

Dr Juan Antonio Valiente Kroon

Curriculum Vitae

December 2011

General information

Born in Mexico City on the 2nd October, 1972. Mexican and Spanish citizen. Married to Dr. Christiane Maria Losert-Valiente Kroon (Austrian).

Addresses

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Current position

Since October 2011. Reader (Associate Professor) in Applied Mathematics at the School of Mathematical Sciences, Queen Mary, University of London, UK.

Areas of competence

Mathematical General Relativity: asymptotics, initial value problems, PDE methods, Computer Algebra, numerical methods.

Languages

Spanish (mother tongue), English, German, French, Dutch (basic notions), Mandarin (basic notions), Papiamentu (spoken).

Previous appointments

10/2007 – 9/2011. *Lecturer in Applied Mathematics* at the School of Mathematical Sciences, Queen Mary, University of London.

10/2005 – 9/2010. *EPSRC Advanced Research Fellow* at the School of Mathematical Sciences, Queen Mary, University of London.

2/2005 – 9/2005. *Guest scientist* at the Gravity group, Institut für Theoretische Physik, Universität Wien, Austria.

2/2003 – 1/2005. *Lise Meitner postdoctoral fellow*, Gravity group, Institut für Theoretische Physik, Universität Wien, Austria.

9/2000 – 12/2002. *Postdoctoral researcher*, Geometrical Analysis and Mathematical Relativity division of the Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Germany.

Education

9/1996 – 7/2000. PhD in Applied Mathematics, Queen Mary & Westfield College, University of London, UK. *Title of the thesis:* On conserved quantities, symmetries and radiative properties of peeling and non-peeling (polyhomogeneous) asymptotically flat

spacetimes. *Supervisor:* Prof. M A H MacCallum.

11/1990 – 2/1996. BSc in Physics (Honours), Universidad Nacional Autónoma de México, México. Grade 100/100. *Title of the thesis:* Thermodynamics of perfect fluid spherical configurations in General Relativity. *Supervisor:* Dr. R A Sussman.

6/1995 – 8/1996. Full courses BSc. Mathematics, Universidad Nacional Autónoma de México, México. Grade 95/100.

Honours & awards

2010. Research Highlight of the year 2009-2010, Journal of Classical and Quantum Gravity to the article *On de-Sitter and Minkowski-like spacetimes* as selected by the editorial board of the journal.

2008. Research Highlight of the year 2007-2008, Journal of Classical and Quantum Gravity to the article *From Geometry to Numerics: interdisciplinary aspects in mathematical and numerical relativity* as selected by the editorial board of the journal.

2005. Research Highlight of the year 2004-2005, Journal of Classical and Quantum Gravity, to the article *Time asymmetric spacetimes near null and spatial infinity. II. Expansions of developments of initial data sets with non-smooth conformal metrics* as selected by the editorial board of the journal

1996. Gabino Barreda Medal, awarded to the best student in the BSc in Physics in the year 1996, National University of Mexico.

Grants

9/2008 – 8/2010: Leverhulme Trust research project grant. Project title: *Isotropic singularities and its evolution*. Principal investigator: Dr. JA Valiente Kroon. Co-applicant: Prof. MAH MacCallum. Amount granted £83,732.

10/2005 – 9/2010: EPSRC Advanced Research fellowship. Project title: *Conformal properties of spacetime*. Amount awarded: £256,026.

2005: Marie Curie mobility fellowship of the European Commission, Brussels. Declined in favour of the EPSRC fellowship.

2005: 4 years postdoctoral grant, FCT Portugal. Declined in favour of the EPSRC research fellowship.

2/2003 – 1/2005: Lise Meitner fellowship, FWF Austria. Project title: *Conformal transport equations at spatial infinity*. Amount awarded: €116,000.

9/1996 – 8/2000: PhD grant, CONACYT, Mexico. Amount awarded: US\$70,000.

Invited talks

9/9/2010. *Null infinity and numerical relativity*. Plenary talk at the Spanish Relativity Meeting, Granada, Spain.

