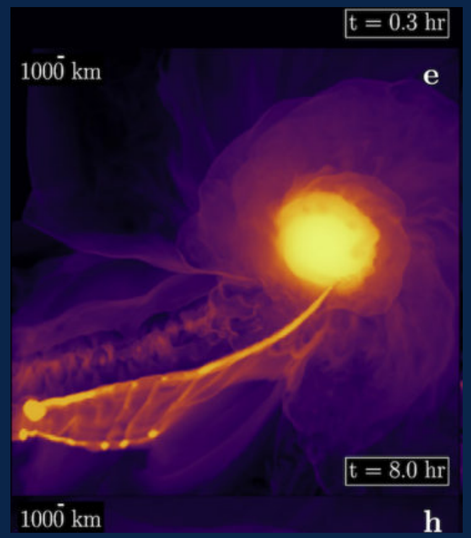
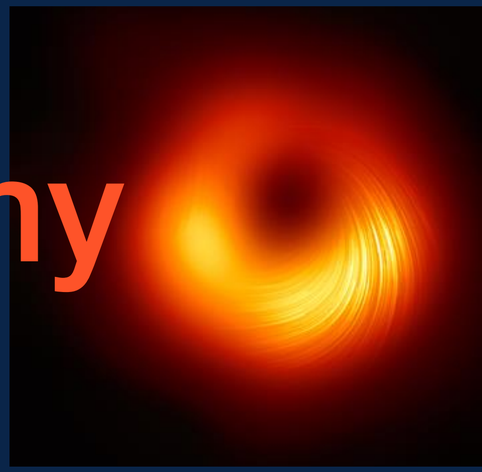
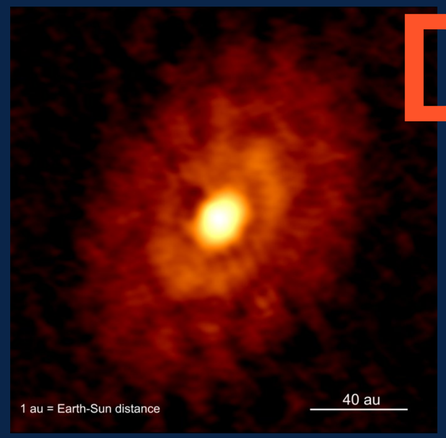
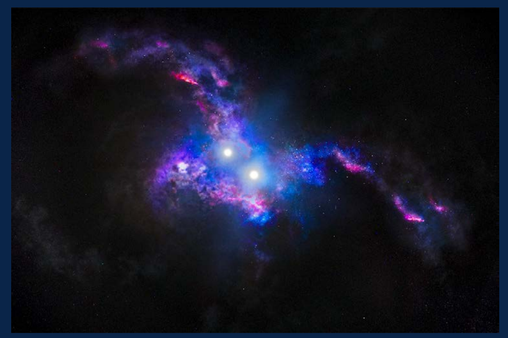
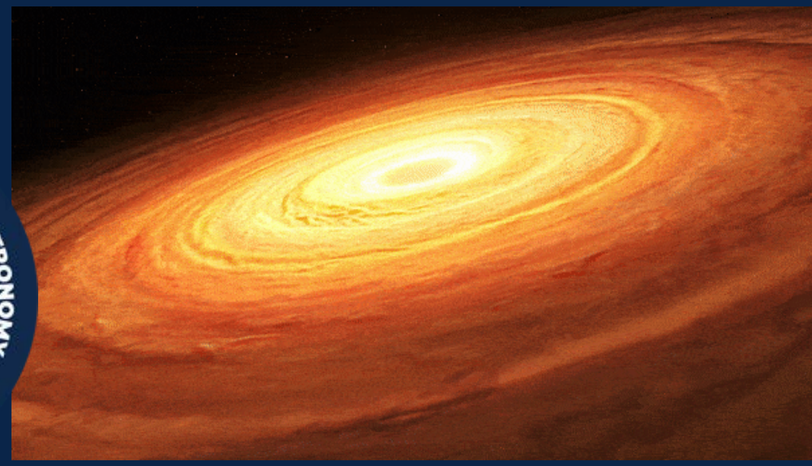


Department of Astronomy









Department of Astronomy: Core Faculty

Core Faculty

Kirk Barrow
Adjunct Assistant Professor
kbarrow@illinois.edu

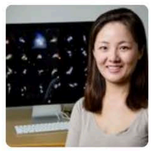
Bryan Dunne
Teaching Assistant Professor, Director of the Campus Observatory
bdunne@illinois.edu

