

Dr Vincent CAUDRELIER

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French nationality
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SCIENTIFIC INTERESTS

My research activities deal with the area of integrable systems in mathematical physics. The tools involved in their investigation cover many branches of Mathematics like quantum groups and their representation theory, analysis of partial differential (or difference) equations, Lie (bi)algebras or Poisson-Lie groups. The predictions of these models are used in several areas of physics like statistical physics, condensed matter physics, fluid mechanics or string theory. More precisely, I study the formulation of such models with boundaries, defects and more generally on graphs. I have found new mathematical tools and theories from such considerations, like the set-theoretical reflection equation, which has connections with the theory of Poisson-Lie groups and important applications in discrete integrable systems for instance. I also initiated the study of the inverse scattering method on a star-graph, to deal with integrable PDEs on graph-like supports.

PROFESSIONAL BACKGROUND: Research and Teaching

- Since Oct 2007: **Lecturer at the Department of Mathematics**, City University London.
- Oct 2005 to Oct 2007: **Research Fellow and Lecturer at the department of Mathematics, University of York**. EPSRC Fellowship (Engineering and Physical Sciences Research Council, UK).
- Sept 2002 to Sept 2005: **Teaching assistant** at the University of Savoie (France) **Seminar leader** for various undergraduate modules in Mathematics and Physics

SUPERVISION

- Sept 2010-2013: **PhD supervision** of Cheng Zhang. Thesis: "Continuous and quad-graph integrable models with a boundary: reflection maps and 3D boundary consistency".
- May-Aug 2011: **MSc project supervision** of Clément Tauber from ENS Lyon.
- May-July 2010: **MSc project supervision** of Cheng Zhang from ENS Lyon.
- March-June 2002: **MSc project supervisor** of two students of the French "Grande Ecole" ENSAE Toulouse.

ACADEMIC BACKGROUND

- 7 June 2005: **PhD awarded** at the Theoretical Physics laboratory of Annecy-le-vieux (France) with **Distinction** ("mention très honorable", highest grade). Speciality: Mathematical Physics.
- Sept 2002 to Sept 2005: **PhD student** at the Theoretical Physics laboratory of Annecy-le-vieux. Subject: « Nonlinear Schrödinger equation and impurities in integrable systems »
- Oct 2002: **Masters** at the Ecole Nationale Supérieure de l'Aéronautique et de l'Espace (**ENSAE Toulouse**).
- June 2002: **Masters of Advanced Study** at the **University de Cambridge** (UK): **Distinction** (highest grade). Part III of the Mathematical Tripos of DAMTP.

PRIZES, AWARDS and HONOURS

- May 2015: Shortlisted nominee for the City University London **Vice-Chancellor's award for Excellence in Learning and Teaching**.
- Jan 2015 Award of the **Dr V. Ramalingaswami INSA chair 2015** for outstanding mid-career scientist by the **Indian National Science Academy**.
- Dec 2014: Award of a **Shapiro Visitor position** at the Department of Mathematics, **Penn State University**, USA.
- Dec 2010: **£5000 prize** at the 4th Annual Research Competition of City University London.
- Oct 2002: **Pegasus Award** awarded at the **ENSAE** graduation ceremony.
- June 2002: **Jesus College Foundation Prize**, **University of Cambridge**.

INVITATIONS AND CONFERENCES

Invitations

- May 2015: **Invited seminar** at the Department of Mathematics, Heriot-Watt University, Edinburgh, UK.
- May 2015: **Invited seminar** at the School of Mathematics, Statistics and Actuarial Science, University of Kent, UK.
- April 2015: **Invited speaker** at the South East Mathematical Physics Seminar conference, University of Hertfordshire, UK.
- March 2015: **Invited seminar** at the Department of Mathematics and Astrophysics, Northumbria University, UK.
- July/Sept 2014: **Invited professor** position. Two two-week positions at the LAPTH, Annecy-le-vieux, France. Collaboration with Profs E. Ragoucy and M. Mintchev.

