}} u_y(y)dy\right) + i|u|^2u = 0,\ t>0,\ x>0 \\ u(x,0) = u_0(x),\ x>0, \quad u_x(0,t) = h() \end{cases} \tag{0.6}$$

We prove the global-in-time existence of solutions for a nonlinear fractional Schrödinger equation with inhomogeneous Neumann boundary conditions. We are also interested in the study of the asymptotic behaviour of the solutions.

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(9) Luca Fanelli, SAPIENZA Università di Roma, Italy, *fanelli@mat.uniroma1.it*

**Title**: About the spectrum of non self-adjoint Schrödinger Hamiltonians*

**Abstract**: Developing a multiplier method " la Morawetz", we prove some spectral stability for magnetic Schrödinger Hamiltonians with suitably subordinated complex potentials. Hardy inequalities naturally come into play. Moreover, in 3D, a suitable application of the Birman-Schwinger Principle gives a quite complete result.

*This is the result of a collaboration with D- Krejcirik (Czech Technical Institute - Prague) and L. Vega (BCAM & UPV/EHU - Bilbao.

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(10) Luiz Gustavo Farah, UFMG, Brazil, *lgfarah@gmail.com*

**Title**: Instability of solitons in KdV and ZK equations*

**Abstract**: We revisit the instability of solitons in the critical generalized Korteweg-de Vries (gKdV) equation, and investigate a similar phenomenon in the Zakharov-Kuznetsov (ZK) equation, a higher dimensional generalizations of the gKdV equation. As a consequence, this leads to the existence of blow-up solutions for the critical ZK equation.

*This is a joint work with Justin Holmer and Svetlana Roudenko.

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(11) Nataliia Goloshchapova, USP, Brazil, *natalygoloshchapova@gmail.com*

**Title**: Instability of excited states of the nonlinear Schrödinger equation (NLS) with the $\delta$-interaction on a star graph

**Abstract**: We investigate an orbital stability of the standing waves $e^{i\omega t}\mathbf{\Phi}(x)$ of the NLS equation with the $\delta$-interaction on a star graph $\mathcal{G}$ (i.e. $N$ half-lines joined at the vertex $\nu = 0$). All the possible profiles $\mathbf{\Phi}(x)$ generate the family of $[\frac{N-1}{2}] + 1$ solutions (stationary states) to the stationary equation associated with the NLS-$\delta$ equation. When an intensity of the $\delta$-interaction is negative, there is a unique ground state among them (in the sense of constraint minimality of the associated action functional). It is the only solution symmetric modulo rotations of the edges of the graph $\mathcal{G}$. The rest of the stationary states are of different action and energy (or they are excited states).

An orbital stability of the ground state was extensively studied in the recent series of papers by R. Adami et al. To our knowledge, nothing is known about stability of exited states. Using the theory by M. Grillakis, J. Shatah, W. Strauss, the theory of extensions of symmetric operators, and the perturbation theory, we show instability of excited states for a negative intensity of the $\delta$-interaction.

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(12) Carlos M Guzmán, UFMG, Brazil, *carlos.guz.j@gmail.com*

**Title**: On the 3D cubic inhomogeneous nonlinear Schrödinger equation*

**Abstract**: We consider the initial value problem for the cubic inhomogeneous nonlinear Schrödinger (INLS) equation

$$\begin{cases} i\partial_t u + \Delta u + \lambda|x|^{-b}|u|^2 u = 0, \qquad t \in \mathbb{R},\ x \in \mathbb{R}^3, \\ \qquad u(0,x) = u_0(x), \end{cases} \tag{0.7}$$

where $u = u(t,x)$ is a complex-valued function in space-time $\mathbb{R} \times \mathbb{R}^3$, $\lambda = \pm 1$ and $b > 0$.