9/7/2010. *Characterisations of initial data sets for the Schwarzschild and Kerr spacetimes*. Parallel session on “Exact Solutions” of the GR 19 Conference, Mexico City, Mexico.

8/4/2010. *A geometric invariant measuring the deviation from Kerr data*. Conference “PDEs, relativity & nonlinear waves”. Granada, Spain.

8/10/2009. *Penrose’s proposal and spatial infinity*. Conference “Space, time and beyond” on the occasion of Prof. Helmut Friedrich’s 65th birthday. Albert Einstein Institute-Max Planck Institute for Gravitational Physics, Golm, Germany.

4/4/2009. *A characterisation of initial data sets for the Kerr space-time*. Specialised one hour lecture at the LMS Invited Lecture Series “Black holes in a vacuum: examples and uniqueness properties”. Centre for Analysis and Nonlinear PDEs, Maxwell Institute for Mathematical Sciences, University of Edinburgh, UK.

20/8/2008. *Characterisations of initial data sets for the Einstein field equations, reviewed.* Conference “Developments in Mathematical Relativity” on the occasion of a.o. Univ. Prof. Robert Beig’s 60th birthday. Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria.

19/7/2008. *A conjecture on the behaviour of the development of time symmetric, conformally flat initial data at spatial infinity.* Conference “Hyperbolic Equations in General Relativity”, Institute of Mathematics of the University of Bordeaux, Bordeaux, France.

25/6/2003. *Polyhomogeneous asymptotics,* invited conference talk given together with Prof. MAH MacCallum at the EuroConference “Hyperbolic Models in Astrophysics and Cosmology” at the Isaac Newton Institute, Cambridge, UK.

Membership in learned societies

Since 2008. Member of the London Mathematical Society.

Since 2006. Member of the Institute of Physics.

Since 2006. Member of the Spanish Society of Relativity and Gravitation.

Since 2004. Member of the International Society on General Relativity and Gravitation.

Service to the profession

2011. PhD examiner of Emily Duffy, Dublin City University. Title of the thesis: *Naked singularities in self-similar gravitational collapse: stability properties of the Cauchy horizon*

Since 2011. Referee for Oxford University Press.

Since 2011. Referee for *Chaos, Solitons & Fractals*.

Since 2010. Referee for *Annales Henri Poincaré*.

Since 2009. Referee for *Journal of Mathematical Physics*.

2009. PhD examiner of Edvin Deadman, University of Cambridge. Title of the thesis: *Outer boundary conditions in numerical Relativity*.

2009 – 2010. Member of the prioritisation panel for Career Acceleration Grants and Leadership Fellowships in Mathematical Sciences (EPSRC).

Since 2008. Member of the committee of the Gravitational Physics group of the IOP.

Since 2008. Editor of the newsletter of the Gravitational Physics group of the IOP.

Since 2008. Referee for *Mexican Journal of Astronomy*.

2007. PhD examiner of Daniel PG Cox, University of London. Title of the thesis: *Black Holes and Radiation Bodies in Non-flat Backgrounds*.

2007. PhD examiner of Christian Lübbe, University of Oxford. Title of the thesis: *An extension theorem for conformal gauge singularities*.

Since 2006. Member of the EPSRC Peer Review College

2006 – 2010. Organiser of the weekly *London Relativity & Cosmology seminars* at Queen Mary, University of London.

Since 2005. Referee for *Proceedings of the Royal Society, London*.

Since 2002. Referee for *Mathematical Reviews of the American Mathematical Society*.

Since 2001. Referee for *Journal of Physics A: Mathematics and General*.

Since 1999. Referee for *Classical and Quantum Gravity*.

Since 1999. Referee for *Europhysics Letters A*.

Organisation of symposia

27 – 29/3/2011. Organiser of a parallel session on mathematical Relativity. *British Applied*

Mathematics Symposium. University College London.

12/9/2011. Co-organiser of the one day meeting *Do we understand gravity?* Gravitational Physics group, Institute of Physics, London.

