

Image credit: Elizabeth Hicks; see caption on p. 18

## *CIERA's Postdocs: The Future of Astronomy*

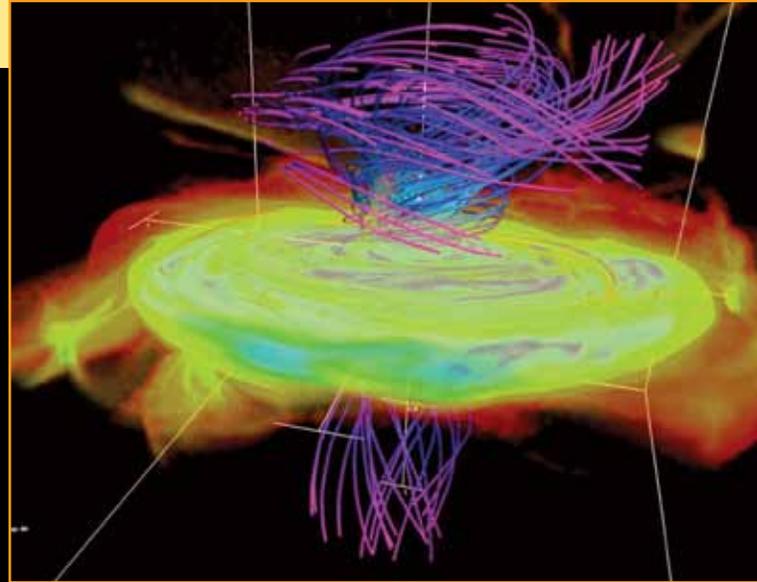
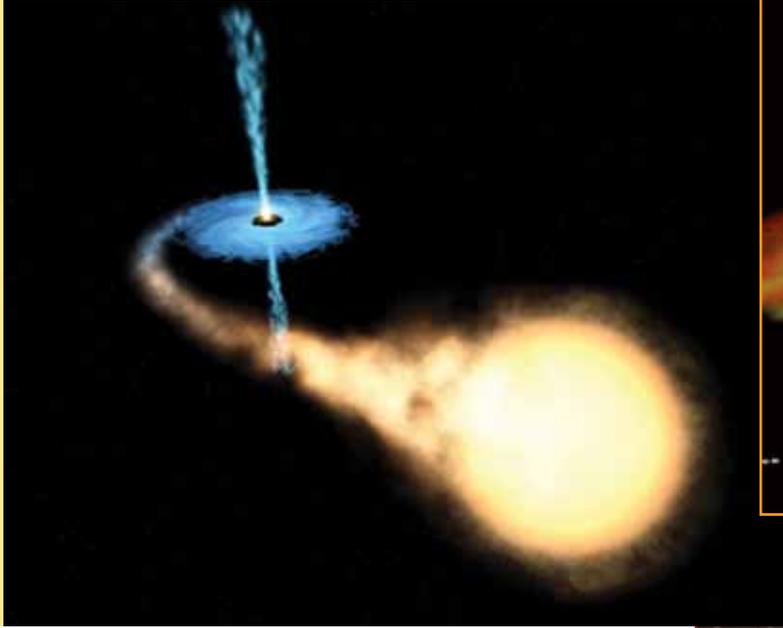
Two years after Northwestern's Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) was established, its codirectors decided that it was ready for an inaugural conference. But with the breadth of research at CIERA, which supports work in both observational and theoretical astrophysics, choosing a topic proved difficult.

"Other astrophysics centers are not as broad as CIERA," says Vicky Kalogera, physics and astronomy and codirector of CIERA. "They tend to focus on a specific part of astrophysics. So when they organize a conference, it usually focuses on that specific area."

After multiple discussions among Kalogera and CIERA codirectors Fred Rasio and Dave Meyer, they decided that the conference should focus on one of CIERA's most prized assets: its postdocs. "The Future of Astronomy: Fellows on the Frontiers of Science"



CIERA codirectors Vicky Kalogera, Fred Rasio, and Dave Meyer.



Evghenii Gaburov studies accretion discs, which are structures formed by diffuse material in orbital motion around a central body. The image on the left shows a disc (in blue) being formed from the matter of a star (in yellow). The image on the right is a computer model of a magnetically levitating accretion disc.

took place August 31 through September 3, 2011.

Columbia University's David Helfand, president-elect of the American Astronomical Society, was one of several faculty members from across the nation who addressed and interacted with the conference participants.

"The point was this: the areas where prize postdoctoral fellows do research represent the future of astronomy," Kalogera says. "Because it's these young people who will become the faculty in the next decade."

This topic was a natural choice for CIERA, which has several outstanding postdoctoral researchers of its own. A large portion of the center's budget funds the CIERA Postdoctoral Fellows Program for prize postdocs at Northwestern to pursue their own independent research. Other postdocs have moveable fellowships from external agencies such as NSF or NASA that allow them to attend a university of their choice. Now Northwestern has its first Hubble Fellow, a recipient of the most prestigious and competitive fellowship in astrophysics.