Brian D. Fields
Professor
bdfields@illinois.edu

Decker French
Assistant Professor
deckerkf@illinois.edu

Charles F. Gammie
Professor
gammie@illinois.edu

Athol J Kemball
Professor
akemball@illinois.edu



Xin Liu
Associate Professor
xinliuxl@illinois.edu

Leslie W Looney
Director - Laboratory for Astronomical Imaging, Chair, Professor
lwl@illinois.edu

Telemachos Ch Mouschovias
Professor
tchm@illinois.edu

Gautham Narayan
Assistant Professor
gsn@illinois.edu

Paul M. Ricker
Professor
pmricker@illinois.edu

Yue Shen
Associate Professor
shenyue@illinois.edu

Joaquin Vieira
Associate Professor
jvieira@illinois.edu

Amanda Winans
Instructor
ajwinans@illinois.edu

Tony Wong
Professor
wongt@illinois.edu

15 faculty (10.5 TT FTE with 3 faculty 50% with Physics)

8 Observational Faculty
5 Theory/Simulation Faculty
2 Instructional Faculty + hiring a new person in AY 23/24

Department of Astronomy: Affiliated Faculty

From Physics, NCSA, Aeronautical Eng., iSchool, Math, and Accounting

Affiliate and Research Faculty

Peter J. Adshead
Assistant Professor of Physics
adshead@illinois.edu

Gabrielle D. Allen
Affiliate Faculty
gdallen@illinois.edu

Robert J Brunner
Faculty Affiliate
bigdog@illinois.edu

Matias Carrasco Kind
Research Assistant Professor
mcarras2@illinois.edu

Patrick I Draper
Assistant Professor of Physics
pdraper@illinois.edu

Siegfried Eggl
Affiliate Faculty
eggl@illinois.edu

Jeffrey P Filippini
Assistant Professor of Physics
jpf@illinois.edu

Robert A Gruendl
Research Associate Professor
gruendl@illinois.edu

Gilbert Holder
Professor of Physics
gholder@illinois.edu

Eliu Antonio Huerta Escudero
Research Assistant Professor
elihu@illinois.edu

Luke Leisman
Visiting Internship Project Developer, Visiting Assistant Professor of Astronomy
lleisman@illinois.edu

Felipe Menanteau
Research Associate Professor
felipe@illinois.edu

Eric P. Morganson
Research Assistant Professor
ericm@illinois.edu

Stuart L. Shapiro
Professor of Physics
slshapir@illinois.edu

Jessie F Shelton
Assistant Professor of Physics
sheltonj@illinois.edu

Matthew J Turk
Assistant Professor of Information Sciences
mjturk@illinois.edu

Helvi Witek
Assistant Professor
hwitek@illinois.edu

Dr. Nicolas Yunes
Professor of Physics
nyunes@illinois.edu

11 TT faculty

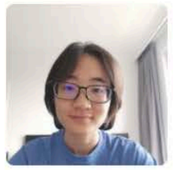
Department of Astronomy: Research Scientist and Postdocs

Michi Baubock
Postdoctoral Research Associate
baubock2@illinois.edu

Dr. Douglas N. Friedel
Research Programmer
friedel@astro.illinois.edu

Arran Gross
Postdoctoral Research Associate
acgross@illinois.edu

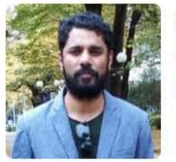
Kacper Kowalik
Research Scientist
kowalikk@illinois.edu



Junyao Li
POSTDOC RES FELLOW
junyaoli@illinois.edu

Kostya Malanchev
Postdoctoral Research Associate

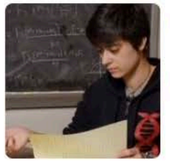
Sean Morrison
Postdoctoral Research Associate
smorris0@illinois.edu



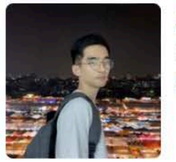
Srinivasan Raghunathan
Postdoctoral Research Associate
srinirag@illinois.edu

Cassie Reuter
Research Scientist
creuter@illinois.edu

Kirill Sokolovskii
Postdoctoral Research Associate
kirill@illinois.edu



Cynthia Trendafilova
Postdoctoral Research Associate
ctrendaf@illinois.edu



Mingyang Zhuang
Postdoctoral Research Fellow
mingyang@illinois.edu

Undergraduate Program

Growth

- **250% growth over 10 years**
- **Currently have 160 majors (In top 5 of the largest major programs in the US!)**
- **25% increase in students taught in classes over last 10 years**

Four Majors

- **Astronomy**
- **CS + Astronomy**
- **Astrophysics**
- **Astronomy and Data Science**

Major Success

- **89+%** of Illinois astronomy graduates secure a “first destination” in full-time employment, continuing education, or service by the time they graduated.
- Over **52%** reported being enrolled in a continuing education program, e.g. a MS or PhD graduate program.