Teaching

2010 – 2012. Lecturer. School of Mathematical Sciences, Queen Mary, University of London. Semester A: *Relativity* (third year course for Mathematics). Semester B: *Discrete Mathematics* (first year course for Science and Engineering).

2/2010. Attendance to the Leadership Summit for Higher Education, organised by the Leadership Foundation for Higher Education, UK.

2/2008 – 8/2010. Postgraduate Certificate in Academic Practice (PGCAP).

2006 – 2007. Teaching assistant. School of Mathematical Sciences, Queen Mary, University of London: *Complex Variables* (second year course for Mathematics), *Differential Equations* (first year course for Mathematics).

1999 – 2000. Computer laboratory assistant. Department of Computer Sciences, Queen Mary & Westfield College. *Introduction to Programming (JAVA)* (first year Computer Science).

1994 – 1996. Teaching assistant and substitute lecturer. Faculty of Sciences, Universidad Nacional Autónoma de México: *Algebra* (first year course for Mathematics and Physics), *Linear Algebra* (second year course for Mathematics and Physics).

Advanced minicourses

4/2011. *Conformal Methods and the Conformal Field Equations*. Invited minicourse for researchers of 15 hours delivered at the Centre of Mathematics of the University of Minho, Braga, Portugal.

Student supervision

Since 10/2011. Serkan Karakus. MSci project. Title: *Warp drive spacetimes*.

1 – 4/2011. David MacKie. Third year project. Title: *The conformal structure of the Schwarzschild black hole*.

Since 2008. Artur Alho. Visiting PhD student from the University of Minho, Portugal. Title: *Non-linear asymptotic stability of scalar field cosmologies*. Co-supervisor: Dr. Filipe Mena.

2008. Jeremy Marcq. Visiting MSc student from the Pierre et Marie Curie University in Paris, France. Supervisor of his master thesis. Title: *General Relativity, a geometric approach*.

2006 – 2008. William J Clavering. PhD student. Title: *Towards Finite Infinity: A Quasi-Local Study of Isolated Systems in General Relativity*. Principal supervisor: Prof. Malcolm AH MacCallum.

Postdoctoral supervision

Since 2/2011. Dr. Daniela Pugliese. Research topic: *relativistic Magnetohydrodynamics*.

4/2009 – 3/2011. Dr. Thomas Bäckdahl. Research topic: *geometric invariants for initial data sets in General Relativity*.

9/2008 – 10/2010. Dr. Christian Lübbe. Named postdoctoral research assistant for the grant *Analysis of initial data at isotropic singularities and its evolution* of the Leverhulme Trust (Unilever).

Science outreach

7/2008 and 7/2009. Taster lecture for A-level students. School of Mathematical Sciences, Queen Mary, University of London, UK. Title: *Black holes and the curvature of spacetime*.

11/2006. Poster presentation. House of Commons, Westminster, London, UK. As part of the programme “Set for Europe”. Title: *Isolated systems in General Relativity*.

2003. Two articles aimed at undergraduate students in Spanish and Basque (in collaboration with R Lazkoz). Title: *Gravitational waves*.

Media coverage

1/2011. A review on the article *The “non-Kerness” of domains of outer communication of black holes and exteriors of stars* has been produced by space.com

<http://www.space.com/10702-black-hole-kerr-state-spacetime.html>

This review has been distributed by the Agency EFE to various newspapers and newsrooms World-wide.

Scientific visits

1/6 – 4/9/2011. Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria. As part of the programme *Dynamics of General Relativity: Numerical and Analytical approaches*.

8 – 15/2011. Research Institute for Particle and Nuclear Physics, Budapest, Hungary.

4 – 6/5/2011. Theoretical Physics group of the University of the Basque Country (UPV-EHU), Bilbao, Spain.

4 – 15/4/2011. Department of Mathematics, University of Minho, Braga, Portugal.

1 – 4/9/2010. Centre for Analysis and Nonlinear PDEs, Maxwell Institute for Mathematical Sciences, University of Edinburgh, UK.

