

JONATHAN ANDREW PEARSON

Personal details

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Education

2009-2012 *Doctor of Philosophy* (to be completed)

- **The University of Manchester**, Jodrell Bank Centre for Astrophysics.
- **Supervisor**: Dr. Richard A. Battye.
- **Thesis title**: Generalized parameterizations of dark energy and modified gravity.
- **Research**: Interest broadly in theoretical cosmology. Particular interest in dark energy models, numerical field theory, topological defects, domain walls, cosmic strings and vortons in gauge field theory, inhomogeneous models of the universe, graph theory, generalized modified gravity theories.
Collaborators: Paul Sutcliffe (Durham), Adam Moss (UBC).
- **Teaching & supervision**: Joint supervision of two MPhys students; supervised an undergraduate summer student, 2011 – project on domain wall network evolution in an $SU(5) \times \mathbb{Z}_2$ theory. Tutoring small groups of 1st year undergraduates: core modules: *maths 1 & 2, dynamics, electricity and magnetism, introduction to astronomy & cosmology, properties of matter*. Assisting Dr. Battye with constructing comprehensive and complete lecture notes for 2nd year undergraduate electromagnetism course.
- **Courses audited**: Attendance with no assessment of a variety of courses, from the mathematics and physics schools: *differentiable manifolds, differential geometry and vector bundles, quantum field theory*.

2005 - 2009 *Undergraduate Masters Degree*

- **The University of Manchester** Physics with Theoretical Physics 1st class: MPhys (hons).
- **Selection of sub-disciplines studied**: Advanced statistical physics (90%), Bose & Fermi gases (95%), complex variables & integral transforms (90%), early universe (100%), electrodynamics (92%), fluid mechanics (82%), gravitation (90%), Lagrangian dynamics (88%), quantum mechanics of atoms & molecules (81%), relativistic quantum physics (82%), solid state physics (92%), symmetries in physics (88%) & various mathematical methods courses.
- **Year long MPhys project**: Supervised by Dr.R.Battye, with title *scaling dynamics of charged domain walls*. Project involves evolving equations of motion with various potentials, with various numbers of interacting fields, whilst investigating the scaling dynamics of resulting topological defects. Numerical work uses Fortran77 & C⁺⁺. Grade for project: 88%.

2003 - 2004 *Diploma*

- **The Open University** Diploma in Mathematics (B): Dip.Maths(Open).
- **Selection of sub-disciplines studied**: Group theory, mathematical modelling, affine geometry, linear algebra, inverse geometry.

2001 - 2003 *A levels* (first three completed at age 14, the fourth at age 15)

- **Richmond College** Maths (A), Physics (A), Chemistry (D), Further Maths (B).

Publications

- Effective action approach to cosmological perturbations in dark energy and modified gravity (in prep) with R.A. Battye
- Stationary gauged vortons (in prep) with R.A. Battye and P.M. Sutcliffe
- The fate of random domain wall networks (in prep) with R.A. Battye
- Stability of X -type junctions
R.A. Battye, J.A. Pearson and A. Moss [Submitted to Phys.Rev.**D82**; *hep-th/1107.1325*]
- Domain walls, charge and dark energy
Conference proceedings, Recontres de Moriond Cosmology 2010 [*hep-th/1010.3195*]
- Charge, junctions and the scaling of domain wall networks
R.A. Battye and J.A. Pearson [Phys.Rev.**D82**, 12, (2010); *hep-th/1010.2328*]
- Formation and evolution of kinky vortons
R.A. Battye, J.A. Pearson, S. Pike and P.M. Sutcliffe [JCAP**09**(2009)039; *hep-th/0908.1865v1*]

