

# MATTHEW BRITTON

## Work Address

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## Personal Information

Citizenship: United States

## Education History

Sept. 1991 - Feb. 1997: Ph.D. Physics  
University of California, Santa Barbara.  
Sept. 1987 - May 1991: B.S. Physics  
Massachusetts Institute of Technology.

## Professional Employment

Research Staff, April 2003 - present.  
California Institute of Technology, Pasadena, California.

Senior Postdoctoral Scholar, May 2000 - April 2003.  
California Institute of Technology, Pasadena, California.

Research Assistant, Jan. 1998 - April 2000.  
Swinburne University of Technology, Victoria, Australia.

Research Assistant, Feb. 1997 - Dec. 1997.  
University of Melbourne, Victoria, Australia.

Graduate Student Researcher, Sept. 1994 - Feb. 1997.  
University of California, Santa Barbara, CA.  
Thesis Title: Interstellar Scattering of Pulsar Radiation  
Thesis Advisor: Professor Carl Gwinn.

## Areas of Expertise

- Theory and simulation of electromagnetic wave propagation through atmospheric turbulence.
- Design of astronomical adaptive optics systems for large telescopes.
- Astronomical data reduction and analysis.
- Wavefront sensing and reconstruction.
- Object oriented programming.

## Recent PI Awards

For the past three years I have been Principal Investigator on successful research proposals to the National Science Foundation Center for Adaptive Optics.

- Real-time Point Spread Function Predictions for the Palomar Adaptive Optics System
- Predicting the Keck Laser Guide Star Point Spread Function for the CfAO Treasury Survey

## Recent Instrument Design Studies

- **The CAMERA Adaptive Optics System: June 06 - Present**  
This is a concept study for an inexpensive laser guide star adaptive optics system suitable for telescopes with apertures less than 5 meters. I am principal investigator on this study.
- **Keck Next Generation Adaptive Optics System Design Study: Nov 06 - Present**  
This study aims to generate a design for the next generation adaptive optics system on Keck. My role in this study is to work with astronomical users to identify photometric and astrometric precision requirements for this system.
- **TMT M1/M2 Alignment Study: June 06 - Oct 06**  
The design for the Thirty Meter Telescope calls for an aplanatic Gregorian relay with a segmented primary mirror. Optical alignment of the primary and secondary is to be performed using an instrument containing a Shack Hartmann sensor. This simulation study aimed to test algorithms that will be used in this alignment procedure.
- **TMT Infrared Multiobject Spectrograph Feasibility Study: Feb 05 - Apr 06**  
The Thirty Meter Telescope instrumentation program includes a near infrared multiobject spectrograph with deployable integral field units. (An integral field unit provides spatially resolved spectroscopy. This concept is also known as hyperspectral imaging.) The requirements for this spectrograph call for independent adaptive optics compensation for each of the scientific targets. My role in this project was to formulate and design an adaptive optics architecture capable of providing this type of compensation.

- **TMT Wide Field Optical Spectrograph Feasibility Study: Feb 05 - Apr 06**

The Thirty Meter Telescope instrumentation program includes a wide field, multislit optical spectrograph. My role in this study was to analyze the scientific utility and technical feasibility of an adaptive optics system that could provide adaptive optics compensation for this instrument.

## Computing Experience

Author of Arroyo - an open source, C++ class library for the simulation of wave propagation through turbulence and adaptive optics systems. This library supports time-resolved, Monte Carlo simulations of physical optics wave propagation. Arroyo includes models for segmented primaries, Shack Hartmann wavefront sensors and deformable mirrors. The library and associated example programs constitute approximately 100,000 lines of C++ source code.

Author of several software packages that link against Arroyo to support specific simulation studies, provide software interfaces to astronomical instrumentation, and support data analysis pipelines.

- Ten years of experience in C++ programming.
- Extensive experience in object oriented design methodologies.
- Multithreaded computing experience on SMP machines using Pthreads.
- Distributed computing experience on clusters using MPI.
- Experience with numerous third party libraries, including Cfitsio, FFTW, LAPACK, PG- PLOT and hardware drivers.
- Favored operating system is Linux.

## Professional Service

Adaptive Optics Development Program Roadmap Committee	2007
Invited lecturer, Center for Adaptive Optics Summer School	2007
Member, Program Committee for the SPIE Conference on Modeling, Systems Engineering and Project Management	2006
Editor, ADASS Conference Proceedings	2005
Thirty Meter Telescope Adaptive Optics Working Group	2003 - 2005
Australia Telescope User's Committee	1998 - 2000
Referee for JOSA, PASA	

Over the past 4 years I have constructed a webpage describing my research in adaptive optics and astronomy (<http://eraserhead.caltech.edu>). This webpage has been growing in popularity, and this year has received approximately one million hits (excluding robots) from researchers in academia, industry and government labs.

When possible, I provide user support for projects that employ Arroyo. Recent projects in which I am not directly involved that have used Arroyo include the Large Synoptic Survey Telescope and the Keck Interferometer.

## **Supervisory Experience**

As part of the instrument design studies software development activities, and astronomical research, I have supervised postdocs, computer programmers, and mechanical engineers. In addition, I have supervised seven undergraduate and graduate students.

## **Telescope Observing Experience**

- Approximately 20 nights at the Hale 5 meter telescope performing near infrared imaging observations with adaptive optics.
- Approximately 10 nights at the Keck telescope performing near infrared imaging and spectroscopic observations with adaptive optics.
- Approximately 100 nights at the Parkes radiotelescope using baseband recorders and hardware correlators to perform radio pulsar observations.

## **Teaching Experience**

During graduate school, I served as a teaching assistant for undergraduate and graduate level courses in physics. I also served as head teaching assistant for one year, managing the teaching assistants for the Santa Barbara Physics Department.

## **Publications**

My three most recent first author publications:

Britton, M. C. 2006, "Analysis of crowded field adaptive optics image data", Proceedings of the SPIE, 6272

Britton, M. C. 2006, "The Anisoplanatic Point-Spread Function in Adaptive Optics", Publications of the Astronomical Society of the Pacific, 118, 885

Britton, M. C. 2004, "Arroyo", Proceedings of the SPIE, 5497, 290

A full list of 38 refereed publications and conference proceedings is available from the Smithsonian/NASA Astrophysics Data System, or on request.