Graduate Program

Demographics, last 6 years

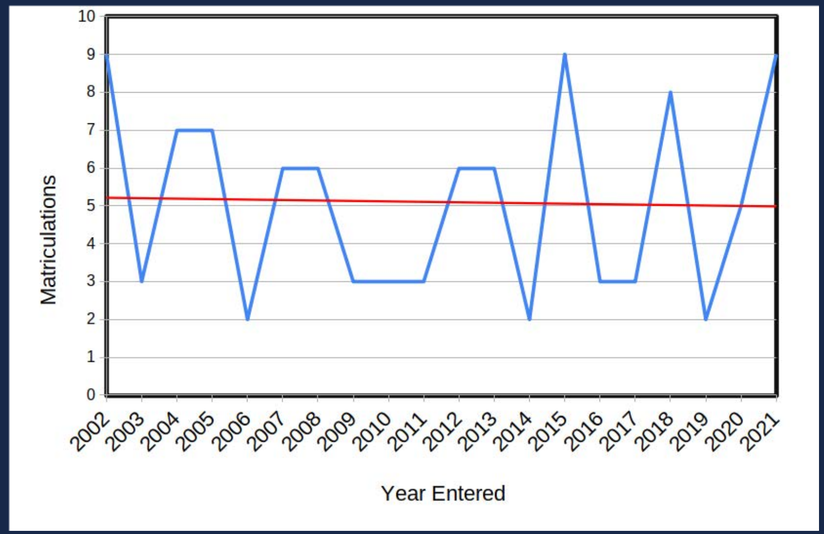
- Average 6.2 enrollments/year, 25-35 students at any time
- 41% female, 14% URM

Degree completion

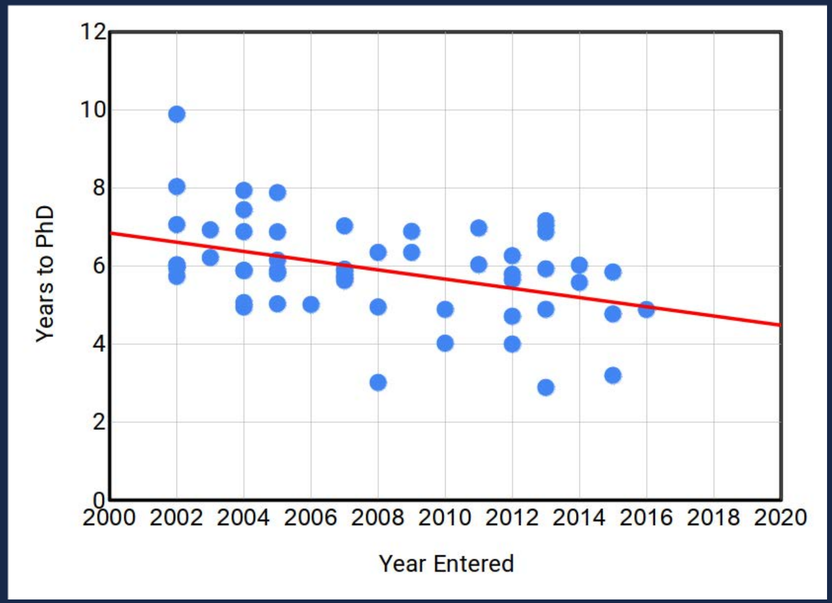
- 83% complete the program
- Average 5.7 years to PhD

Placement after degree

- 60% postdoctoral appointments
- 40% industry positions



Enrollment



Time to degree

Diversity Equity and Inclusion

Highlights

- Developed Department plan of action after 2020 Shutdown STEM, posted and updated on website
- New faculty committee on DEI
- Help operate many outreach activities, including the Girls' Astronomy Summer Camp
- The Society for Equity in Astronomy (SEA) is a graduate student led organization that hosts discussions and mentors undergraduates