14 – 25/6/2010. Gravitational Physics Group, Faculty of Physics, University of Vienna, Austria.

24 – 26/11/2009. Research Institute for Symbolic Computation, University of Linz, Austria.

28/9 – 9/10/2009. Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Golm, Germany.

31/3 – 4/4/2009. Centre for Analysis and Nonlinear PDEs, Maxwell Institute for Mathematical Sciences, University of Edinburgh, UK.

14/11 – 14/11/2008. Mittag Leffler Institute, Stockholm-Djursholm, Sweden. As part of the semester on *Mathematical Methods in General Relativity*.

7 – 14/4/2008. Niels Bohr International Academy, Copenhagen, Denmark. As part of the workshop *Mathematical Aspects of General Relativity*.

8 – 12/10/2008. Instituto de Astrofísica de Andalucía, Granada, Spain.

8 – 19/1/2007. Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Golm, Germany.

9 – 20/10/2006. Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK. As part of the programme *Global Methods in Mathematical Relativity II*.

14/11 – 4/12/2005. Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK. As part of the programme on *Global Problems in Mathematical Relativity*.

1 – 31/5/2005. Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Golm, Germany.

14 – 25/6/2004. Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Golm, Germany.

8 – 12/12/2003. Institute of Nuclear Sciences, UNAM, Mexico.

16 – 21/10/2003. Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Golm, Germany.

6 – 17/5/2002. University of the Basque Country (UPV-EHU), Bilbao, Spain.

21 – 25/2/2000. Max Planck Institut für Gravitationsphysik, Albert Einstein Institut, Golm, Germany.

Contributed talks

9/6/2010. *A rigidity property for asymptotically simple developments of time symmetric data.* Parallel “Mathematical Relativity and further developments” of the GR19 Conference, Mexico City, Mexico.

6/8/2008. *A rigidity property of asymptotically simple spacetimes.* Contributed talk at the PDE parallel session of the International Conference of Mathematical Physics (ICMP09). Prague, Czech Republic.

13/6/2007. *Towards a proof of a rigidity conjecture for asymptotically flat spacetimes.* Contributed talk at the “Mathematical studies of the field equations” session of the GR18 meeting, Sydney, Australia.

24/11/2006. *A view of spacetime from spatial infinity.* Contributed talk at the conference “From Geometry to Numerics” at the Institut Henri Poincaré, Paris, France.

5/9/2006. *Null infinities with asymmetric smoothness.* Contributed talk at the Spanish Relativity Meeting ERE 2006, Palma de Mallorca, Spain.

4/9/2006. *Initial data sets for the Schwarzschild spacetime.* Contributed talk at the Spanish Relativity Meeting, ERE 2006, Palma de Mallorca, Spain.

4/4/2006. *On smoothness asymmetric null infinities.* Contributed talk at the British Gravity Meeting, BritGrav 2006, Nottingham, UK.

23/7/2004. *Obstructions to the smoothness of null infinity.* Contributed talk at the parallel session on “Mathematical studies of the field equations” of the GR17 meeting. Dublin, Ireland.

20/7/2004. *Nonexistence of conformally flat slices in stationary solutions.* Contributed talk at the session on “Exact Solutions and their Interpretation” of the GR17 meeting. Dublin, Ireland.

14/5/2004. *Nonexistence of conformally flat slices in stationary solutions.* Contributed talk at the workshop “Dynamics and Thermodynamics of Black Holes and Naked Singularities”, Department of Mathematics of the Milan Polytechnic, Italy.

4/3/2004. *Asymptotic expansions near spatial infinity and the peeling behaviour.* Contributed talk at the 319th WE-Heraeus Seminar “Mathematical Relativity: new Ideas and Developments”, Physikzentrum Bad Honnef, Germany.

24/7/2003. *The Newtonian limit of uniformly accelerated particles.* Contributed talk at the parallel session on “Exact Solutions (physical aspects)” of the 10th Marcel Grossman Meeting. Rio de Janeiro, Brazil.

