Curriculum Vitæ

Dr. Jonathan D. Carroll, PhD, BSc (Hons)
Born: 30/10/1983
24 Amber Road
Hope Valley
South Australia 5090
Ph: +61 0407 978 786
Fax: +61 (08) 8303 3551
jcarroll@physics.adelaide.edu.au
http://www.physics.adelaide.edu.au/cssm/staff/carroll/

Current Position

- **Research Associate** — University of Adelaide
  Centre for Complex Systems and the Strucure of Matter (CCSSM) — *Nov 2009 - Nov 2012*
  - Theoretical Physics
  - Dense Matter, Neutron Star Structure and Composition
  - Muonic Hydrogen Spectroscopy, Proton Radius Puzzle
  - Additional Roles: Local Seminar Organiser, Webmaster

Education

- **University of Adelaide** — Adelaide, South Australia
  Ph.D. Theoretical Physics — *Mar. 2006 - Dec. 2009*
  - Group: Theoretical Physics (CSSM, School of Chemistry & Physics)
  - Supervisors: Prof. A. G. Williams (CSSM), Prof. D. B. Leinweber (CSSM)
  - Collaboration: Prof. A. W. Thomas (then at Jefferson Lab; VA, USA)
  - Conferred: 31/12/2009
- **University of Adelaide** — Adelaide, South Australia
  B.Sc. (Hons.) Theoretical Physics — *2005*
  - Graduated with First Class Honours
  - Relevant courses: Quantum Field Theory, Gauge Field Theory, Relativistic Quantum Mechanics, Particle Physics, Statistical Mechanics, Advanced Dynamics and Relativity, Mathematical Physics
- **University of Adelaide** — Adelaide, South Australia
  B.Sc. Physics & Theoretical Physics — *2002 - 2004*
  - Relevant courses: Physics, Chemistry, Mathematics
- **Modbury High School** — Adelaide, South Australia
  Secondary Education — *1997 - 2001*
  - Graduated with Tertiary Entrance Ranking (TER) of 97.45
  - Awarded Top-Of-Class for Physics
  - Perfect Score (20/20 - Outstanding Achievement) for Physics final exam

Conferences / Workshops

- **CSSM International Workshop: T(R)OPICAL QCD** Cairns, Australia
  Invited Speaker *2010*
  - Title: "*The Radius of the Proton; Size Does Matter*"
  - International conference for fields of nuclear, lattice, hadronic and phenomenological physics.

- **International Nuclear Physics Conference** Vancouver, BC, Canada
  Participant *2010*
  - INPC2010. Hosted by TRIUMF at the University of British Columbia.

- **National Nuclear Physics Summer School** Vancouver, BC, Canada
  Participant *2010*
  - NNPSS-TSI. International summer school hosted at TRIUMF.

- **Achievements and New Directions in Subatomic Physics** Adelaide, Australia
  Invited Speaker *2010*
  - Workshop in Honour of Tony Thomas' 60th Birthday.

- **Meson-Nucleon Physics and the Structure of the Nucleon** Williamsburg, VA, USA
  Registered Speaker *2010*
  - Title: "*The Quark-Meson Coupling model as a description of dense matter*"
  - 12th International Conference on Meson-Nucleon Physics and the Structure of the Nucleon (MENU 2010).

- **Australian Institute of Physics (AIP) National Congress** Adelaide, Australia
  Registered Speaker *2008*
  - Title: "*Hybrid Stars in the Octet QMC Model*"
  - National congress of Australian physicists from all fields with international plenary speakers.

- **CSSM International Workshop: T(R)OPICAL QCD** Port Douglas, Australia
  Invited Speaker *2008*
  - Title: "*Modelling QMC Stars with the Octet QMC Model* "
  - International conference for fields of nuclear, lattice, hadronic and phenomenological physics.

- **Workshop for Scientific Visualisations: OzViz** Adelaide, Australia
  Attendee *2007*
  - Australia and New Zealand workshop on scientific visualisations and methods.

- **CSSM International Conference: QCD and the Strong Interactions** Adelaide, Australia
  Attendee *2006*
  - International conference for fields of nuclear, lattice, hadronic and phenomenological physics.

- **Nuclear and Particle Physics Group (AIP) Summer School** Melbourne, Australia
  Attendee *2006*
  - Workshop for fields of nuclear, experimental, and high-energy particle physics with international speakers.

Research Projects

- **Proton Radius Puzzle** — Research, Adelaide University
  Prof. A. W. Thomas, CSSM — *2010 –*
  - Collaboration with Prof. G. A. Miller, University of Washington, Seattle, USA, and Prof. J. Rafelski, University of Arizona, Tuscon, USA
  - Developed non-perturbative treatment of hydrogen wavefunction for comparison to established methods

- **Hyperon QMC Hybrid Stars** — Ph.D. & continuing, Adelaide University
  Prof. A. G. Williams, Prof. D. B. Leinweber, CSSM — *2006 –*
  - Title: "Applications of the Octet Baryon Quark–Meson Coupling Model to Hybrid Stars"
  - Topic: Deriving and calculating effects of particle interactions in dense hadronic matter using QMC with applications to neutron stars and quark stars
  - Included one month of international research at Jefferson Lab; VA, USA with Prof. A. W. Thomas in 2007.