We obtain local and global results for the initial data in $H^1(\mathbb{R}^3)$. Moreover, we prove scattering for the focusing case ($\lambda = 1$) in $H^1(\mathbb{R}^3)$. To this end, for the first one we use the contraction mapping principle based on the Strichartz estimates, and to show scattering we use the ideas introduced by Kenig-Merle [2] in their study of the energy-critical NLS and Holmer-Roudenko [1] for the $3D$ cubic NLS.

*This is a joint work with Luiz Farah (UFMG). The author was partially supported by CAPES/Brazil.

## References

[1] J. Holmer, S. Roudenko, *A sharp condition for scattering of the radial 3D cubic nonlinear Schrödinger equation* , Comm. Math Phys, 435–467, 2008.

[2] C. E. Kenig, F. Merle, *Global well-posedness, scattering, and blow-up for the energy-critical focusing nonlinear Schrödinger equation in the radial case* , J. Invent. Math, 166: 645–675, 2006.

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(13) Masayuki Hayashi, Waseda University, Japan, *masayuki-884@fuji.waseda.jp*

**Title**: Global existence of solutions for the derivative nonlinear Schrödinger equation*

**Abstract**: We give a sufficient condition for global existence of the solutions to the derivative nonlinear Schrödinger equation (DNLS) by a variational argument. Wu (2015) proved that the solution with the initial data $u_0$ is global if $\|u_0\|_{L^2}^2 < 4\pi$ by applying the gauge transformation and the sharp Gagliardo–Nirenberg inequality. The variational argument gives us another simple proof of the global existence for

(DNLS). Moreover, we can show that the solution to (DNLS) is global if the initial data $u_0$ satisfies that $\|u_0\|_{L^2}^2 = 4\pi$ and the momentum $P(u_0)$ is negative. Our approach can be also applied to the generalized derivative nonlinear Schrödinger equation.

*This is a joint work with Noriyoshi Fukaya and Takahisa Inui.

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(14) Pedro Isaza, Universidad Nacional de Colombia, Medellin, Colombia, *pisaza@unal.edu.co*

**Title**: On optimal exponential decay properties of solutions to the Korteweg-de Vries equation*

**Abstract**: We consider the Cauchy problem associated to the Korteweg-de Vries equation (KdV) and study the preservation of exponential decay of order 3/2 on the right of the $x$-axis as time evolves. More precisely, for a solution which decays at $t = 0$ as $exp(-a_0x^{3/2})$ for $x > 0$, we find an optimal function $a(t)$ with $a(0) = a_0$ such that the solution decays as $exp(-a(t)x^{3/2})$ for $t > 0$.

*This is a joint work with Carlos A. León

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(15) José Manuel Jiménez, Universidad Nacional de Colombia, Colombia, *jmjimene@unal.edu.co*

**Title**: On the unique continuation property of solutions of the three-dimensional Zakharov-Kuznetsov equation*

**Abstract**: We prove that if the difference of two sufficiently smooth solutions of the three-dimensional Zakharov-Kuznetsov equation

$$\partial_t u + \partial_x \triangle u + u\partial_x u = 0, \quad (x, y, z) \in \mathbb{R}^3,\ t \in [0, 1]\ ,$$

decays as $e^{-a(x^2+y^2+z^2)^{3/4}}$ at two different times, for some $a > 0$ large enough, then both solutions coincide.

*Joint work with Eddye Bustamante and Jorge Mejía Universidad Nacional de Colombia, Sede Medelln.

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(16) Anudeep Kumar, George Washington University, USA, em anudeep@email.gwu.edu

**Title**: Singular vs global solutions in generalized Hartree equation

**Abstract**: We study the long time behavior of solutions for the nonlinear inter-critical ($0 < s < 1$) generalized Hartree equation, where the nonlinearity is of nonlocal type and is expressed as a convolution. We first establish the threshold that gives the asymptotic behavior of solution: blows-up in finite time vs global in time existence & scattering in $H^1$. We present two approaches: one via the well - known method of concentration - compactness and other one is without the concentration - compactness. We also investigate a stable blow-up dynamics for this equation in the $L^2$ - critical setting in various dimensions and obtain the rigorous description in the 3-dimensional case.