21/7/2003. *Does asymptotic simplicity allow for gravitational radiation near null infinity?* Contributed talk at the parallel session on “Global Issues, Cosmic Censorship and Singularities” of the 10th Marcel Grossman Meeting. Rio de Janeiro, Brazil.

20/7/2003. *The smoothness of null infinity: its relevance for Numerical Relativity.* Contributed talk at the parallel session on “Computer Methods” of the 10th Marcel Grossman Meeting. Rio de Janeiro, Brazil.

20/7/2003. *Exploring spatial infinity with computer algebra.* Contributed talk at the parallel session on Computer Methods of the 10th Marcel Grossman Meeting. Rio de Janeiro, Brazil.

10/6/2002. *Early radiative properties of time symmetric, conformally flat initial data.* Contributed talk at the British Gravity Meeting, BritGrav 2002, London, UK.

18/9/2001. *Conserved quantities and Bondi mass in black hole collisions.* Contributed talk at the Spanish Relativity Meeting, ERE 2001. Madrid, Spain.

16/7/2001. *On Killing vectors and Bondi expansions.* Contributed talk at the A1 Workshop (Exact solutions & Interpretation) of the 16th International Conference on General Relativity and

Gravitation (GR16). Durban, South Africa.

9/9/1999. *On Killing vectors and Bondi Expansions.* Contributed talk at the Spanish Relativity Meeting, ERE 1999. Bilbao, Spain.

Seminar talks

30/11/2011. *On the nonlinear stability of scalar field cosmologies,* at the London Relativity & Cosmology Seminar, Queen Mary, University of London, UK.

8/11/2011. *Approximate twistors and positive mass,* at the Mathematical Institute, University of Oxford, UK.

27/7/2011. *Geometric invariants for black hole spacetimes.* As part of the programme *Dynamics of General Relativity: Numerical and Analytical approaches.* Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria.

10/6/2011. *Studying black holes by means of geometric invariants.* Seminar of the Theory Group of the Research Institute for Particle and Nuclear Physics, Budapest, Hungary.

6/5/2011. *Geometric invariants for black hole spacetimes,* at the Seminar of Relativity and Cosmology of the Theoretical Physics group of the University of the Basque Country (EHU-UPV), Bilbao, Spain.

7/12/2010. *Stability problems in mathematical General Relativity: conformal methods and geometric invariants,* at the Seminar of the Dynamical Systems and Statistical Mechanics group, Queen Mary, University of London, UK.

4/6/2010. *A geometric invariant measuring the deviation from Kerr data,* at the Relativity Seminar of the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK.

25/5/2010. *A geometric invariant measuring the deviation from Kerr data,* at the London Relativity & Cosmology Seminar, Queen Mary, University of London, UK.

21/12/2009. *A geometric invariant measuring the deviation from Kerr data,* at the Institute of Theoretical Physics of the University of Vienna, Austria.

26/11/2009. *Computer Algebra applications in General Relativity,* RISC, University of Linz, Austria.

3/8/2008. *A characterisation of initial data sets for the Kerr spacetime,* at the Academy of Sciences, Prague, Czech Republic.

21/1/2009. *Characterisation of initial data sets in General Relativity,* at the London Relativity & Cosmology Seminar, Queen Mary, University of London, UK.

11/12/2008. *Regularity conditions at spatial infinity revisited,* Mittag-Leffler Institute, Stockholm-Djurshom, Sweden.

14/4/2008. *Regularity conditions at spatial infinity revisited,* Niels Bohr International Academy, Copenhagen, Denmark.

30/4/2008. *A view of spacetime from spatial infinity,* at the Mathematical Physics seminar of the Department of Physics of the University of York, UK.

22/12/2007. *Killing spinor initial data,* at the Institute of Theoretical Physics of the University of Vienna, Austria.

30/12/2007. *Towards a proof of a rigidity conjecture for asymptotically flat spacetimes,* at the Mathematical Institute, University of Oxford, UK.

4/9/2007. *A view of spacetime from spatial infinity,* at the Institute of Astronomy of the National University of Mexico (UNAM), Mexico.