- Jan. 2014: **Invited speaker** at the Analysis on Graphs workshop in Royal Holloway, UK.
- Dec. 2013: **Invited speaker** at the Quantum Integrable Systems International Workshop, Bose National Centre, Kolkata, India.
- Nov. 2013: **Invited seminar** at the School of Mathematics and Statistics of the University of Glasgow.
- Feb. 2012: **Invited seminar** at Institut Jean Lamour, LPM Nancy, France.
- Feb 2012: **Invited seminar** at Laboratoire de Mathématiques et Applications de Metz, France.
- June 2011: **Invited talk** at a one-day workshop on final year projects in the School of Mathematics, Statistics & Actuarial Science, University of Kent.
- May 2010: **Invited professor** position. One-month position at the LAPTH, Annecy-le-vieux, France. Collaboration with Prof. E. Ragoucy on a project on quantum graphs.
- Jan. 2010: **Visiting researcher**. One-week invitation at the University of Pisa, Italy. Collaboration with Prof. M. Mintchev on a project on quantum graphs.
- December 2009: **Visiting researcher**. One-week invitation at the LAPTH, Annecy-le-vieux, France. Collaboration with Prof. E. Ragoucy on a project on quantum graphs.
- May 2009: **Invited research fellow**. One-month invitation at the LAPTH, Annecy-le-vieux, France. Collaboration with Prof. E. Ragoucy on a project on quantum graphs.
- Feb 2007: **Invited seminar** at City University London.
- Feb 2007: **Invited seminar** at LPTHE Jussieu, Paris.
- Nov 2006: **Invited seminar** at University of Kent.
- Oct 2006: **Invitation** from University of Pisa. Collaboration with M. Mintchev and talk
- Mai 2006: **Invited talk** at the conference **Integrable and Conformal Field Theory**, University of Durham. Website : <http://www.cpt.dur.ac.uk/ICFT06/>
- April 2006: **Invitation** from LPS Orsay, Paris. Collaboration with J.N. Fuchs and Talk
- April 2006: **Invited seminars** at LPTHE Jussieu, Paris and LPTA, Montpellier.
- Feb 2005: **Invitations** from the University of York, University of Durham and University Heriot-Watt, Edinburgh. Collaboration with N. Crampé and Talks.
- Oct 2004: **Invitation** from the theory group, University of Pisa. Collaboration with M. Mintchev.

International conferences

- May 2015: NEEDS 2015 International Conference, Italy.
<http://bugs.unica.it/NEEDS2015/>.
Plenary speaker: "*On the inverse scattering method for the nonlinear Schrödinger equation on a star-graph*".
- Sept 2014: Conference **RAQIS'14: Recent Advances in Quantum Integrable Systems**, Dijon, <http://raqis14.sciencesconf.org/resource/page/id/6>
Talk: "*Set-theoretical reflection equation in integrable field theories and fully discrete systems*"
- Aug 2014: **New Trends in Quantum Integrability**, Surrey, UK.
- Aug 2014: SIAM Conference on **Nonlinear Waves and Coherent Structures**, Cambridge, UK, <http://www.siam.org/meetings/nw14/>.
- Sept. 2012: **Plenary Speaker** at the international conference RAQIS in Angers, France. <http://laph.cnr.fr/conferences/RAQIS/RAQIS12/>
- Sept. 2011: Conference **CFT And Integrable Models**, Bologna, <http://cft-im.bo.infn.it/2011/>
- Aug. 2011: Conference **Quantum Theory and Symmetries**, Prague, <http://www.km.fjfi.cvut.cz/qts7/>
- July 2007: Conference **Infinite Dimensional Algebras and Quantum Integrable Systems**, <http://www.ualg.pt/idaquis/welcome.html>
Talk: "*On defects in classical integrable field theories*"
- April 2007: Workshop **Graph Models of Mesoscopic Systems, Wave-Guides and Nano-Structures**, Newton Institute Cambridge.
Website: <http://www.newton.cam.ac.uk/programmes/AGA/agaw03.html>
- Dec 2006: Conference and workshop **Themes in the interface of representation theory and physics**, City University, London.
Website: <http://www.staff.city.ac.uk/~ra359/MEETINGS/conf06.html>
- Sept 2006: Euclid international workshop **Integrable models and applications**, ENS Lyon. Website : <http://perso.ens-lyon.fr/jean-michel.maillet/index.html#table>
- July 2006: 7th Bologna workshop **CFT and Integrable Models**
Website: <http://www-th.bo.infn.it/conferences/cft06/>
Talk: "*Some applications of the Bethe ansatz in solid state physics*"
- Sept 2005: Workshop **Recent Advances in Quantum Integrable Systems**, LAPTH Annecy. Website : <http://lappweb.in2p3.fr/laph/RAQIS05/index.html>
Talk: "*Integrable N-particle Hamiltonians with reflection algebra symmetry*"
- June 2005: International colloquium **Integrable systems and quantum groups**, Prague. Website : <http://kmlinux.fjfi.cvut.cz/~intsystems/2005.php>
Talk: "*Factorization in integrable systems with impurity*"