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(17) Claudio Muñoz, Universidad de Chile, Chile, *cmunoz@dim.uchile.cl*

**Title**: Scattering in the energy space for Boussinesq equations*

**Abstract**: In this talk we show that all small solutions in the energy space of the generalized 1D Boussinesq equation must decay to zero as time tends to infinity, strongly on slightly proper subsets of the space-time light cone. Our result does not require any assumption on the power of the nonlinearity, working even for the supercritical range of scattering. No parity assumption on the initial data is needed.

*This is joint work with F. Poblete (U. Austral Valdivia) and J. C. Pozo (UFRO Temuco).

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(18) Fábio Natali, Universidade Estadual de Maringá, Brazil, *fmnatali@hotmail.com*

**Title**: Orbital Stability of Periodic Traveling-wave solutions for the Log-KdV Equation

**Abstract**: In this talk, we establish the orbital stability of periodic waves related to the logarithmic Korteweg-de Vries equation. Our motivation is inspired in the recent work [1], in which the authors established the well-posedness and the linear stability of Gaussian solitary waves. By using the approach put forward recently in [3] to construct a smooth branch of periodic waves as well as to get the spectral properties of the associated linearized operator, we apply the abstract theories in [2] and [4] to deduce the orbital stability of the periodic traveling waves in the energy space.

## References

[1] R. Carles and D. Pelinovsky, On the orbital stability of Gaussian solitary waves in the log-KdV equation, Nonlinearity, 27 (2014), 3185-3202.

[2] M. Grillakis, J. Shatah and W. Strauss, Stability theory of solitary waves in the presence of symmetry I., J. Funct. Anal. 74 (1987), 160-197.

[3] F. Natali and A. Neves, Orbital stability of solitary waves, IMA Journal of Applied Mathematics, 79 (2014), 1161-1179.

[4] M. I. Weinstein, Modulation Stability of Ground States of Nonlinear Schrodinger Equations, SIAM J. Math, 16 (1985), 472-490.

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(19) Masahito Ohta, Tokyo University of Science, Japan, *mohta@rs.tus.ac.jp*

**Title**: Strong instability of standing waves for nonlinear Schrödinger equations with a partial confinement

**Abstract**: We consider the nonlinear Schrödinger equation with a one-dimensional harmonic potential

$$i\partial_t u = -\Delta u + x_N^2 u - |u|^{p-1}u, \quad (t,x) \in \mathbf{R} \times \mathbf{R}^N, \tag{1}$$

where $N \geq 2$, $x_N$ is the $N$-th component of $x = (x_1, ..., x_N) \in \mathbf{R}^N$, and $1 < p < 1 + 4/(N-2)$. For $\omega \in (-1, \infty)$, let $\phi_\omega(x)$ be a ground state for the stationary problem

$$-\Delta\phi + x_N^2\phi + \omega\phi - |\phi|^{p-1}\phi = 0, \quad x \in \mathbf{R}^N.$$

We prove that if $1 + 4/(N-1) \leq p < 1 + 4/(N-2)$, then for any $\omega \in (-1, \infty)$, the standing wave solution $e^{i\omega t}\phi_\omega(x)$ of (1) is strongly unstable by blowup. Remark that Bellazzini, Boussaïd, Jeanjean and Visciglia (2017) constructed orbitally stable standing wave solutions of (1) for the case $1 + 4/N < p < 1 + 4/(N-1)$.

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(20) Ademir Pazoto, Universidade Federal do Rio de Janeiro (UFRJ), Brazil, *ademir@im.ufrj.br*

**Title**: Boundary controllability of a coupled system of KdV-type equations*

**Abstract**: We consider a system of equations derived by Gear and Grimshaw to model the strong interaction of two-dimensional, long, internal gravity waves propagating on neighboring pycnoclines in a stratified fluid. It has the structure of a pair of KdV equations coupled through both dispersive and nonlinear effects. The purpose is to see whether one can force the solutions of the system to have certain desired properties by choosing appropriate control inputs, when the system is posed on a bounded interval. We prove that, unlike other models, the length of the spatial domain may play a crucial role in determining the controllability, specially if some configurations of four input controls are allowed to be used. This phenomenon, the so-called critical length phenomenon, was observed for the first time by Rosier while studying the boundary controllability of the KdV equation.

