Elizabeth P. Hicks

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Dr. Elizabeth P. Hicks is a research scientist and the founder of Epsilon Delta Labs, a new research lab focusing on interdisciplinary research. She specializes in interdisciplinary research at the boundary between astrophysics and fluid dynamics, studying problems where simulations of pure fluid phenomena can inform astrophysical research. In her research, Dr. Hicks has used both theoretical methods and large-scale numerical simulations. Dr. Hicks also loves science/art collaboration. In particular, she and choreographer Megan Rhyme recently created a dance about turbulence, "Far From Equilibrium", which premiered at the Museum of Science and Industry (MSI) in Chicago.

Research Interests

Fluid dynamics, dynamical systems, turbulence, hydrodynamic instabilities, transition to turbulence, Type IA supernovae, combustion, coherent structures, pattern formation, protoplanetary disks/planet formation, large-scale numerical simulations, flight, time series analysis, the Sun, plasma astrophysics, ocean waves, inertial particle dynamics, the Solar System, numerical methods

Education

University of Chicago, Chicago, IL
Ph.D., Astronomy & Astrophysics – August 2011
Thesis: Rayleigh-Taylor unstable, premixed flames: the transition to turbulence
(adviser: Robert Rosner)
M.S., Astronomy & Astrophysics – 2007

Columbia University, New York, NY
B.A., Astrophysics – May 2005

Professional and Research Experience (since 2011)

Epsilon Delta Labs, Evanston, IL
Research Scientist – September 2014 - present

- Rayleigh-Taylor unstable flames (September 2014 - present)
  – An investigation of the effects of curvature on the flame speed of Rayleigh-Taylor unstable flames.

Northwestern University, Evanston, IL
CIERA Fellowship – September 2011 - August 2014

- Rayleigh-Taylor unstable flames (September 2011 - August 2014)
  – An investigation of the impact of self-generated turbulence on Rayleigh-Taylor unstable flames.

- Particle dyamics with Adilson Motter. (September 2011 - August 2012)
  – An investigation of particle aggregation by vortex mergers.

Science+Art Collaboration

- *Far From Equilibrium: Curiosity, Creativity, Uncertainty*
  – A collaboration with choreographer Megan Rhyme, composer Roger Zare and others. This project is an extends "Far From Equilibrium: A Dance about Turbulence" to include turbulence-inspired music and an interactive research environment created by researchers from physics, engineering, dance, journalism, and music. It will be performed this summer (2016) in Chicago.

- *Far From Equilibrium: A Dance about Turbulence*
  – A collaboration with choreographer Megan Rhyme. This project explored the characteristics of turbulence using modern dance. It premiered at the Museum of Science and Industry (MSI) in Chicago on Oct. 17, 2015.

Large-Scale Computing Allocations and Awards

Extreme Science and Engineering Discovery Environment (XSEDE)
Startup Award (100,000 hours) – January 2016, PI: E. Hicks

Argonne Leadership Computing Facility (Argonne National Labs)
Director's Discretionary Allocation for Mira (600,000 hours) – August 2015, PI: E. Hicks
Director's Discretionary Allocation for Mira (1,925,000 hours) – Jan. 2015, PI: E. Hicks
Director's Discretionary Allocation for Mira (1,000,000 hours) – June 2014, PI: E. Hicks
Director's Discretionary Allocation for Mira (5,000,000 hours) – June 2013, PI: E. Hicks

National Energy Research Scientific Computing Center (NERSC)
(Lawrence Berkeley National Laboratory)
ERCAP 2015 (150,000 hours)– PI: E. Hicks
ERCAP 2014 (225,000 hours)– PI: E. Hicks
ERCAP 2013 (200,000 hours)– PI: E. Hicks
ERCAP 2012 (200,000 hours)– PI: E. Hicks
ERCAP 2011 (100,000 hours)– PI: R. Rosner
Supplemental Allocation Award 2011 (50,000 hours) – PI: R. Rosner
Startup Allocation 2011 (50,000 hours)– PI: R. Rosner
Startup Allocation 2010 (15,000 hours)– PI: R. Rosner

QUEST (Northwestern University)
New Project Award (180,000 hours) – January 2014, PI: E. Hicks
Research Award (632,600 hours) – July 2013, PI: E. Hicks

Research Award (450,000 hours) – January 2012, PI: E. Hicks

Publications

–E. P. Hicks, *Rayleigh-Taylor Unstable Flames – Fast or Faster?*, 2015, *The Astrophysical Journal*, 803, 72.

