# Allison Hume

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## Education

University of California Santa Cruz, Santa Cruz, CA. September 2014 - Present
M.S. in Computer Science

Princeton University, Princeton, NJ. September 2009 - June 2013
A.B. in Astrophysical Sciences; Certificate in Applications of Computing GPA: 3.24

## Technical Skills

Able to learn new programming languages and software packages quickly.

Programming languages
Proficient in: Python, Java, C.
Have experience in: C++, BASH.

Technologies
Proficient in: SQL, Teradata database, Teradata Aster database, Unix environment.
Have experience in: MapReduce, SVN, Git.

## Sample Projects

Collaborated as part of a 10-person team to create a primality tester for large (300-digit) numbers in C. Used Java to create a study program for the physics GRE that generates practice problem sets. Used IDL to create a Monte Carlo simulation of properties of a fission reaction.

## Research Experience

Senior Thesis - "Optimizing 3D Simulated Astrophysical Collisionless Shocks" Fall 2012-Spring 2013
Thesis work involved optimizing a highly parallel particle-in-cell simulation written in Fortran 90. Optimizations include: creating appropriate data structures to hold data contiguously in memory, rewriting calculations to avoid double precision arithmetic, and re-modularizing the simulation to avoid overhead from function calls. An overall improvement in run time of about 20% was achieved. Due to optimizations, larger simulations can be run than have previously been possible and more in-depth physical questions can be answered.

Summer research at Princeton University Astrophysics Department, Princeton, NJ Summer 2012
Continued work on second Junior Project funded by a grant from the NSF REU program. Created several Python modules that can be used in conjunction with the VisIt software package to easily analyze and view simulation results. One module is for file processing; it allows easy conversion between the files that will be generated as simulation output and the types of files that can be quickly read into VisIt for easy visualization. The second module allows extended control over VisIt functionality, including functions to rotate a visualization around a user-determined axis, zoom in and out in a controlled manner, and quickly plot features such as magnetic streamlines.

Junior Project II - "Visualizing 3D Fields and Particle Orbits in Astrophysical Collisonless Shocks" Spring 2012
For second independent Junior Project, visualized three-dimensional fields and particle orbits from simulations of collisionless shocks in plasma. Finding a good way to visualize the simulation results was important for understanding the physics of the simulation. Used Python to expand functionality of software package VisIt, to analyze the data, and to create advanced visualizations and animations. Found effective workflows for quickly creating plots of plasma density, magnetic energy, field lines, and particle position and energy. Created several animations that contained combinations of these variables and illuminated interesting features in the simulation output. The animations not only showed physically interesting information, but also demonstrated how to quickly create additional visualizations in the future.

Junior Project I - “Cluster Mass versus Richness Relation” Fall 2011

For first independent Junior Project, examined a discrepancy between recent sky survey results and generally accepted weak lensing observations. The discrepancy was in the relationship between the mass and richness (similar to number density) of galaxy clusters. Determined a relationship between galaxy cluster mass and richness using a third method, which involved observations of the galaxy cluster correlation function, and obtained results that supported the weak lensing observations. Used IDL and Mathematica to perform data analysis and present the results. The conclusion was that there is an inappropriate approximation in the model used by the recent sky survey to analyze their results.

Summer research at SLAC National Laboratory Theoretical Physics Group, Menlo Park, CA Summer 2011

Participated in the Summer Undergraduate Laboratory Internship. Used a new algorithm called Dynamic Quantum Clustering to perform unsupervised data mining on large amounts of data. The goal was to test whether this algorithm could successfully cluster spectroscopic data and identify previously unknown components. Used Maple to implement the algorithm and analyze its output. Analysis included visualizing clusters and determining attributes of the spectra that had led to the formation of different clusters. Results showed that the algorithm worked extremely well and was able to identify very small amounts of a different chemical component in a large data set that contained two main components.

Summer 2010

Summer research at University of Kwazulu-Natal Astrophysics and Cosmology Research Unit, Durban, South Africa

Sent by Princeton University Astrophysics Department under an NSF REU program grant. Worked on developing a statistical pipeline for data anticipated from a new sky survey. Specifically, aided in constraining parameters in theoretical cosmological research. Determined the likelihood boundaries that are expected to be set by the sky survey on the dark energy parameters by learning statistical data analysis techniques and implementing them in IDL.

Senior internship at University of Pennsylvania Astrophysics Department, Philadelphia, PA May, 2009

Participated in research at the University of Pennsylvania for an internship at the end of senior year of high school. Learned the geometry of gravitational lensing and how to create visualizations with Mathematica. Completed a demonstration of lensing using Mathematica for the Wolfram Demonstration Project. The demonstration can be found at:
http://demonstrations.wolfram.com/GravitationalLensingByAPointMass/

## Publications

*Analyzing Big Data With Dynamic Quantum Clustering* October 2013

M. Weinstein, F. Meirer, A. Hume, Ph. Sciau, G. Shaked, R. Hofstetter, E. Persi, A. Mehta, D. Horn
http://arxiv.org/abs/1310.2700
Demonstrates the application of DQC to big, noisy, complex, and dense datasets.

*Gravitational Lensing By a Point Mass* for the Wolfram Demonstration Project April 2009

Allison Hume, Jacek Guzik
http://demonstrations.wolfram.com/GravitationalLensingByAPointMass/
Visually demonstrates the appearance of an object being lensed by a point mass.