

## Mark Yashar

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### DATA ANALYSIS AND SCIENCE • SCIENTIFIC COMPUTING/PROGRAMMING • HIGH PERFORMANCE COMPUTING • PHYSICS

Experienced data analyst, physicist, and engineer with expertise in scientific computing and numerical modeling methods. Experience and knowledge of image processing, algorithm development, and data visualization, with particular attention to detail and excellent written and oral communication skills. Knowledge and experience with technical/scientific writing, as well as teambuilding, project management, and leadership skills. Ability to solve high level technical and scientific problems with both a holistic and granular point-of-view. Qualifications include:

#### COMPUTING/SOFTWARE

- Operating Systems: **Windows, Linux (Red Hat, Centos, Ubuntu), Unix, Mac OS.**
- Programming Languages and Data Analysis Packages: **Python** (including **numpy**, **matplotlib**, and **scipy** libraries), **C/C++** (including object-oriented programming and associated use of **gdb** and **ddd** debuggers and **Eclipse**), **MATLAB/Octave**, **Fortran**, **Perl**, **R**, Unix shell scripting, **IDL**, **Mathematica**, **HTML**, **Java**, **Berkeley DB XML**, **MySQL**, Common Astronomy Software Applications (**CASA**), Image Reduction and Analysis Facility (**IRAF**), **Supermongo**, **Meqtrees**, Weather Research and Forecasting Model (**WRF**), NCAR Command Language (**NCL**), NetCDF Command Line Operators (**NCO**).
- Other Software Applications: **LaTeX**, **EXCEL** (including use of formulas, functions, and plotting features and capabilities), Concurrent Versions System (**CVS**), **VMware Workstation**, **Liferay Enterprise**.
- Supercomputers (e.g., **Cray XE6**) and high-performance computing.

#### SCIENTIFIC/TECHNICAL

- Monte Carlo methods and techniques
- Markov Chain Monte Carlo (**MCMC**) (including Bayesian analysis) and Metropolis-Hastings algorithms
- Data, signal, and image processing and analysis; error analysis and statistics
- Data visualization
- Numerical modeling, simulation
- Scientific/technical writing

#### MANAGEMENT & LEADERSHIP

- Excellent written and oral communications
- Cost/benefit ratio analysis and risk management
- Leadership and teambuilding
- Project Management
- Financial accountabilities and grant writing

## EDUCATION

12/2008

**University of California, Davis (UCD)** (Davis, California)

PhD in Physics

Dissertation: "Topics in Microlensing and Dark Energy"

Gained skills and experience in Monte Carlo, MCMC, Bayesian, and Kolmogorov-Smirnoff methods and techniques, and data visualization; also gained experience and skills in MATLAB, Fortran, C, Perl and UNIX shell scripting.

Advisor: Dr. Andreas Albrecht

01/1999

**San Francisco State University (SFSU)** (San Francisco, California)

MS in Physics

05/1994

**San Francisco State University** (San Francisco, California)

BA in Physics, Concentration in Astronomy

## EXPERIENCE

02/2012-02/2014

**Postdoctoral Scholar-Employee**, University of California, Berkeley (UCB), Department of Earth and Planetary Science, Berkeley, California (CA)

Supervisor: Dr. Inez Fung, Professor of Atmospheric Science; **Contributor to the 2007**

**Nobel Peace Prize** awarded to the United Nations Environmental Program (UNEP)

Intergovernmental Panel for Climate Change (IPCC)

- Carried out research focused on mesoscale and regional (forward or "bottom-up") atmospheric transport modeling and analysis of anthropogenic and biogenic carbon dioxide emissions from northern California for multi-scale estimation and quantification of atmospheric CO<sub>2</sub> concentrations.
- Made extensive use of **WRF** (written mostly in **FORTRAN**), the **WRF-Chem** coupled weather-air quality model for atmospheric transport simulations, and the Vegetation Photosynthesis and Respiration Model (WRF-VPRM) biospheric model to simulate CO<sub>2</sub> biosphere fluxes and atmospheric CO<sub>2</sub> concentrations. This work also involved the use of the **R statistical scripting language**, the **NCAR Command Language (NCL)**, **MATLAB**, **Python**, and **Ferret** for additional pre- and post-processing, modification, and visualization of netCDF files, and further enabling and expediting data analysis of simulation results.
- Troubleshooted WRF, WRF-Chem, and VPRM simulation runs and results to increase data efficiency and to decrease time to solve problems.
- Installed, compiled, built, and configured WRF, WRF-Chem, and VPRM on the National Energy Research Scientific Computing Center (NERSC) multi-core supercomputing system "Hopper" and submitted batch job scripts to this system to run the WRF model simulations.
- Assisted students and post-docs in installing and configuring WRF and WRF-Chem.

