

Barbara Prinari: Curriculum Vitae

Barbara Prinari

Born in Milano (Italy) on July 5, 1972

Tenured Assistant Professor, Physics Department - University of Salento (Lecce), Italy

Contact Information

Dipartimento di Fisica - Università del Salento

Via per Arnesano

I73100 Lecce, Italy

Telephone: +39 0832 297455 (office) +39 0832 300032 (home); Fax: +39 0832 297505

Email: barbara.prinari@le.infn.it

<http://www.fisica.unile.it/~prinari>

Education

University of Lecce, Dec 1999, Ph.D. in Theoretical Physics

University of Lecce, Jul 1996, Degree in Physics (summa cum laude)

Employment

2005- present: Assistant Professor (with tenure) of Theoretical Physics, Physics Department - University of Salento (Lecce, Italy)

Aug - Dec 2007: Visiting Professor, Department of Applied Mathematics, University of Colorado at Boulder

Aug - Dec 2006: Visiting Professor, Department of Applied Mathematics, University of Colorado at Boulder

2002-2005: Assistant Professor (tenure-track), Physics Department, University of Lecce (Italy)

Feb - Aug 2001: Visiting Scholar, Department of Applied Mathematics, University of Colorado at Boulder

2000-2002: Post-doctoral fellowship, University of Lecce, Italy

Research Interests and Accomplishments

A central theme in my research is the study of nonlinear partial differential equations by means of the so-called Inverse Scattering (IST) transform method.

Part of my research activity deals with the development of a new mathematical technique which allows one to extend the IST for $(2 + 1)$ -dimensional equations to the case of potentials that are not decaying along a finite number of directions in the plane. In a series of papers,^[1,2,3,4,6,7,10,13,15] I have contributed to generalizing the IST for the Kadomtsev-Petviashvili equations [a $(2 + 1)$ -dimensional version of the KdV equation] to include also line soliton solutions. The new mathematical method my collaborators and I have developed is applicable to other equations in $(2 + 1)$ -dimensions relevant for physical applications.

Since 2001, I have been working in collaboration with Mark J. Ablowitz, at the Department of Applied Mathematics, University of Colorado at Boulder. Our common research activity mainly focuses on the IST for continuous and discrete Nonlinear Schrödinger systems (NLS).

My main research contributions in this field are listed below.

- I have co-authored a monograph and two invited encyclopedia articles^[17,22] on scalar and matrix/vector nonlinear Schrödinger systems, both continuous and discrete, especially from (but not limited to) the point of view of the inverse scattering transform.
- I have worked on vector soliton interactions, and for the first time clarified their nature, proving that the multisoliton collision process is pair-wise and the net result of the interaction is independent of the order in which such collisions occur.^[11,12]
- I have rigorously studied issues of solvability of both the direct and inverse problems associated with the scalar NLS equation,^[14] identifying function spaces for which both problems are well posed, have a unique solution and the corresponding direct and inverse maps are one to one in the same space.
- I have developed the inverse scattering transform for the defocusing vector NLS equation under nonvanishing boundary conditions, a problem that had been open for over 30 years. I have also characterized soliton solutions in the IST framework, including novel dark-bright solitons.^[18]
- I have worked on an integrable discretization of the vector NLS equation and derived, for the first time, an explicit formula for discrete vector soliton interactions^[16] that generalizes the result obtained by Manakov in 1974 for the 2-component vector NLS equation.
- I have studied the IST for an integrable discretization of the scalar NLS equation under nonvanishing boundary conditions,^[19] elucidating the problem of analyticity of eigenfunctions and scattering data.
- I have studied the strong coupling limit of nonlinear Schrödinger systems by using Hirota's bilinear method and the Pfaffian technique.^[21]

Over the years, I have also studied other discrete systems. More specifically, I have introduced a new discretization of the Schrödinger operator and showed that a new integrable discretization of the KdV equation at large times is associated to the resulting scattering problem.^[5,8] I have also obtained the whole hierarchy of nonlinear differential-difference equations associated with the spectral problem introduced in [5], and I have proved that the 'inverse' class in the hierarchy is local.^[9]

Recently, I have developed a new research direction, which is applying generalized kinetic and dynamical methods to the analysis of biological and social systems. This is a challenging, highly interdisciplinary area, that involves stochastics in addition to analysis, and requires a combination of exact methods, approximations and numerical simulations. In this area, I have developed (and published on) a statistical method for modeling and controlling the quality of an existing neuropsychiatric ward, where experimental data have been collected for almost a decade.^[20]

Grants

In 2000, 2002, 2004 I have obtained PRIN grants from the MIUR (Italian Ministry for University and Research) within a project named "Sintesi" (Symmetries, Integrability and Singularities).

