Michael J. Fairchild, B.S.
614 Lex Drive
Charlotte, NC 28262

U.S. Citizen
Email: mjfairch@gmail.com
Phone: 704-840-8559

EDUCATION

2007-present **Ph.D. Applied Mathematics**, UNC Charlotte, Charlotte, NC, **GPA=4.0.**
2007-2009 **M.S. Mathematics**. UNC Charlotte, **GPA=4.0.**
2003-2007 **B.S.** with majors in **Physics** and **Mathematics**, *Magna Cum Laude*. UNC Charlotte.

- **Physics GPA=4.0**. Departmental Honors.
- **Mathematics GPA=4.0**. Departmental Honors.
- **Overall GPA=3.974** (4.0 except for one B in anthropology).
- Physics Thesis Work: Thermodynamics of the ß-Hairpin to Coil Transition.
- Mathematics Thesis Work: Nonparametric Smoothing in Inverse Problems.

FINANCIAL SUPPORT

2007 **$25,000 TIAA-CREF doctoral fellowship** for applied mathematics, UNC Charlotte. This is a cash award offered annually to the top applicant for the Ph.D. program.
2006-8 Supported as a physics graduate student (while still an undergraduate) at **$25,000**/year, under NIH-R01 grant titled "Predicting protein stability and flexibility." PI: Dr. Donald J. Jacobs, UNCC.

HONORS, FELLOWSHIPS, SCHOLARSHIPS (UNC Charlotte)

2007 $25,000 TIAA-CREF doctoral fellowship for applied mathematics
2007 First Place Award (Physics), Excellence in Undergraduate Research
2007 First Place Award (Math), 14th Annual Undergraduate Research Conference
2007 First Place Award (Physics), 14th Annual Undergraduate Research Conference
2006 Fiechtner Award & Scholarship (mathematics)
2006 Chosen as Phi Kappa Phi scholar for the College of Arts & Sciences (with scholarship)
2006 Sigma Pi Sigma (national honors physics fraternity) induction
2006 Phi Kappa Phi (national honors fraternity) induction
2005 Lynn Houser Pearce mathematics scholarship
2005 Pi Mu Epsilon (national honors mathematics fraternity) induction
2005 Junior Marshal
2003-7 Chancellor's List

RESEARCH PUBLICATIONS

[1] 2007: D.J. Jacobs, M.J. Fairchild, "Thermodynamics of a B-hairpin to Coil Transition: Application of Free Energy Decomposition and Constraint Theory", Chapter 2 in book Progress in Biopolymer Research, pp45-76, ISBN 1-60021-984-5, Nova Publishers

CONFERENCE ABSTRACTS

[2] 2008: "All Atom Free Energy Decomposition For Amino Acids," 52nd Annual Biophysical Society Meeting, Long Beach, CA
[1] 2007: "Thermodynamics of a beta-hairpin to coil transition elucidated by an exact solution using a minimal distance constraint model," 51st Annual Biophysical Society Meeting, Baltimore, MD

RESEARCH EXPERIENCE

UNC Charlotte Computational Biophysics Lab, 2006-2008. Advisor: Dr. Don Jacobs.

- **Free energy decomposition of amino acids**: I wrote C++ code to determine the partition function for each of the twenty standard amino acids. The key was to reverse engineer the entropies by using the Top500 database to determine amino acid probabilities per coarse-grained conformational macrostate; this coupled with energy calculations from the OPLS force field enabled reverse engineering of the entropies, assuming a canonical Boltzmann distribution. The results were presented at the 2008 Biophysical Society meeting.
- **ß-hairpin**: I developed an analytic expression for the partition function of a ß-hairpin turn in proteins. Using this partition function, I wrote C++ code to predict free energy landscapes, heat capacity curves, and unfolding transitions. The results were presented at the 2007 Biophysical Society meeting.
- **Cluster management**: I co-maintained a 102 node Apple Xserve cluster.
- **High level programming design**: I led the research group's high level object-oriented C++ design and programming for over two years. I trained my replacement post-doc on OO programming, invoking

BLAS/LAPACK from C++, and on using the singular value decomposition to implement principle component analysis.
- **Protein (un)folding**: I developed and implemented a novel hydrogen bond dilution algorithm to predict protein unfolding pathways; a variational principle was employed whereby we minimized the change in Gibbs free energy along the unfolding pathway.

UNC Charlotte Mathematics Department, 2005-2007. Advisor: Dr. Tom Lucas.
- **SplineUI**: I developed a feature rich MATLAB GUI, called SplineUI, for smoothing one dimensional noisy data. The tool allows the user to choose the basis functions, including B-spline cubics, B-spline quntics, and Legendre polynomials. The SplineUI also implemented various end-conditions including natural, clamped, and not-a-knot. Since smoothing is a tradeoff between interpolation and curvature, I implemented penalized smoothing by using generalized cross validation to determine a smoothing parameter. Computational speedups and numerical stability were achieved through use of the QR factorization and the singular value decomposition.
- **Smoothing multidimensional data**: I generalized the one dimensional results from SplineUI into a prototype for smoothing multidimensional data. I extended the results from the SplineUI by using tensor products of the basis functions.