*Joint work with R. Capistrano Filho and F. Gallego.

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(21) Didier Pilod, UFRJ, Brazil, *didierpilod@gmail.com*

**Title**: Well-posedness for low dispersion fractional KdV and KP equations*

**Abstract**: In this talk we will review some recent results on the well-posedness for some classes of nonlocal dispersive equations in dimensions 1 and 2 at low regularity. Those classes contain in particular the fractional KdV equation

$$\partial_t u + u\partial_x u - D_x^\alpha \partial_x u = 0\,,$$

with low dispersion $0 < \alpha \leq 1$ in dimension 1, and the fractional KP equation

$$\partial_t u + u\partial_x u - D_x^\alpha u_x + \kappa \partial_x^{-1}\partial_y^2 u = 0\,,$$

with low dispersion $0 < \alpha < 2$ in dimension 2, ($\kappa = 1$ corresponding to the fKP-II equation and $\kappa = -1$ to the fKP-I equation).

Here $D^\alpha$ denotes a fractional derivative of order $\alpha \in \mathbb{R}$ and is defined *via* Fourier transform by $D^\alpha f = \big(|\xi|^\alpha \widehat{f}(\xi)\big)^\vee$.

*This talk is based on joint works with Felipe Linares (IMPA), Jean-Claude Saut (Université Paris-Saclay), Luc Molinet (Université de Tours) and Stéphane Vento (Université Paris 13).

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(22) Gustavo Ponce, University of California-Santa Barbara, USA, *ponce@math.ucsb.edu*

**Title**: On Special Properties of Solutions to the Camassa-Holm equation*

**Abstract**: We study special properties of solutions to the IVP associated to the Camass-Holm equation. These properties include the regularity and the space decay of solutions. The first aim is to show how the regularity on the initial data is transferred to the corresponding solution in a class containing the "peakon solutions. In particular, we show that the local regularity is similar to that exhibited by the solution of the inviscid Burgers equation with the same initial datum. The second goal is to prove that the decay results obtained by Himonas-Misiolek-Ponce-Zhou extend to the class of solutions considered here and it is sharp in this class. Finally, we shall see how this result presents a natural question in other equations, including the generalized Korteweg-de Vries equation.

*Joint work with F. Linares and T. Sideris.

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(23) Svetlana Roudenko, George Washington University, USA, *roudenko@gwu.edu*

**Title**: Blowup in the 2d critical Zakharov-Kuznetsov equation*

**Abstract**: We consider the 2d generalized Zakharov-Kuznetsov (ZK) equation in the $L^2$-critical setting (i.e., with the cubic nonlinearity). As it is discussed in Luiz Farah's talk, this equation exhibits instability of solitary waves, which leads to the formation of blow-up solutions. We show that the 2d cubic ZK equation indeed

has finite energy solutions that blow-up in finite or infinite time. This is the first rigorous proof of blow-up in the ZK setting.

*It is a joint work with Luiz Farah, Justin Holmer and Kai Yang.

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(24) Luis Vega, BCAM, Bilbao, Spain *lvega@bcamath.org*

**Title**: 1-d Cubic NLS with several Dirac deltas as inital condition: Talbot effect and Intermittency*

**Abstract**: The aim of talk is threefold. First, we solve the cubic nonlinear Schrödinger equation on the real line with initial data a sum of Dirac deltas. Secondly, we show a Talbot effect for the same equation. Finally, we prove an intermittency phenomena for a class of singular solutions of the binormal flow, that is used as a model for the vortex filaments dynamics in 3-D fluids and superfluids.