Since 2002, I have been associate to the INFN (Italian Institute for Nuclear Physics), and I have obtained grants from the INFN - IV Committee with a project named IS LE41.

Teaching Experience

Since 2002, I have been teaching several courses to students in Physics and Mathematics in Lecce:

1. Calculus I and II (2002-2005)
2. Mathematical Methods for Physicists (2002-2007, Fall 2008)
3. Mathematical Methods for Nonlinear Physics (Spring 2007, Fall 2008)
4. Physics II for Mathematicians (Spring 2007, 2008)

In 2006 and 2007 I taught at the Department of Applied Mathematics, University of Colorado at Boulder.

1. Fall 2006: APPM 5430 - Complex Variables (team teaching with M. Ablowitz)
2. Fall 2007: APPM 2360 - Differential Equations

Service

Nov 2007 - present: member of the Teaching Counsel of the Degree Program in Physics (University of Salento, Lecce - Italy)

Spring 2007 and Fall 2008: organizer of the sessions of seminars for undergraduate students (Physics Department - University of Salento, Lecce - Italy)

Reviewer:

Inverse Problems, Journal of Mathematical Physics, Journal of Physics A: Math. Theor., Journal of Mathematical Analysis and Applications, Mathematical Reviews

Conferences:

Member of the Local Organizing Committee of the following international workshops, conferences and schools (and co-editor of the relative Proceedings)

“Nonlinear Physics: Theory and Experiment V”, (2008) June 12-21, Gallipoli (Italy)

“Nonlinear Physics: Theory and Experiment IV”, (2006) June 22 - July 1, Gallipoli (Italy)

“Nonlinear Physics: Theory and Experiment III”, (2004) June 24 - July 3, Gallipoli (Italy)

“Symmetry and Perturbation Theory (SPT) 2004”, (2004) May 30 - June 6, Sardinia (Italy)

“Nonlinear Physics: Theory and Experiment II”, (2002) June 27 - July 6, Gallipoli (Italy)

“IV Diffiety School” (director: Prof. A. Vinogradov), (2000) July 19-27, Forino (Av)

Publications

Monographs

M.J. Ablowitz, B. Prinari, A.D. Trubatch, *“Discrete and Continuous Nonlinear Schrödinger Systems”*, LMS Lecture Notes Series **302**, Cambridge University Press (2004)

Journal Articles

1. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Towards an Inverse Scattering theory for bidimensional nondecaying potentials”*, Theor. Math. Phys. **116**, pp. 741-781 (1998)
2. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Backlund and Darboux transformations for the nonstationary Schrödinger equation”*, Proc. Steklov Institute of Math. **226**, pp. 42-62 (1999)
3. B. Prinari, *“On some nondecaying potentials and related Jost solutions for the heat conduction equation”*, Inverse Problems **16**, pp. 589-603 (2000)
4. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Towards an Inverse Scattering theory for nondecaying potentials of the heat equation”*, Inverse Problems **17**, 937-957 (2001)
5. M. Boiti, F. Pempinelli, B. Prinari and A. Spire, *“An integrable discretization of KdV at large times”*, Inverse Problems **17**, pp. 515-526 (2001)
6. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Inverse scattering transform for the perturbed 1-soliton potential of the heat equation”*, Physics Letters A **285**, pp. 307-311 (2001)
7. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Inverse scattering theory of the heat equation for the perturbed 1-soliton potential”*, Journal of Math. Phys. **43**, pp. 1044-1062 (2002)
8. M. Boiti, F. Pempinelli, B. Prinari and A. Spire, *“Integrable discretization of the sine-Gordon equation”*, Inverse Problems **18**, pp. 1309-1324 (2002)
9. M. Boiti, M. Bruschi, F. Pempinelli and B. Prinari, *“A discrete Schrödinger spectral problem and associated evolution equations”*, Journal of Physics A **36**, pp. 139-149 (2003)
10. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Extended resolvent and inverse scattering with an application to KPI”*, Journal of Math. Phys. **44**, pp. 3309-3340 (2003)
11. M.J. Ablowitz, B. Prinari, A.D. Trubatch, *“Soliton interactions in the vector NLS equation”*, Inverse Problems **20**, pp. 1217-1237 (2004)
12. M.J. Ablowitz, B. Prinari, A.D. Trubatch, *“Nonlinear Schrödinger Systems and their Soliton Dynamics”*, Dynamics of PDE **1**, pp. 239-299 (2004)
13. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *“Spectral Theory of the nonstationary Schrödinger equation with a two-dimensionally perturbed one-dimensional potential”*, Theor. Math. Phys. **144**, pp. 1100-1116 (2005)
14. J. Villarroel, M.J. Ablowitz, and B. Prinari, *“Solvability of the direct and inverse problems for the nonlinear Schrödinger equation”*, Acta App. Math. **87**, pp. 245-280 (2005)

15. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, “*Spectral theory of the nonstationary Schrödinger equation with a bidimensionally perturbed one-dimensional potential*”, Proc. Steklov Institute of Math. **251**, pp. 6-48 (2005)
16. M.J. Ablowitz, B. Prinari, A.D. Trubatch, “*Discrete Vector Solitons: Composite Solitons, Yang Baxter Maps and Computation*”, Studies in App. Math. **116**, pp. 97-133 (2006)
17. M.J. Ablowitz, B. Prinari, “*Nonlinear Schrödinger equations*”, Encyclopedia of Mathematical Physics, Edts. J-P Francoise, F.G. Naber, T.S. Tsun, pp. 552-560 (2006)
18. B. Prinari, M.J. Ablowitz and G. Biondini, “*Inverse scattering transform for the vector nonlinear Schrödinger equation with non-vanishing boundary conditions*”, Journ. Math. Phys. **47**, 063508 (2006)
19. M.J. Ablowitz, G. Biondini and B. Prinari, “*Inverse scattering transform for the integrable discrete nonlinear Schrödinger equation with non-vanishing boundary conditions*”, Inv. Probl. **23**, 1711-1758 (2007)
20. M. Lo Schiavo, B. Prinari and A.E. Serio, “*Analysing Quality with Generalized Kinetic Models*”, Math. Comp. Model. **47** 11501166 (2008)
21. K-ichi Maruno and B. Prinari, “*Determinant and Pfaffian solutions of the strong coupling limit of integrable discrete NLS systems*”, Inv. Probl. **24** 055011 (2008)
22. M.J. Ablowitz and B. Prinari, *Nonlinear Schrödinger systems: continuous and discrete*, invited contribution to Scholarpedia (peer reviewed encyclopedia), Scholarpedia, 3(8):5561 (2008)

Conference Proceedings (Editor)

1. M. Boiti, L. Martina, F. Pempinelli, B. Prinari and G. Soliani eds : “Nonlinearity, Integrability and All That: Twenty Years After NEEDS79”, World Scientific Pu.Co., Singapore (2000)
2. M.J. Ablowitz, M. Boiti, F. Pempinelli and B. Prinari eds : “Nonlinear physics: theory and experiment. II”, World Scientific Pu.Co., Singapore (2003)
3. M. Boiti, F. Pempinelli A.K. Pogrebkov and B. Prinari eds.: Proceedings of the workshop “Nonlinear physics: theory and experiment. III”, published as a special issue of Theor. Math. Phys. 144 issues 1 and 2 (2005)
4. G. Gaeta, B. Prinari, S. Rauch-Wojchiecowski, S. Terracini eds.: “Symmetry and Perturbation Theory”, Proceedings of the International Conference SPT2004, World Scientific Pu.Co., Singapore (2005)
5. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari eds.: Proceedings of the workshop “Nonlinear physics: theory and experiment. IV”, published as a special issue of Theor. Math. Phys. 151 issues 1-3 (2007)
6. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari eds.: Proceedings of the workshop “Nonlinear physics: theory and experiment. V”, to be published as a special issue of Theor. Math. Phys. (2009)

Conference Proceedings

1. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *N-waves soliton solution on a generic background for KPI equation*, Proceedings of the conference Day on Diffraction 99 - St. Petersburg (Russia) (1999) p. 167 (refereed)
2. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *Wave soliton solution on a generic background for KPI equation*, CRM Proceedings and Lecture Notes vol. **25** (2000) p. 47 (refereed)
3. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *Some non decaying potentials for the heat conduction equation*, in "Nonlinearity, Integrability and All That: Twenty Years After NEEDS'79", M. Boiti, L. Martina, F. Pempinelli, B. Prinari and G. Soliani eds, World Scientific Pu.Co., Singapore, (2000) p. 33
4. M. Boiti, F. Pempinelli, A.K. Pogrebkov and B. Prinari, *Some non decaying potentials for the nonstationary Schrodinger equation*, in "Nonlinearity, Integrability and All That: Twenty Years After NEEDS'79", M. Boiti, L. Martina, F. Pempinelli, B. Prinari and G. Soliani eds, World Scientific Pu.Co., Singapore, (2000) p. 42
5. M. Boiti, F. Pempinelli, B. Prinari and A. Spire, *Discrete sine-Gordon equation* in "Nonlinear physics: theory and experiment. II", M.J. Ablowitz, M. Boiti, F. Pempinelli and B. Prinari eds, World Scientific Pu.Co., Singapore (2002) p. 30