

ALEX DEICH

adeich2@illinois.edu
web: deichdeich.github.io
cell: 831.421.2487

Education

- Reed College**, Portland, Oregon May 2016
BA in Physics
Senior thesis: *Particle Dynamics in a Time-Dependent Kerr Geometry* [PDF](#)
- Montana State University**, Bozeman, Montana 2018 - 2019
Graduate student before moving with my group to Illinois
- University of Illinois**, Champaign-Urbana, Illinois 2019 - Present
Student with Nico Yunes

Research Experience

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

- University of Illinois** September 2019 - Present
Graduate student
- I am a student in Nicolás Yunes' gravity group, studying modifications to general relativity
 - My current work involves high-resolution numerical integration of extreme mass-ratio inspirals to search for chaos in the trajectories
 - I also work as an instructor and grader for the 200-level physics classes (mechanics, electromagnetism)
- Swift Gamma-Ray Burst Explorer** September 2017 - August 2018
Researcher/Science Planner
- Constructed observation timelines for the *Swift* spacecraft which balance on-board resource restrictions such as momentum wheel buildup, passive temperature control, and target visibility.
 - Independently engaged in research with *Swift* (see "Projects" section below)
 - Designed and ran simulations to optimize the spacecraft response procedure to LIGO signals
- Swift Gamma-Ray Burst Explorer** September 2017 - Present
Developer for Automation Initiative
- As a member of the Science Operations Team (SOT) at *Swift*, I was part of a 3-person team automating the observation scheduling
 - The automation initiative is a comprehensive overhaul of the scheduling process consisting of a Python-based collection of programs which interface with the main MySQL observation database and construct observation timelines with no human input.
 - My contributions include: constructing a temperature prediction and optimization module, modeling momentum buildup with TensorFlow, writing documentation for these, and designing large-scale code structure.
- Swift Gamma-Ray Burst Explorer** December 2017 - Present
XRT Burst Advocate

- Lead data analysis from the x-ray telescope (XRT) when a gamma-ray burst was detected
- Advised the science operations team on observation procedure to maximize science returns.
- Generated several dozen circulars on the Gamma-Ray Coordinates Network

San Antonio Military Medical Center
Consulting researcher

August 2017 - August 2018

- I am collaborating with a group of neuroscience researchers led by Dr. Mostafa Ahmed who have developed a new method of repairing facial nerve lesions.
- My duties are as a mathematical consultant. I have designed two algorithms in particular for quantitatively comparing data of the activity of facial nerves.
- Co-authored two papers on this research, in prep.

Oregon State University [code](#), [PDF](#)
Researcher

July 2016 - August 2017

- Built an analysis package in Python for investigating the physics of gamma-ray bursts.
- Designed an extensive simulation code which integrates a GRB fireball to produce the expected lightcurve for arbitrary wavelength, fireball energy, lorentz factor, and fireball structure.
- The simulation code, whose documentation is available on GitHub, is very extensible and has found applications elsewhere.
- Derived analytical relationships for the energetics of short gamma-ray bursts.
- Co-authored a paper based on this research.

University of Utah [code](#)
Research Assistant

June 2014 - August 2015

- Designed data fits to derive reddening values and metallicity from wide-field Hubble data of young stars in the Andromeda galaxy to look for a gradient in metallicity across the galaxy.
- Wrote a tool which allowed the user to interact with large data sets graphically. The user can select regions of data, and plot or perform analysis on those data. The documentation is available on GitHub.
- Performed Monte Carlo simulations of stellar populations of various ages, which we used to refine the parameters of our data.
- Presented the project at the 2015 meeting of AAS in Seattle, Washington, where it was a finalist for the Chambliss Award for Undergraduate Research.

Projects

The Effect of Stellar Ejecta on Post-Supernova Binary Orbital Trajectories December 2019 - Present
University of Illinois, independent project

- I am conducting hydrodynamic simulations with the PLUTO MHD code to study the effect of supernova on the orbits of binary systems
- This can be used to better predict LISA waveforms
- This work is ongoing

Probing the Stability of Compact Objects in *Swift* archival data
Swift, independent project

December 2017 - July 2018

- I used x-ray reflection spectroscopy to probe the stability of compact objects

- I ran several simulations of accretion disk spectra with various spin-up and spin-down scenarios using Dauser and Garcia's [relxill](#) model
- Used *Swift* archival data for evidence of a changing spin in compact objects.

Computer skills

Languages

Fluent: Scientific Python, C, Mathematica, \LaTeX

Proficient: C++, IDL, Fortran

Packages and programs (in order of familiarity): NumPy, Matplotlib, AstroPy, pandas, TAKO, TOPCAT, SAOImage DS9, xspec, IRAF (and PyRAF), TensorFlow,

Simulation codes (in order of familiarity): PLUTO, FLASH

Techniques: MCMC fitting and error determination, statistical fourier analysis, gradient descent, Runge-Kutta integration techniques, adaptive step sizing and grid spacing, neural network optimization, MHD simulation

Presentations

Automating the *Swift* Scheduling Pipeline May 2018
SPIE Astronomical Telescopes + Instrumentation

Probing the Stability of Compact Objects with X-ray Reflection Spectroscopy January 2018
American Astronomical Society

Calculating the Cocoon Energy of Short GRBs October 2016
Oregon State University

Particle Dynamics in a Time-Dependent Kerr Geometry May 2016
Reed College

PHAT Youths: Determining Metallicity for Hot Young Stars in M31 January 2015
American Astronomical Society

- Chambliss Award Honorable Mention for Undergraduate Research

Photometric Analysis of Clusters in the Vista Variables in the Via Lactea (VVV) Survey January 2014
American Astronomical Society

Publications

Mostafa M Ahmed, **Alex Deich**, et al. "Transgenic Mouse Facial Nerve Model of Synkinesis"
Forthcoming, 2020.

A. Deich, J. Gropp, S. LaPorte, "Automating the Swift Scheduling Pipeline" Conference paper, presented at SPIE July 2018

D. Lazzati, **A. Deich**, B. Morsony, J. Workman. "Off-axis emission of short γ -ray bursts and the detectability of electromagnetic counterparts of gravitational-wave-detected binary mergers", MNRAS, **471**, 2, October 2017