02/2009-02/2012

**Postdoctoral Research Associate**, University of Illinois Urbana-Champaign (UIUC),  
National Center for Supercomputing Applications (NCSA), Champaign, Illinois  
Supervisor: Dr. Athol Kemball, Associate Professor of Astronomy, Center Affiliate of NCSA

- Conducted research and development in Square Kilometer Array (SKA) calibration and processing algorithms and computing with a **focus on cost and feasibility studies** of radio imaging algorithms and direction- dependent calibration errors with the Technology Development Project (TDP) Calibration Processing Group (CPG) at UIUC.
- Evaluated the computational costs of non-deconvolved images of a number of existing radio interferometry algorithms used to deal with non-coplanar baselines in wide-field radio interferometry and co-authored a corresponding internal technical report ("Computational Costs of Radio Imaging Algorithms Dealing with the Non-Coplanar Baselines Effect: I") with A. Kemball.
- Implemented and utilized numerical and imaging simulations in conjunction with the use of the **Meqtrees** software package and the **CASA** software package (written mostly in **C++**) to address cost, feasibility, dynamic range, and image fidelity issues related to calibration and processing for SKA and the dependence of these issues on certain key antenna and feed design parameters such as sidelobe level and mount type. Numerical simulations included Monte Carlo simulations (written in **Python**) to test analytical expressions.
- Installed, built, compiled, configured and set up C++ software development environment for CASA (including use of gdb, ddd, and Eclipse C++ debuggers) and all its dependencies, and made modifications to C++ code as necessary.
- Installed, configured, and maintained Java-based **Liferay Portal** software bundled with Apache Tomcat application server and connected to a MYSQL database on a Linux machine.
- Installed, configured, maintained, and utilized **VMware Workstation** on a host Linux system.

05/2006-12/2008

**Research Assistant**, UCD, Department of Physics, Davis, CA

Supervisor: Dr. Andreas Albrecht, Professor of Physics

- Carried out research project with Professor Andreas Albrecht's research group that involved an MCMC analysis of a dark energy quintessence model (known as the Inverse Power Law (IPL) or Ratra-Peebles model) that included the utilization of Dark Energy Task Force (DETF) data models that simulated current and future data sets from new and proposed observational programs.
- Wrote, modified and submitted batch job scripts to run **MATLAB** MCMC code on a Linux computing cluster to expedite the running of the MCMC simulations and the generation of MCMC output.
- Generated simulated data sets for a Lambda-CDM background cosmology as well as a case where the dark energy was provided by a specific IPL model. Then used an MCMC algorithm to map the likelihood around each fiducial model via a Markov chain of points in parameter space, starting with the fiducial model and moving to a succession of random points in space using a Metropolis-Hastings stepping algorithm. From the associated likelihood contours, found that the respective increase in constraining power with higher quality data sets produced by analysis gave results that were broadly consistent with the DETF for the dark energy

parameterization that they used. Also found, consistent with other findings, that for a universe containing dark energy described by the IPL potential, a cosmological constant can be excluded by high quality “Stage 4” experiments by well over 3 sigma.

- Troubleshooted and debugged simulation runs and results.
- Lead author of paper published in Physical Review D on research results, using Monte Carlo, MCMC, Metropolis-Hastings, Bayesian, and various mathematical modeling and uncertainty quantification methods/skills.
- Assisted a graduate student in generating 3-dimensional Chi-squared plots with MATLAB that helped develop intuition into the actual physical behavior of the Albrecht-Skordis (AS) dark energy quintessence model – a better understanding than would have been allowed by running the full MCMC on the larger parameter space. This systematic investigation revealed that there were some numerical problems and issues involved in the student’s analysis of the AS model.