4/5/2007. *A view of spacetime from spatial infinity,* at the Relativity seminar of the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK.

16/11/2006. *A view of spacetime from spatial infinity,* Relativity seminar of the School of Mathematical Sciences of the University of Southampton. Southampton, UK.

- 14/11/2005.** *Time asymmetric spacetimes near null and spatial infinity*, Isaac Newton Institute, Cambridge, UK.
- 5/12/2005.** *A characterisation of Schwarzschild initial data*, at the London Relativity & Cosmology Seminar, Queen Mary, University of London, UK.
- 30/5/2005.** *A characterisation of Schwarzschild initial data*, at the Max Planck Institute for Gravitational Physics, Golm, Germany.
- 28/4/2005.** *Schwarzschild initial data*, at the Institute of Theoretical Physics of the University of Vienna, Austria
- 11/11/2004.** *Nonexistence of conformally flat slices in stationary spacetimes*, at the Institute of Theoretical Physics of the University of Vienna, Austria.
- 21/6/2004.** *Nonexistence of conformally flat slices in stationary spacetimes*, at the Max Planck Institute for Gravitational Physics, Golm, Germany.
- 11/2/2004.** *Peeling properties of spacetimes containing black holes*, at the London Relativity Seminar, Queen Mary, University of London, UK.
- 10/12/2003.** *Peeling properties of spacetimes containing black holes*, at the Institute of Nuclear Sciences of the National University of Mexico (UNAM), Mexico City, Mexico.
- 4/12/2003.** *Peeling properties of spacetimes containing black holes*, at the Institute of Theoretical Physics of the University of Vienna, Austria.
- 27/10/2003.** *Nonexistence of conformally flat slices in the Kerr solution*, telephonic conference to the Gravity Group of the Louisiana State University, Baton Rouge, USA.
- 20/10/2003.** *News from spatial infinity*, at the Max Planck Institute for Gravitational Physics, Golm, Germany.
- 17/3/2003.** *Expansions near null and spatial infinity. Part II: the nonlinear gravitational field*, at the Institute of Theoretical Physics of the University of Vienna, Austria.
- 13/3/2003.** *Expansions near null and spatial infinity. Part I: Maxwell fields*, at the Institute of Theoretical Physics of the University of Vienna, Austria.
- 11/11/2002.** *The Newman-Penrose constants ride again*, at the Max Planck Institut for Gravitational Physics, Golm, Germany.
- 11/9/2002.** *The mathematical description of isolated systems in General Relativity*, at the Mathematics Department of the University of Minho, Braga, Portugal.
- 8/5/2002.** *Spacetime in a neighbourhood of null and spatial infinities*, at the University of the Basque Country (UPV-EHU), Spain.
- 14/11/2001.** *Looking at black hole collisions from close to null and spatial infinities*, at the London Relativity Seminar, Queen Mary, University of London, UK.
- 24/9/2001.** *Expansions close to null and spatial infinity*, at the Max Planck Institute for Gravitational Physics Symposium, Golm, Germany.
- 3/4/2001.** *Polyhomogeneous expansions near null and spacelike infinity*, given at the International Workshop “The Conformal Structure of Spacetimes (Geometry, Analysis, Numerics)”, Tübingen, Germany.
- 22/2/2000.** *Polyhomogeneous spacetimes and their conserved quantities*, at the Max Planck Institute for Gravitational Physics, Golm, Germany.
- 27/5/1999.** *Conserved quantities in asymptotically flat spacetimes*, at the Research Students Seminar at the Physics Department of Imperial College, London, UK.
- 18/2/1999.** *Newman-Penrose constants for polyhomogeneous spacetimes*, at the Southampton-Portsmouth Relativity Seminar, Southampton, UK.
- 2/10/1998.** *Newman-Penrose constants and polyhomogeneity*, at the London Relativity Seminar, Queen Mary & Westfield College, London, UK.
- 25/4/1998.** *Newman-Penrose constants and polyhomogeneous spacetimes*, at the Relativity Seminar, Faculty of Sciences, Charles University, Prague, Czech Republic.