Talks

- Cosmology seminar: Imperial College 3/2/12 (invited) “*Generalized modified gravity*”
- JBCA internal seminar, PhysSoc, particle physics “Bohr’s lunch”: Nov 2011 “*Modified gravity*” – non-technical review & introduction
- Gravity and particles seminar series: Nottingham 28/10/11 (invited) “*Domain wall network dynamics*”
- JBCA theory seminar: 13/10/11 “*Relativistic elasticity theory*”
- PASCOS 2011: DAMTP 6/7/11 “*Generalized perturbations in modified gravity and dark energy*”
- UK Cosmology Meeting: DAMTP: 20/5/11 “*Stationary gauged vorton solutions*”
- JBCA theory seminar: 5/5/11 “*Vortons: an introduction to spinning solitons*”
- University of Manchester’s PhysSoc “Random walks in physics”: 4/4/11 “*Solitons: how to describe extended objects in physics*”
- JBCA internal seminar: 24/11/10 “*Inhomogeneous universes*”
- UK Cosmology Meeting: Durham: 6/9/10 “*Stability of X -type junctions*”
- Recontres de Moriond – Cosmology: 16/3/10 “*Domain walls, charge and dark energy*”
- JBCA internal seminar: 17/2/10 “*Defects, domain walls and dark energy*”
- UK Cosmology Meeting: King’s College London: 18/11/09, “*Formation and evolution of kinky vortons*”
- PhD introductory classes: JBCA: 16/11/09 “*Evolution of topological defects in field theory*”
- *Public engagement* – talks at MOSI (Museum of Science and Industry), Manchester; Jodrell Bank Observatory visitor centre; interviewed on Jodcast; Bright Club Manchester.

Conferences

- PASCOS 2011
- Testing General Relativity with Cosmology - Royal Society meeting 2011
- Recontres de Moriond 2010
- Regularly attend UK Cosmology meetings

Skills

- Can program in C++ & Fortran77, mainly for scientific purposes.
- Able to competently use various operating systems: Mac OS X, Unix & Windows XP.
- Use mathematical, graphing & typesetting packages, including Mathematica, GnuPlot, SuperMongo & L^AT_EX.
- Proven competency in self-learning mathematical, physical, computational methods; also in conveying complex ideas & techniques to peers.

Academic achievements of note

- **Degree status:** Exam mark average consistently above 80%. Started university 1 year early.
- **Online degree notes:** Creating & maintaining an online physics resource (www.jpoffline.com), hosting my original works & typeset lecture notes. Some notes are now used by lecturers as hand-outs. Website regularly receives more than 10,000 hits per month.
- **Summer 2008, 8 week research project:** *Cosmic texture*. Project involved using Fortran77 and JPL's HEALPix software to populate a sky map with texture "spots" having pre-determined temperature profiles, finding subsequent power spectrum; as well as literature research. Supervised by Dr.R.Battye at Jodrell Bank Centre for Astrophysics.
- **Summer 2007, summer school:** Chosen as one of 30 world-wide delegates at *International Undergraduate Summer School*, hosted by the University of Sheffield, funded by PPARC. Lectures on particle physics & cosmology, with a 4 week project on *quintessence models of dark energy*. Numerical work used Maple.
- **Pre-university education:** All qualifications gained before university were at least 3 years "early". Delegate at Stanford University's Education Program for Gifted & Talented Youth, summer 2002 (youngest & one of 3 nationwide to receive a full scholarship from Warwick University, UK).

Non-academic notes

- Extensive experience with speaking to large audiences, formally and "informally".
- Volunteer work at Lee Abbey Youth Camps: 2005 – 2010; a Christian charity. Pastoral care of children, creating multimedia entertainment resources. Previous website manager for <http://camps.leeabbey.org.uk>.
- Member of IvyManchester (church). Lead small group discussions on a weekly basis; organise publicity events; youth leader. Creator of original version of <http://www.churchinaclub.co.uk> website
- 2004 – 2005: Holding the full time position of *booking & scheduling coordinator*, at the NHS Alexandra Hospital, Redditch; phasing in the government initiative for patient choice. Responsible for in- and out-patient waiting lists, informing patients, data handling, inter-department liason.