01/2004-01/2006

**Research Assistant/Participating Guest.** Lawrence Livermore National Laboratory, Livermore, CA, and UCD, Department of Physics

Supervisor: Dr. Kem Cook

- Engaged in a research project with Dr. Kem Cook at LLNL that expanded and extended the work of others and involved the utilization and development of reddening models, star formation histories, color magnitude diagrams (CMDs), and microlensing population models of the Large Magellanic Cloud (LMC) to constrain the locations of micro-lensing source stars and micro-lensing objects (Massive Compact Halo Objects -- MACHOs) in the Large Magellanic Cloud (LMC) and the Milky Way halo using data of 13 microlensing source stars obtained by the MACHO collaboration with the Hubble Space Telescope (HST).
- Carried out a 2-dimensional Kolmogorov-Smirnov (KS) test along with Monte Carlo simulations to quantify the probability that the observed microlensing source stars were drawn from a specific model population.
- Utilized and modified C, Fortran and Perl code and UNIX shell scripts during the course of this research project to implement and carry Monte Carlo simulations and KS tests. Supermongo interactive plotting package was used for visualization of some simulation results. Simulation results were described and discussed in PhD dissertation.

01/2003-05/2003

**Student Project**, UCD, Department of Physics, Davis, CA

- Wrote computer code in **Fortran** and **IDL** for the final project in a graduate level computational physics course instructed by Dr. John Rundle which computed a closed orbital ellipse of an extrasolar planet orbiting a single star using data input by the user. The program queried the user to enter various orbital and physical parameters of the planet-star system and used this data to calculate the observed effective equilibrium blackbody temperature of the extrasolar planet for a given orbital phase. The program also calculated the planet-to-star flux ratios at given orbital phases.
- Generated plots showing the shape and size of the orbit, orbital speed vs. orbital phase, planet temperature vs. orbital phase, and planet-to-star flux ratios vs. orbital phase, and which also indicated as to whether the inputs entered met the criteria for a habitable planet.

09/2002-12/2008

**Reader**, UCD, Department of Physics, Davis, CA

- Graded homework assignments and exams, and recorded and calculated grades (using **EXCEL**) for undergraduate and graduate physics courses including classical mechanics, electricity and magnetism, mathematical methods in physics, astrophysics, introductory astronomy and cosmology, and quantum mechanics.
- Held office hours.
- Proctored exams.

09/2002-05/2003

**Research Assistant**, UCD, Department of Physics, Davis, CA

Supervisor: Dr. Matt Richter, Research Physicist

- Processed, extracted, and displayed data of spectra of stars and circumstellar material obtained by the Texas Echelon Cross Echelle Spectrograph (TEXES) for the mid-infrared used with the NASA Infrared Telescope Facility, using Fortran (for data extraction) and IDL (for data visualization and display).

08/1999-08/2001

**Data Aide**, Stanford Linear Accelerator Center (SLAC), Particle Astrophysics Group, Menlo Park, CA

Supervisors: Professor Elliott Bloom, Dr. Paul Kunz

- Handled and processed data and maintained data archive for the Unconventional Stellar Aspect (USA) X-ray astronomy experiment at SLAC.
- Downloaded raw data files from the Naval Research Laboratory (NRL) and processed them to create FITS files for scientist's use locally.
- Submitted batch jobs to other computing systems and clusters.
- Wrote and assisted in writing and developing Perl and UNIX shell scripts for the purpose of automating and expediting many of the data handling, processing, and archive maintenance tasks. Also copied the raw data files to computer tape cartridges.
- Assisted in scheduling and setting up USA teleconferences.
- Assisted in supporting, maintaining, and administering printer systems and software and Windows operating systems on multiple machines.
- Maintained inventory of Particle Astrophysics group computers, other hardware,

and software licenses.