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PUBLICATIONS

Journals

- [1] *On the Inverse Scattering Method for Integrable PDEs on a Star Graph*, Comm. Math. Phys. **338** (2015), 893 and [arXiv:1409.5277](#).
- [2] *Multisymplectic approach to integrable defects in the sine-Gordon model*, J. Phys. **A48** (2015) 195203 and [arXiv:1411.5171](#).
- [3] *A multisymplectic approach to defects in integrable classical field theory*, JHEP **02** (2015), 088 and [arXiv:1411.0418](#), with A. Kundu.
- [4] *Exact scattering matrix of graphs in magnetic field and quantum noise*, J. Math. Phys. **55** (2014) 083524 and [arXiv:1401.4967](#), with M. Mintchev, E. Ragoucy.
- [5] *Integrable boundary for quad-graph systems: Three-dimensional boundary consistency*, SIGMA **10** (2014), 014 and [arXiv:1307.4023](#), with N. Crampé and Q.C. Zhang.
- [6] *Yang-Baxter and reflection maps from vector solitons with a boundary*, Nonlinearity **27** (2014) 1081-1103 and [arXiv:1205.1133](#), with Q. C. Zhang.
- [7] *Set-theoretical reflection equation: Classification of reflection maps*, J. Phys. **A46** (2013) 095203 and [arXiv:1210.5107](#), with N. Crampé and Q.C. Zhang.
- [8] *Quantum Wire Network with Magnetic Flux*, Physics Letters **A377** (2013) 1788-1793 and [arXiv:1202.4270](#), with M. Mintchev and E. Ragoucy.
- [9] *Vector nonlinear Schrödinger equation on the half-line*, J. Phys. **A45** (2012) 105201 and [arXiv:1110.2990](#), with Q.C. Zhang.
- [10] *Direct computation of scattering matrices for general quantum graphs*, Nucl. Phys. **B828** (2010), 515 and [arXiv:0907.5359](#), with E. Ragoucy
- [11] *Symmetries of Spin Calogero Models*, SIGMA **4** (2008), 090, and [arXiv:0809.3948](#) with N. Crampé.
- [12] *On a systematic approach to defects in classical integrable field theories*, IJGMMP **5**, No. 7 (2008), 1085-1108 and [arXiv:0704.2326](#)
- [13] *Exact energy spectrum for models with equally spaced point potentials*, Nucl. Phys. **B738** (2006), 351 and [cond-mat/0511619](#), with N. Crampé.

- [14] *Exact results for the one-dimensional many-body problem with contact interaction: Including a tunable impurity*, Rev. Math. Phys. **19** (2007), 349 and [cond-mat/0501110](#), with N. Crampé.
- [15] *Reflection-Transmission Quantum Yang-Baxter Equations*, J. Phys. **A38** (2005), 3431 and [hep-th/0412159](#), with M. Mintchev, E. Ragoucy and P. Sorba.
- [16] *Spontaneous symmetry breaking in the non-linear Schrödinger hierarchy with defect*, J. Phys. **A38** (2005), 2241 and [math-ph/0411022](#), with E. Ragoucy.
- [17] *The quantum non-linear Schrödinger model with point-like defect*, J. Phys. **A37** (2004), L367-L376 and [hep-th/0404144](#), with M. Mintchev and E. Ragoucy.
- [18] *Solving the quantum non-linear Schrödinger equation with delta-type impurity*, J. Math. Phys. **46** (2004) 042703 and [math-ph/0404047](#), with M. Mintchev and E. Ragoucy.
- [19] *Integrable N-particle Hamiltonians with Yangian or Reflection Algebra Symmetry*, J. Phys. **A37** (2004), 6285-6298 and [math-ph/0310028](#), with N. Crampé.
- [20] *Lax pair and super-Yangian symmetry of the non-linear super-Schrödinger equation*, J. Math. Phys. **44** (2003), 5706 and [math.QA/0306115](#), with E. Ragoucy.
- [21] *Quantum Resolution of the nonlinear super-Schrödinger equation*, Int. J. Mod. Phys. **A19** (2004), 1559 and [math-ph/0306010](#), with E. Ragoucy.

Proceedings

- [22] *Factorization in integrable systems with impurity*, [hep-th/0508157](#), Czech. J. Phys. **55** (2005), 1365.