UNC Charlotte Physics Department, 2005-2006. Advisor: Dr. Susan Trammell
- **Astronomy research lab**: I installed, setup, and configured scientific code (polarizer routines for IDL) on Sun workstations. These codes were used to analyze Hubble Space Telescope data on the proto-planetary nebula AFGL 618. I analyzed the observational polarimetry data and produced plots of the polarimetry vector fields. These plots were used in superposition with optical and infrared images, with the aim of better understanding the structural development and morphology of AFGL 618.

RELEVANT NON-ACADEMIC WORK EXPERIENCE

Vice President, Bank of America, 1998-2006.
- I was one of 12 software architects responsible for defining the technology strategy within the Global Treasury Services (GTS) division of Bank of America. If split off as a separate company, GTS is so large that it would be a Fortune 500 company.
- I gave extensive research and decision support on a $20MM capital expenditure technology budget.
- I served as lead software architect for numerous large-scale multimillion dollar software development projects within GTS, many of which were international projects.
- Prior to my role as an architect, I was a senior developer writing server-side Java code. I also mentored junior developers on OO design and programming.

COMPUTER SKILLS

Expert: Data structures and algorithms, C, C++, MATLAB, LaTeX, Linux, Mac OS X, TCP/IP networking.
Fluent: Java, Maple, Mathematica, multi-threading, Object Oriented Analysis & Design (OOAD), UML, design patterns.
Basic competency: LAM / MPI grid computing, 80x86 assembler, Perl, UNIX shell scripting, SQL and database programming, Postscript, Asymptote, Visual Python, HTML, XML, CSS, Solaris, OpenBSD, Windows, DOS. I can build, configure, and test computers, as well as install and configure operating systems. I can install and configure applications in a UNIX environment and setup firewalls.

TEACHING EXPERIENCE

- Linear Algebra - Fall 2008 @ UNC Charlotte. A sophomore/junior level course on linear algebra, with 36 enrolled students.

PROFESSIONAL AND ACADEMIC AFFILIATIONS

- American Mathematical Society (AMS)
- Society for Industrial and Applied Mathematics (SIAM)
- Sigma Pi Sigma, the national honors physics fraternity
- Pi Mu Epsilon, the national honors mathematics fraternity
- Phi Kappa Phi, the national honors fraternity
- Society of Physics Students (SPS)
- Biophysical Society (BPS)

… CONTINUED ON NEXT PAGE ...

CAMPUS LEADERSHIP

2007 Invited to lecture a class of physics freshmen on navigating through a physics degree at UNCC.
2006 Physics representative, Student Advisory Board to College of Arts & Sciences, UNCC.
2006 Invited to lecture a class of physics freshmen on navigating through a physics degree at UNCC.
2006 Lecture on Legendre polynomials, given to SPS, UNCC.
2006 Lecture on time derivatives in rotating coordinate systems, given to SPS, UNCC.
2006 Two lectures on linear algebra, given to SPS, UNCC.
2005 Two lectures on group theory, given to SPS, UNCC.
2005 President, UNCC Chapter of the Society of Physics Students. I organized, lobbied, and petitioned for the reinstatement of our previously dormant SPS chapter. I was elected president for the 2005 academic year, growing our membership from 5 to 18 people.

PERSONAL

- I speak, read, and write German moderately well.
- I am an Eagle Scout, a licensed pilot, skydiver, and ham radio operator (station KG4GMH).
- I manage a small network of Linux servers, a firewall, and several domains.

REFERENCES

- Dr. Don Jacobs: Assistant Professor, Department of Physics & Optical Science, UNC Charlotte, Charlotte, NC 28223. Phone: 704-687-8143. Email: djacobs1@uncc.edu
- Dr. Tom R. Lucas: Professor, Department of Mathematics & Statistics, UNC Charlotte, Charlotte, NC 28223. Phone: 704-687-4571. Email: trlucas@uncc.edu
- Dr. Susan R. Trammell: Associate Professor, Department of Physics & Optical Science, UNC Charlotte, Charlotte, NC 28223. Phone: 704-687-8164. Email: srtramme@uncc.edu
- Dr. Faramarz Farahi: Professor & Chair, Department of Physics & Optical Science, UNC Charlotte, Charlotte, NC 28223. Phone: 704-687-8136. Email: ffarahi@uncc.edu
- Dr. Joel Avrin: Professor & Graduate Coordinator, Department of Mathematics & Statistics, UNC Charlotte, Charlotte, NC 28223. Phone: 704-687-4929. Email: jdavrin@uncc.edu

END OF FILE