*This is a joint work with V. Banica.

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(25) Stéphane Vento, Université Paris 13, France *vento@math.univ-paris13.fr*

**Title**: Energy methods for KdV type equations with fractional dispersion

**Abstract**: This talk is based on a joint work with Luc Molinet and Didier Pilod. We consider the Cauchy problem associated with the fractional KdV equations

$$\partial_t u - D_x^\alpha \partial_x u = \partial_x(u^2),\ t \in \mathbb{R},\ x \in \mathbb{R} \text{ or } \mathbb{T},$$

with $\alpha \in (0, 2]$. Classical energy methods allow to prove the well-posedness for initial data with high regularity in $L^2$-based Sobolev spaces $H^s$. In this talk, we show that we may improve these methods thanks to Bourgain's type estimates as well as modified energy arguments. Our results include global and unconditional well-posedness on both $\mathbb{R}$ and $\mathbb{T}$ without the use of a gauge transform.

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# Abstracts - Posters

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(1) Fabrício Cristófani, Universidade Estadual de Maringá, Brazil, *fabriciognr@gmail.com*

**Title**: A Simple Criterion of Orbital Stability of Periodic Traveling wave solutions for regularized dispersive equations*

**Abstract**: In this talk, we establish a criterion for the orbital stability of periodic waves related to a general class of regularized dispersive equations. We present sufficient conditions for the stability without knowing the positiveness of the associated hessian matrix. As applications of our method, we show the orbital stability for two dispersive equations: the classical BBM equation and a fifth-order model. As a novelty, we prove the orbital stability of periodic waves that miminize a Lyapunov functional .

## References

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[4] V.M. Hur and M. Johnson, *Stability of periodic traveling waves for nonlinear dispersive equations*, SIAM J. Math. Anal., 47 (2015), pp. 3528-3554.

[5] M. Johnson, *On the stability of periodic solutions of the generalized Benjamin-Bona-Mahony equation*, Phys. D 239 (2010), pp. 1892-1908.

*Joint work with Fabio Natali from Universidade Estadual de Maringá, Parana and Ademir Pastor from Universidade Estadual de Campinas, São Paulo.

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(2) Eleomar Cardoso Júnior, UFSC, Brazil, *eleomar.junior@ufsc.br*

**Title**: Stability properties of periodic traveling waves for the Intermediate Long Wave equation

**Abstract**: In this work, we determine orbital and linear stability of periodic waves with the mean zero property related to the Intermediate Long Wave equation. Our arguments follow the recent developments associated with Hamiltonian-Krein index.

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(3) George Jose Bautista Sanchez, UFRJ, Brazil, *geojbs25@gmail.com*

**Title**: Large-time asymptotics of a Boussinesq system for water waves*

**Abstract**: In this work we are concerned with the stabilization properties of the linearized Boussinesq system of BBM-BBM type introduced by J. Bona, M. Chen and J.-C. Saut as a model for the motion of small amplitude long waves on the surface of an ideal fluid. We propose several dissipation mechanisms leading to systems for which one has both the existence of solutions and a nonincreasing norm. It is shown that all the trajectories are attracted by the origin provided that the Unique Continuation Property holds.

*Joint work with A. F. Pazoto, Universidade Federal do Rio de Janeiro.

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(4) Francisco J. Vielma Leal, IMECC-UNICAMP, Brazil, *fvielmaleal7@gmail.com*

**Title**: On the Controllability and Stabilization of the Benjamin Equation

**Abstract**: The Benjamin equation is an integro differential-equation that serves as a generic model for unidirectional propagations of long waves in a two-fluid system where the lower fluid with greater density is infinitely deep and the interface is subject to capillarity. It was derived by Benjamin to study gravity-capillarity surface waves of solitary type on deep water. In this poster, we prove exact controllability and stabilization for the Benjamin equation on a periodic domain $\mathbb{T}$. The main tool in the proof is the so-called Ingham's inequality.

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