ALEX DEICH

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Education

Reed College, Portland, Oregon — May 2016
BA in Physics
Senior thesis: *Particle Dynamics in a Time-Dependent Kerr Geometry*

Pacific Collegiate School, Santa Cruz, California — 2010

Research Experience

Note: Many of the projects listed have associated reports and code, which are linked to where appropriate. These are also available on http://deichdeich.github.io.

Oregon State University — July 2016 - Present
I am currently working with Dr. Davide Lazzati at Oregon State University, where we are modeling the expected emission of a short-duration gamma ray burst (GRB), as seen askance from the direction of the jet. This will allow us to use data from LIGO to search for the afterglow of binary star mergers, which are thought to be progenitors of short GRB's. My duties involve calculating and deriving analytical expressions for various parameters associated with the system, as well as writing a complete analysis package in Python.

Reed College code, PDF — September 2015 - May 2016
For my senior thesis at Reed, I investigated the dynamics of a time-varying Kerr geometry. Kerr geometries result from spinning mass distributions. Most analyses approximate the spin as constant in time, which is reasonable for many applications. However, there are several physical motivations for a non-static spin, and the effect of a changing spin on orbiting test particles is nontrivial. My analysis primarily constituted a large, self-designed n-body simulation of 10^4 particles in a Kerr geometry, combined with some analytic treatment of the system.

University of Utah code — June 2014 - August 2015
I worked at the University of Utah in Salt Lake City with Dr. Anil Seth, on data from the Panchromatic Hubble Andromeda Treasury (PHAT). This project derived metallicity for young, massive stars in M31. This project saw me accomplish three goals: 1) I designed several data fitting algorithms in Python to derive reddening values and metallicity. 2) I wrote a tool which allowed the user to interact with large data sets graphically. The user can select regions of data with the mouse, and make plots or perform analysis on the points in those regions. 3) I performed Monte Carlo simulations of stellar populations of various ages, which we used to refine the parameters of our data.

I have shown that there exists a weak radial metallicity gradient in the galaxy, providing more thorough confirmation of previous spectroscopic studies. I presented the project at the 2015 meeting of AAS in Seattle, Washington, where it was a finalist for the Chambliss Award for Undergraduate Research.

Cerro-Tololo Interamerican Observatory — January - March 2013
In 2013, I worked at the Cerro-Tololo Interamerican Observatory (CTIO) in La Serena, Chile. This was an NSF-funded Research Experience for Undergraduates (REU). While there, I worked with Dr. Alexandre Roman-Lopes of the Universidad de La Serena and Andrea Kunder of CTIO in characterizing data from the Vista Variables in the Via Lactea (VVV) Survey. I applied PSF and aperture

photometry to the data with the DAOPHOT package, and wrote numerous data analysis scripts in Python. By matching sources with the 2MASS survey, I derived correlation functions between the two surveys, which significantly reduced error, and has wider application in the use of VVV data. I presented the project at the winter 2014 meeting of the AAS conference in Washington, DC. While in Chile, I collected data on two telescopes there. I spent two nights on the 0.9-meter SMARTS telescope and three on the 4-meter Blanco telescope using the new Dark Energy Camera (DECam), as part of the Dark Energy Survey. The data from the Blanco is being used by Dr. Armin Rest of Harvard University in a 2014 paper.

Reactor operator 2013

In 2013, I trained as a nuclear reactor operator on the Reed Research Reactor, where the research centers around quantitative neutron activation analysis for trace-element concentrations.

Humboldt State University September 2010 - December 2012

From 2011 to 2012, I assisted Dr. Ryan Campbell at Humboldt State University in Arcata, California, in photometric and spectroscopic studies of Low-Accretion Rate Polars (LARPs). My duties included CCD image reduction with IRAF as well as Python and FORTRAN scripting. By using time-resolved spectroscopy, we were able to create a three-dimensional model of the LARP, indicating where the accretion columns were on the surface. The model was obtained with a genetic algorithm built using the PyEvolve package.

Projects

Visualization of 1-Dimensional Quantum Potentials code 2015

To learn how to use an animation library in Python (matplotlib.animate), I wrote a script which solves Schrodingers equation for a particle in an arbitrary 1D potential, and renders the result in real time.

FTIR spectroscopy of Ag+ in photofilm PDF 2015

With another student at Reed, I performed fourier transform infrared (FTIR) spectroscopy on consumer-grade photography film to determine the absorption of metallic silver. In addition to taking the measurements, I wrote a small peak-finding script to analyze the data.

Exoplanet Lightcurve Fitting code 2015

When an exoplanet crosses between its star and the Earth, telescopes record a dip in the stars light. The plot of the intensity of the light over time, or light-curve is a frequently used measurement to determine various parameters about an exoplanet. I independently wrote a small Python script to fit analytically determined light-curves to data. The script used a steepest-descent algorithm to determine the fit. It was determined that steepest-descent was too liable to get stuck in local minima to be useful.

Teaching Experience

Scientific Python instructor 2015 - 2016

I taught four sessions for undergraduates at Reed College about using the NumPy, SciPy, and matplotlib Python libraries for scientific computation.

Reed College Science Outreach 2014 - 2015

Reed College's Science Outreach program pairs undergraduates with elementary classrooms around Portland for weekly science classes. For three semesters between 2014 and 2015, I taught science to 10- and 11-year-olds at Lewis Elementary and Ventura Park Elementary schools in southeast Portland. Topics included chemistry, biology, and physics. Lessons emphasized hands-on learning in small groups, with minimal lecturing. In addition to in-class work, my duties included lab design and set-up.

New Brighton Middle School 2011 - Present

Three or four times a year for the last five years I have led sixth-grade science class lectures in physics and astronomy at New Brighton Middle School in Capitola, California.

Humboldt State University 2011 - 2012

For four semesters at Humboldt State University, I was a student tutor for physics and mathematics. Courses included newtonian mechanics, calculus I, and electromagnetism.

Skills

Programming languages

Fluent: Python (including SciPy, NumPy and AstroPy), Mathematica, object-oriented code design
Proficient: C, IDL, MATLAB, R
Familiar: LabVIEW, FORTRAN, Objective-C

Human languages

Proficient in Spanish, can read and write Dutch.

Operating systems

Mac OS, multiple distributions of Linux/Unix-based OS

Software

IRAF, TOPCAT, THELI, ds9, LaTeX, vim, Excel, word

References

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