- **QHD Equations of State** — Honours Level, Adelaide University
  Prof. A. G. Williams, Dr. A. C. Kalloniatis, CSSM — *2005*
  - With assistance from Dr. P. Wang
  - Derivation and investigation of Quantum Hadrodynamics with applications to neutron stars
  - Extension of QHD to original research.

- **QFT and Dense Matter** — Summer Scholarship, Adelaide University
  Dr. A. C. Kalloniatis, Prof. B.-Y. Park, CSSM — *2004/2005*
  - Advanced introduction to Quantum Field Theory
  - Various QFT derivations and calculations
  - Literature reviews for Skyrmion matter models

- **Visual Astronomy** — Level 3 B.Sc., Adelaide University
  Dr. P. McGee, Astrophysics Group — *2004*
  - Developed existing optical methods for examining intensity changes to detect exo-planets
  - Implemented method to verify existence of extra-solar planet and measure observables
  - Spectroscopic investigations of various parameters of both planet and environment to determine constituents.

- **Cloud Sensing** — Summer Scholarship, Adelaide University
  Prof. R. W. Clay, Astrophysics Group — *2003/2004*
  - Detailed use of legacy Fortran77 program to produce model data of infra-red absorption by atmospheric water vapour
  - Application of data to cloud-sensing searches, in particular for automated astronomy
  - Interpretation and analysis of data.

- **Integrated Circuit Manufacturing Processes** — External
  Commonwealth Scientific and Industrial Research Organisation (CSIRO) — *2001*
  - Studied various contemporary methods for IC production
  - Tested various outdated IC chips
  - Produced working IC chips using thin-layer deposition, UV light stenciling, liquid etching.

Academic Publications

- **Non-perturbative Analysis of the Influence of the Proton Magnetization and Charge Densities on the Hyperfine Splitting of Muonic Hydrogen**
  J. D. Carroll, A. W. Thomas, G. A. Miller, J. Rafelski.
  In progress [arXiv:physics.atom-ph/1108.5785]

- **Proton form-factor dependence of the finite-size correction to the Lamb shift in muonic hydrogen**
  J. D. Carroll, A. W. Thomas, J. Rafelski, G. A. Miller.
  In progress [arXiv:physics.atom-ph/1108.2541]; 2 Citations.

- **Toward a resolution of the proton size puzzle**
  G. A. Miller, A. W. Thomas, J. D. Carroll, J. Rafelski.
  Phys. Rev. A **84**, 020101(R) (2011) [arxiv:1101.4073 [physics.atom-ph]]; 9 Citations.

- **Non-Perturbative Relativistic Calculation of the Muonic Hydrogen Spectrum.**
  J. D. Carroll, A. W. Thomas, J. Rafelski, G. A. Miller.
  Phys. Rev. A **84**, 012506 (2011) [arXiv:1104.2971 [physics.atom-ph]]; 4 Citations.

- **The Radius of the Proton: Size Does Matter.**
  J. D. Carroll, A. W. Thomas, J. Rafelski, G. A. Miller.
  AIP Conf. Proc. **1354** 25-31 (2011) [arXiv:1105.2384 [physics.atom-ph]]; 2 Citations.

- **The Quark-Meson Coupling model as a description of dense matter.**
  J. D. Carroll.
  AIP Conf. Proc **1374** [arXiv:1010.3759 [hep-ph]]

- **QMC and the nature of dense matter: written in the stars?.**
  J. D. Carroll.
  AIP Conf. Proc. **1261** 226-231 (2010) [arXiv:1004.1217 [nucl-th]]; 1 Citation.

- **Applications of the Octet Baryon Quark-Meson Coupling Model to Hybrid Stars.**
  J. D. Carroll.
  PhD Thesis [arXiv:1001.4318 [hep-ph]]; 2 Citations.

- **Phase Transition from QMC Hyperonic Matter to Deconfined Quark Matter.**
  J. D. Carroll, D. B. Leinweber, A. W. Thomas, and A. G. Williams.
  Phys. Rev. C **79** 045810 (2009) [arXiv:0809.0168 [nucl-th]]; 6 Citations.

- **Neutral pion decay into ν-$\bar{\nu}$ in dense skyrmion matter.**
  A. C. Kalloniatis, J. D. Carroll and B. Y. Park.
  Phys. Rev. D **71** 114001 (2005) [arXiv:hep-ph/0501117]; 3 Citations.