01/1999-06/1999

**Student**, San Francisco State University, Department of Physics and Astronomy, San Francisco, CA

- Engaged in a laboratory project for an astronomy lab course instructed by Dr. Adrienne Cool in which possible cataclysmic variable (CV) star candidates were identified from light curves and R vs. H-alpha plots using R and H-alpha CCD images taken with the Hubble Space Telescope (HST) Wide Field Planetary Camera 2 (WFPC 2) of the central regions of the globular star cluster NGC 6397. Used **IRAF**, **SAOTNG**, and Supermongo software packages in the analysis.
- Carried out an observational project on variable stars for this astronomy lab course using a 10-inch Epoch Telescope-CCD system and the IRAF and SAOTNG software packages. Created a web page using **HTML** to post project results online.

## GRANTS AND SUPPORTED RESEARCH ASSOCIATESHIPS

- National Science Foundation Grant (02/2009-02/2012, A. Kembell)
- Department of Energy (2007, A. Albrecht; 2012, I. Fung)
- National Science Foundation (2004, K. Cook, R. Becker)

## PROFESSIONAL AFFILIATIONS/MEMBERSHIPS

American Physical Society (2002-Present)

American Geophysical Union (2013-Present)

## PUBLICATIONS

**M. Yashar**, B. Bozek, A. Albrecht, A. Abrahamse, M. Barnard, Exploring Parameter Constraints on Quintessential Dark Energy: The Inverse Power Law Model, Physical Review D, 79, 103004, 2009.

M. Barnard, A. Abrahamse, A. Albrecht, B. Bozek, **M. Yashar**, A measure of the impact of future dark energy experiments base on discriminating power among quintessence models, Physical Review D, 78, 043528; 2009, Physical Review D, 80, 129903(E), 2008.

M. Barnard, A. Abrahamse, A. Albrecht, B. Bozek, **M. Yashar**, Exploring Parameter Constraints on Quintessential Dark Energy: the Albrecht-Skordis model, Physical Review D, 77, 103502, 2008.

## INTERNAL TECHNICAL REPORTS

**M. Yashar**, A. Kembell, Computational Costs of Radio Imaging Algorithms Dealing with the Non-coplanar Baselines Effect: I, TDP Calibration and Processing Group Memo #3 ([http://www.astro.kembell.net/Publish/files/ska\\_tdp\\_memos/cpg\\_memo3\\_v1.1.pdf](http://www.astro.kembell.net/Publish/files/ska_tdp_memos/cpg_memo3_v1.1.pdf)), 2010.

A. Kembell, T. Cornwell, **M. Yashar**, Calibration and Processing Constraints on Antenna and Feed Designs for SKA: I, TDP Calibration and Processing Group Memo #4 ([http://www.astro.kembell.net/Publish/files/ska\\_tdp\\_memos/CP\\_Antenna\\_Feed.pdf](http://www.astro.kembell.net/Publish/files/ska_tdp_memos/CP_Antenna_Feed.pdf)), 2009.

## **WORKSHOPS AND CONFERENCE PARTICIPATION**

- American Geophysical Union Fall Meeting, Moscone Center, San Francisco, CA, December 9-13, 2013
- Basic WRF Winter Tutorial, National Center for Atmospheric Research (NCAR), Boulder, CO, January 28 – February 1, 2013
- Model Evaluation Tools (MET) WRF Tutorial, NCAR, Boulder, CO, February 4-5, 2013
- SKA Calibration and Processing F2F Group Meeting, Hyatt Regency O'Hare Hotel, Chicago, IL, January 15, 2010
- 5th Annual Cosmology in Northern California (CINC '08), Kavli Institute for Particle Astrophysics and Cosmology (KIPAC), Stanford Linear Accelerator Center. 18 April, 2008
- 4th Annual Cosmology in Northern California (CINC '07), University of California, Davis. 11 May, 2007
- Cosmo 2006 International Workshop on Particle Physics and the Early Universe, Granlibakken Conference Center and Resort, Tahoe City, CA. 24 - 29 September, 2006

## **REFERENCES**

Inez Fung, Sc.D.

Professor of Atmospheric Science

(Contributor to the 2007 Nobel Peace Prize awarded to the United Nations Environmental Program (UNEP) Intergovernmental Panel for Climate Change (IPCC))

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