### Northwestern's First Hubble Fellow

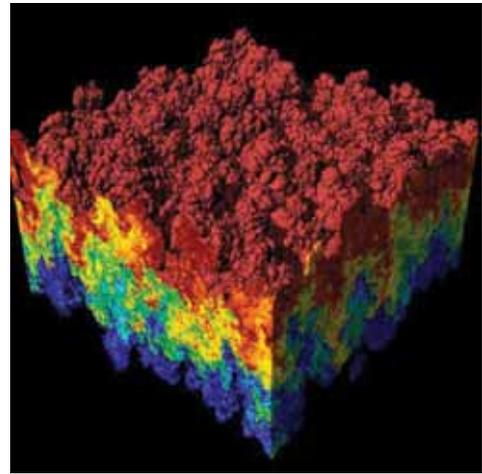
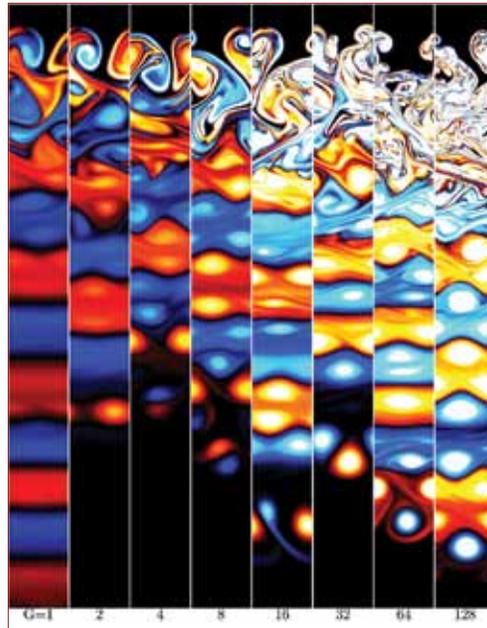
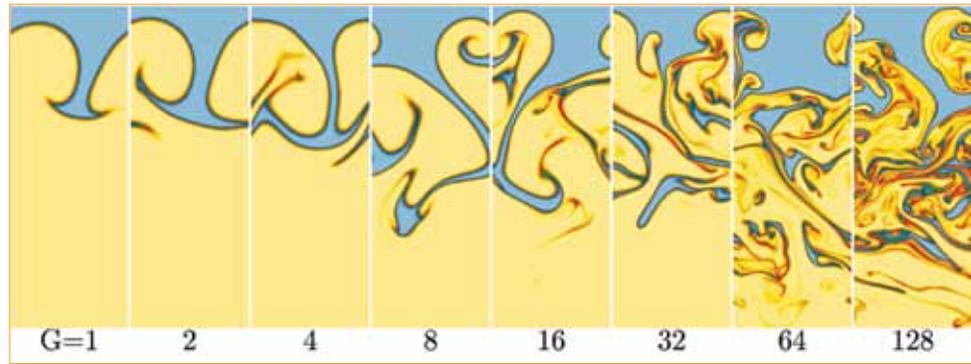
"If you look back 50 years, we never had an external fellowship," Kalogera says. "Now we have a Hubble Fellow. He could have gone anywhere he wanted—Harvard, Princeton, or Caltech—but he decided to come here. This says something very positive about our astronomy program."



Evghenii Gaburov

CIERA's Hubble Fellow is Evghenii Gaburov, who holds a double PhD in computer science and astrophysics from the University of Amsterdam in the Netherlands. He uses Northwestern's Quest high-performance computing system to complete numerical calculations that will improve understanding of magnetically levitating accretion discs around black holes. An accretion disc is a structure formed by scattered material that collects around a central body, such as a black hole or star, due to gravity. Gaburov is curious about how these structures form and evolve.

"I had colleagues in Amsterdam and at the Leiden Observatory who got their PhDs at Northwestern," Gaburov says of his decision to come to the University. "There are strong faculty members here whose research overlaps with my interests."



## Bridging Disciplines

CIERA Fellow Elizabeth Hicks didn't have to travel nearly as far as Gaburov to arrive at Northwestern. Her PhD is from the University of Chicago, where she studied fluid dynamics to learn about star flames and supernovae. Hicks' work is interdisciplinary, bridging the gap between astrophysics and applied mathematics. Her fellowship is cofunded by a grant for Adilson Motter, physics and astronomy, who studies dynamical systems.

Hicks is interested in the fading flames of white dwarf stars and how these flames affect whether or not the star goes nova. She is also interested in planet formation, using numerical fluid simulation to examine particles and how they might accumulate to form planets. CIERA's interdisciplinary nature allows Hicks to collaborate on these projects with Motter.