Statistics:
h-index: 3
Total citations: 29

Invited Academic Colloquia

- **University of Adelaide**, Adelaide, Australia. May 2011
- **University of Melbourne**, Melbourne, Australia. March 2011
- **University of Washington**, Seattle, WA, USA. June 2010
- **Jefferson Laboratory Theory Center**, Newport News, VA, USA. June 2010
- **University of Maryland**, College Park, MD, USA May 2010
- **Argonne National Laboratory**, Argonne, IL, USA May 2010

Public Engagement

- **The Conversation** (online)
  [Total online pageviews as of October 2011: **14,500+**]

  Explainer: Einstein's Theory of General Relativity
  J. D. Carroll, L. Tunstall. 12/10/2011

  Neutrinos and the speed of light? Not so fast ...
  J. D. Carroll. 26/9/2011

  95% chance 'God particle' statements are being misread by the media
  J. D. Carroll. 15/9/2011

  Explainer: Standard Model of Particle Physics
  J. D. Carroll. 25/8/2011

  If I had a blank cheque I'd do what theoretical physics does now, only bigger
  J. D. Carroll. 22/7/2011

  Explainer: the Z' (hypothetical) particle
  J. D. Carroll. 6/4/2011

- **'Can You Believe It?'** The Advertiser (newspaper)

  How beer changed the world of science
  J. D. Carroll. 2/3/2010

  Tipping the scales - Does my bum look big in this Higgs field?
  J. D. Carroll. 31/3/2009

  Breaking Rules - You can't break the laws of physics. Or can you?
  J. D. Carroll. 15/11/2008

- **ABC891** (Radio)

  Discussing the Myth of Low-Carb Beers, Breakfast with Spence Denny
  Live over telephone radio interview. 14/12/2010

  Discussing the Science of Star Trek, Breakfast with Tony McCarthy and John Kenneally
  Live over telephone radio interview. 8/9/2010

  Discussing the Science of Beer, Afternoons with Carole Whitelock
  Live in studio radio interview. 14/3/2010

Work Experience

- **University of Adelaide** — Adelaide, South Australia
  Interim Lecturer — *August 2011 – September 2011*
  - Quantum Mechanics III: 7 Lectures, 4 Tutorials.
    Student Experience of Learning & Teaching (SELT) Analysis: 001315798976958
    Overall **88**% **satisfaction** (full results available on request).

- **SciWriting** — Mianyang, Sichuan Province, China
  Assistant Course Teacher — *April 2011*
  - Teaching research writing skills in English to researchers in the Chinese Academy of Engineering Physics, in association with the China Academy of Sciences.

- **University of Adelaide** — Adelaide, South Australia
  Tutor — *2002 - 2008*
  - Astronomy I
  - Physics I
  - Physics for the Life and Earth Sciences I
  - Physics: Principles and Applications I

Awards

Semi-Finalist, Channel 9 Young Achiever Awards	2011
University of Adelaide Doctoral Research Medal	2009
CSSM Doctoral Award	2009
Departmental Ph.D. Research Scholarship / RTS	2006–2009
Invited to join Golden Key International Honour Society	2006
Walter and Dorothy Duncan Trust Grant	2003
Adelaide University Scholarship	2002
Perfect Score 20/20 - Year 12 Physics final exam	2001

Interests

Academic: Theoretical Particle Physics, Quantum Field Theory, Quantum Mechanics, Astrophysics, Astronomy, General Physics, Physics Education

Computers: Legacy computer construction/maintenance/testing, general electronics, coding/scripting, software, image processing/manipulation, system configurations, website construction, security

Sports: Golf, Cycling, Badminton, Darts, 8-Ball

Languages: (Advanced) English, (Conversational) French, (Conversational) Mandarin

Amateur: Digital Photography, Astronomy, Craft-Brewing, Woodwork, Puzzle-solving

Other: Reading novels (science-fiction), Cooking, Video games, Debating, Social Club activities

Leadership & Service to Community

Club President: Amateur Winemakers & Brewers Club of Adelaide (AWBCA), UniAdelaide Physics Club (SPACED), UniAdelaide Beer Appreciation Society (Stein Club)

Club Vice-President: UniAdelaide Physics Club (SPACED), UniAdelaide Beer Appreciation Society (Stein Club)

Club Committee: UniAdelaide Physics Club (SPACED), UniAdelaide Maths Club (AUMaSS), UniAdelaide Beer Appreciation Society (Stein Club)

General Club Member UniAdelaide Physics Club (SPACED), UniAdelaide Maths Club (AUMaSS), UniAdelaide Engineering Club, UniAdelaide Beer Appreciation Society (Stein Club), UniAdelaide Chess Club, UniAdelaide Film Club, Australian Institute of Physics (AIP), Astronomical Society of South Australia (ASSA), Wine Guild of South Australia

- Local Seminar Organiser (CCSSM)

- Participation in University of Adelaide Open Day activities and production of displays

- Assistance with a Year 12 Major Science Project