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Goals

I anticipate defending my PhD thesis in the spring and subsequently starting postdoctoral research at another institution. I plan to continue the research that I am currently pursuing: computational astrophysics relating to star formation. I am particularly interested in the role heterogeneity plays in the evolution of structure.

Education

Dates	School	Degrees Received	Location
2004–Present	University of Rochester Dept. of Physics & Astronomy	PhD (2010) MA (2006)	Rochester, NY, USA
2001–2004	University of Washington	BS w/ Distinction, Physics (2004) BS w/ Distinction, Astronomy (2004)	Seattle, WA, USA

Awards

- Frank J. Horton Fellowship, 2004–Present. Full scholarship, stipend provided by the Laboratory for Laser Energetics at the University of Rochester.
- Higgs-Osborne Prize, 2004. Monetary award for exceptional ability in undergraduate laboratory work at the University of Washington.
- Mary Gates Research Scholarship, awarded two times, 2002–2004. The scholarship is intended "to enhance the educational experience of undergraduate while they are engaged in research guided by faculty."
- National Merit Scholar, 1999, resulting in full scholarship at Arizona State University for one year.

Research Experience

07/2004–Present: **Graduate Student, Physics & Astronomy, U. of Rochester**

I am currently pursuing graduate work in computational astrophysics. My research focuses on stellar formation, especially with regard to modelling the protostellar outflows known as Herbig-Haro (HH) objects. HH objects are notable for their high degree of collimation, while retaining structure on scales smaller than their radii. I seek to better understand HH objects with new models which posit a degree of heterogeneity either in the jet (*clumped jets*) or in the surrounding environment.

I am also investigating the physics of *clumps*: dense spheroids which are overrun by winds or shocks, such as is seen in supernova remnants. My research to date has focused on the concept of *self-convergence* when multiple physical processes are included. I am also interested in the general problem of clump-clump collisions, which relates to clumped jets.

I have developed the computational code *AstroBEAR* on a variety of fronts, from building an AMR algorithm which parallelizes more efficiently, to incorporating the HYPRE package of linear solvers for the solving of elliptic equations like self-gravity. I have given presentations and posters at conferences as well as participating in weekly departmental and group meetings.

09/2002–05/2004: **Undergraduate Researcher, the ZaP Z-Pinch Project, Dept. of Aeronautics & Astronautics, U. of Washington**

At the UW I undertook research with a laboratory experiment focused on plasma propulsion technology. The ZaP Z-Pinch Project investigates the role that radially-sheared flow can play in the stabilization of plasma columns. My duties primarily consisted of data analysis: using software such as IDL, MATLAB, and Excel, for temporally-varying photometric measurements of the plasma column. The goal was to better characterize the pinch's movement over time. I addressed this by building and employing a photometric diagnostic instrument which had a series of spatially-separated, aligned channels, like the tines on a comb. By varying its orientation on the experiment, it allowed us to observe the axial or radial motion of the column. My duties also included some CAD drafting and diagnostic instrument design, and presentation of results in meeting and conference settings.

Leadership Experience

- In 2003–2004, I acted as lead investigator for the Undergraduate Radio Astronomy Research Group at the University of Washington. My duties included directing group efforts, coordinating and facilitating weekly meetings, recruiting, and acting as primary contact between the group and faculty/staff. Early in the project I led efforts to repair & reinforce the radio dish, which had been damaged previously by wind.
- I have been the senior graduate student in our research group for several years. Our group consists of four graduate students, three undergraduate students, and one postdoctoral researcher. I am asked to provide assistance and input on a daily basis from members of the group on topics ranging from compilation errors, to astrophysical phenomena, to correct grammar in publications.

Computer Skills

Proficiency:	FORTRAN, MATLAB, Mathematica, Interactive Data Language (IDL), MS Office/Open Office suite, HTML; Windows, Linux.
Competency:	LaTeX, PERL, Javascript, AutoCAD, SolidWorks, Photoshop/the GIMP
Basic Knowledge:	Java, C

Publications

Yirak, K., Schroeder, E., Frank, A., & Cunningham, A.J. 2009 "Jets as Heterogeneous Collimated Plasmoids II: Parameter Space Exploration," to be submitted to the *Astrophysical Journal*

Yirak, K., Frank, A., & Cunningham, A.J. 2009 "Self-convergence of Radiatively Cooling Clumps," submitted to the *Astrophysical Journal*

Yirak, K., Frank, A., Cunningham, A.J., & Mitran, S. 2009 "Hypersonic Buckshot: Astrophysical Jets as Heterogeneous Collimated Plasmoids," *Astrophysical Journal*, 695, 999

Frank, A., Ciardi, A., **Yirak, K.**, Lebedev, S. 2009 "Astrophysical Jets as Hypersonic Buckshot: Laboratory Experiments and Simulations," *RevMexAA*, 36, 193

Yirak, K., Frank, A., Cunningham, A.J., & Mitran, S. 2008 "The Interaction between a Pulsed Astrophysical Jet and Small-Scale Heterogeneous Media," *Astrophysical Journal*, 672, 996

Tramposch, J., Homer, L., Szkody, P., Henden, A., Silvestri, N.M., **Yirak, K.**, Fraser, O., & Brinkmann, J. 2005 "SDSS J210014.12+004446.0: A New Dwarf Nova with Quiescent Superhumps?" *Publications of the Astronomical Society of the Pacific*, 117, 262 (9 citations)

Homer, L., Szkody, P., Raymond, J.C., Fried, R.E., Hoard, D.W., Hawley, S.L., Wolfe, M., Tramposch, J.N., **Yirak, K.** 2004 "Chandra Observation of V426 Ophiuchi: Weighing the Evidence for a Magnetic White Dwarf," *Astrophysical Journal*, 610, 991 (7 citations)

Talks and Posters

Yirak, K. 2009 "Clumpy Flows: Quasi-Ballistic Model of HH Objects," 18th Kingston Meeting on Computational Astrophysics, Halifax, Nova Scotia; talk and poster

Shroyer, B., Cunningham, A.J., Frank, A., Poludnenko, A., Jones, T., **Yirak, K.**, Carroll, J. 2009 "Radiative MHD Shocks in Heterogeneous Media," *AAS Bulletin*, 41, 695; poster

Yirak, K. 2008 "AMR Simulations of Clumped 3D Radiatively-Cooling Jets," 5th JETSET Meeting, Galway, Ireland; talk

Yirak, K., Frank, A., Cunningham, A.J. 2007 "A Nonuniform Launching Mechanism Relevant to Heterogeneous Astrophysical Jets," *AAS Bulletin*, 39, 848; poster

Yirak, K. 2007 "The Interaction Between a Pulsed Astrophysical Jet and a Small-Scale Heterogeneous Medium," 2nd JETSET Meeting, Torino, Italy; talk