–E. P. Hicks, *A shear instability mechanism for the pulsations of Rayleigh–Taylor unstable model flames*, 2014, *Journal of Fluid Mechanics*, 748, 618-640.

–E. P. Hicks and R. Rosner, *Gravitationally Unstable Flames: Rayleigh-Taylor Stretching Versus Turbulent Wrinkling*, 2013, *The Astrophysical Journal*, 771, 135.

–Elizabeth Hicks and Robert Rosner, *The effects of burning on the development of 2D turbulence*, 2010, *Physica Scripta*, Vol. 2010, T142, 014046.

Presentations/Posters

Rayleigh-Taylor Unstable Flames: Speed and Structure. 25th ICDERS Conference, August 2015, Leeds, UK. (Conference Presentation)

Rayleigh-Taylor unstable flames: instability, turbulence and burning. Turbulent Mixing and Beyond (TMB) 2014, August 2014, Trieste, Italy. (Conference Presentation)

Rayleigh-Taylor Unstable Flames – Fast or Faster? Computations in Science Seminars, April 2nd, 2014, University of Chicago, Chicago, IL (Invited Talk)

Rayleigh-Taylor Unstable Flames – Fast or Faster? 66th Annual Meeting of the APS Division of Fluid Dynamics, November 2013, Pittsburgh, PA (Conference Presentation)

Comparing a Rayleigh-Taylor Unstable Flame to a Circular Cylinder. 64th Annual Meeting of the APS Division of Fluid Dynamics, November 2011, Baltimore, MD (Conference Presentation)

The Transition to Turbulence of Rayleigh-Taylor Unstable Flames. American Astronomical Society, AAS Meeting 217, January 2010, Seattle, WA (Conference Presentation)

Rayleigh-Taylor unstable, premixed flames: the transition to turbulence. 63rd Annual Meeting of the APS Division of Fluid Dynamics, November 2010, Long Beach, CA (Conference Presentation)

Gravitationally-unstable premixed flames: the transition to chaos. Dynamics Days 2010: International Conference on Chaos and Nonlinear Dynamics, January 2010, Evanston, IL, USA. (Poster)

The effects of burning on the development of 2D turbulence. 2nd International Conference

on Turbulent Mixing and Beyond (TMB), August 2009, Trieste, Italy. (Poster)

Honors

Northwestern Visualization Scientific Images Contest, Honorable Mention	2014
CIERA fellowship	9/2011–8/2014
Doolittle-Harrison Fellowship	2010
McCormick Graduate Fellowship	8/2005–6/2007
Graduation *magna cum laude* (top 15% of class), Columbia University	2005
I. I. Rabi scholar, Columbia University	2001-2005

Teaching

Teaching Assistant – *Stellar Astronomy (PHSC 119)*	Winter 2009
Teaching Assistant – *Global Warming (PHSC 134)*	Fall 2009
Teaching Assistant – *General Physics 3 (PHYS 123)*	Spring 2008

Advising

Rachel McEnroe, undergraduate, University of Chicago (w/ Wendy Zhang)	1/2014–1/2015

Activities

Fluid Fridays reading group, founder and contributor	Spring 2009–Fall 2015
Condensed Matters Journal Club, participant	Fall 2010–Summer 2011
AstroGreen Committee member	Fall 2008– Spring 2009
WOPAT Treasurer	Spring 2006– Spring 2008

Outreach

Far From Equilibrium at the MSI	October 17, 2015
Science/Art Fair at the Evanston Public Library	May 30, 2015
Harold Washington Library Outreach Event	February 20, 1015
Museum of Science and Industry "Science Cafe"	October 25, 2014
Evanston Township High School Visualization Outreach Event	October 15, 2014
"Music & Astronomy", Ravinia	July 31, 2012