"I'm obviously interested in astrophysics, but I'm also interested in fluid mechanics and dynamical systems,"

Elizabeth Hicks studies Rayleigh-Taylor unstable flames. The top image is a computer simulation showing the temperature field of the flame for various values of gravity. The higher the values of gravity, the faster the flame moves. Blue represents the unburnt material and yellow is burnt material. The lower left image shows the vorticity field for the same simulation. The lower right image shows Rayleigh-Taylor instability, with the hotter temperatures in red. The flames moves upward against the direction of gravity.

Hicks says. "Northwestern was one of the only places where I could do all that at the same time."

"Elizabeth's research is one of the examples of the interdisciplinary activity that we try to encourage and nurture through CIERA," Kalogera adds. "All top universities have astrophysics centers, but Northwestern's focus on interdisciplinarity is unique."

Another CIERA fellow—Will Farr, who received his PhD from MIT—also works on projects that bridge astrophysics and applied mathematics and statistics. During his time in CIERA, he has already coauthored two *Nature* papers.

## A Young Star

Another astrophysics rising star is CIERA-Lindheimer Fellow Aaron Geller whose research into blue stragglers made a splash this fall. Typically, as stars age, they run out of fuel in the center and become large and red. A blue straggler is a specific type of star that continues to look young as it ages. Geller and his collaborators hypothesized that blue stragglers maintain a youthful look by eating the mass from a companion star. This theory ended up matching their observations. His research resulted in a media frenzy—first a paper in *Nature*, then a live interview on National Public Radio’s “Science Friday,” followed by coverage in *Scientific American* and on CNN.

Geller started this work with his adviser while completing his PhD at the University of Wisconsin-Madison. He studies stars through observations and numerical simulations to better understand their encounters and interactions with one another.

“At Wisconsin my adviser and the other graduate students all worked on the same project,” Geller says. “Being a part of CIERA offers a lot more freedom. People are interested in similar things, but they are all working on their own projects. There are more opportunities to collaborate and get input on my work.”

## Astronomy's Bright Future

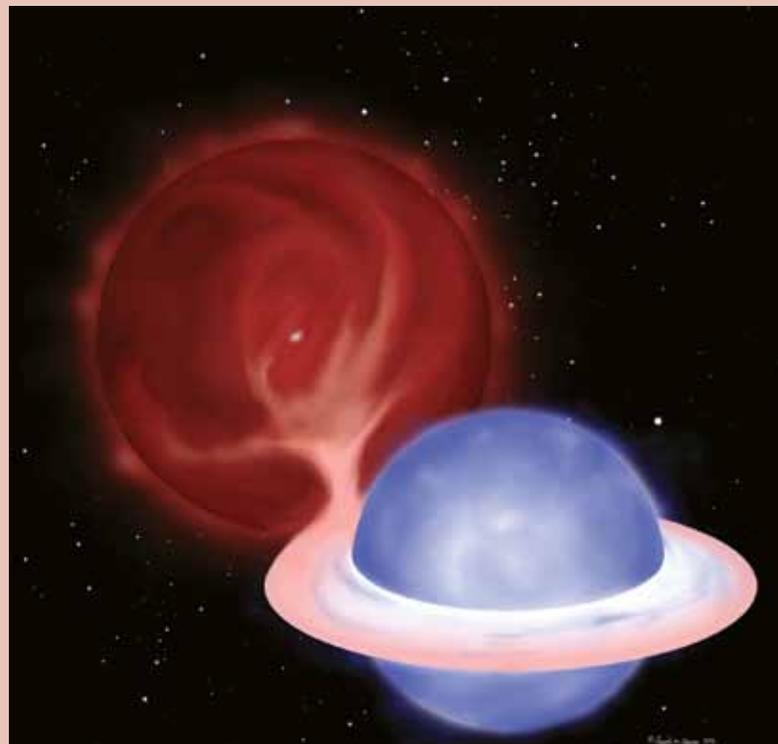
Gaburov, Hicks, Geller, and the other CIERA fellows presented their work at the center’s inaugural conference along with other postdoctoral fellows from Harvard, MIT, Princeton, and other universities across the United States. While all the speakers were postdocs, the audience was filled with impressed faculty members.

“The most common comment we had from faculty in the audience was that they hadn’t been to a meeting where all the talks were of such high quality,” Kalogera says. “They were amazed by the consistent quality of all the presentations.”

If CIERA’s postdocs are a measure of the future of astronomy, then the future is looking very bright.

For more information about the research at CIERA, visit [www.ciera.northwestern.edu](http://www.ciera.northwestern.edu).

—by *Amanda Morris*



Pictured above is Aaron Geller and below is his artistic rendering of a blue straggler star eating the mass of an older, red star. This process allows the blue star to remain looking young as it ages.