Campus Observatory

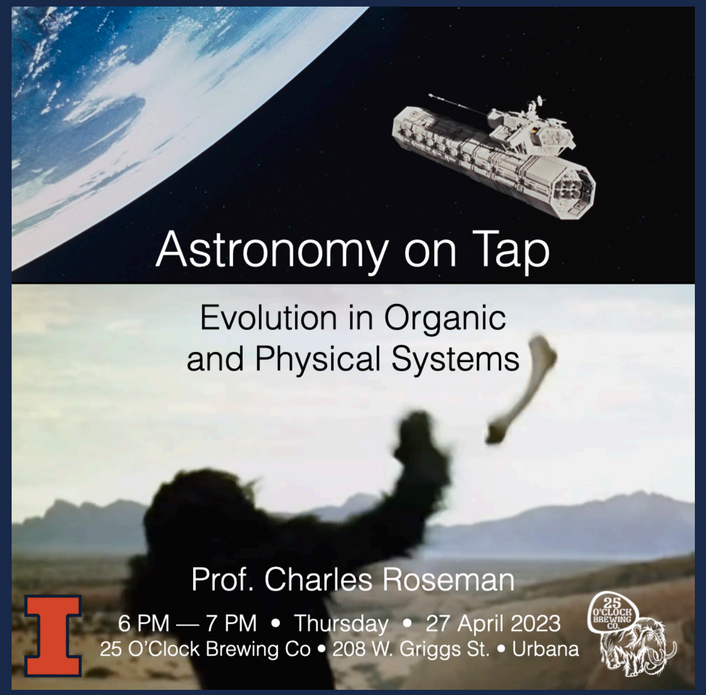
- Historic importance: one of two National Historic Landmarks on campus
- Campus Observatory is for teaching and outreach, not research
  - Introductory courses use it every semester for night observing— about 1000 students per year (pre-covid)
- Strong connection to all Illinois alums— Friends of the Observatory
- Important public outreach: Astronomical Society at the University of Illinois (UIAS) run open houses once a month reaching 1000+ people every year

ASTRONOMY ON TAP CHAMPAIGN URBANA (2016 - PRESENT)

- Astronomy on Tap - presenting new & topical research to the public. Topics that bridge science and society including science denialism, afrofuturism, astro & art, living in space, even a live tap dance performance!

- 40—100 people at in-person events (often end up standing room only) + special events for Pygmalion

- At the 25 O’clock Brewing Company or Rose Bowl in Urbana



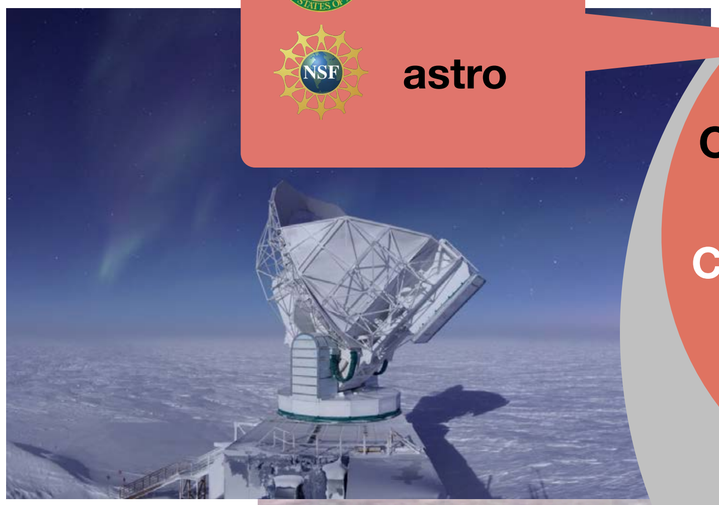
Core Observation @ Illinois Astronomy

- **Decker French** Galaxy evolution, transient astronomy, optical and radio observations
- **Athol Kemball** Advanced computing, interferometry, masers, evolved stars, lensing
- **Xin Liu** Survey/data science, cosmic evolution of galaxies and galactic nuclei, black holes, machine learning
- **Leslie Looney** Star and planet formation, circumstellar disks, polarization
- **Gautham Narayan** Cosmology, transients, survey science, multimessenger, machine learning, supernovae
- **Yue Shen** Cosmology, quasars and AGN, galaxy formation and evolution, surveys and time-domain science
- **Joaquin Vieira** Cosmology, extragalactic surveys, galaxy evolution, instrumentation
- **Tony Wong** Molecular clouds, star formation in nearby galaxies, evolution of disk galaxies

Key themes: survey science, cosmology, galaxies/quasars, compact objects, supernovae, evolved stars, star and planet formation

Provide faculty leadership of the key science questions for strategic priorities

Illinois CAPS | Center for AstroPhysical Surveys



physics
astro

CMB Surveys
SPT
CMB-S4

cosmology

Optical Surveys
DES
LSST

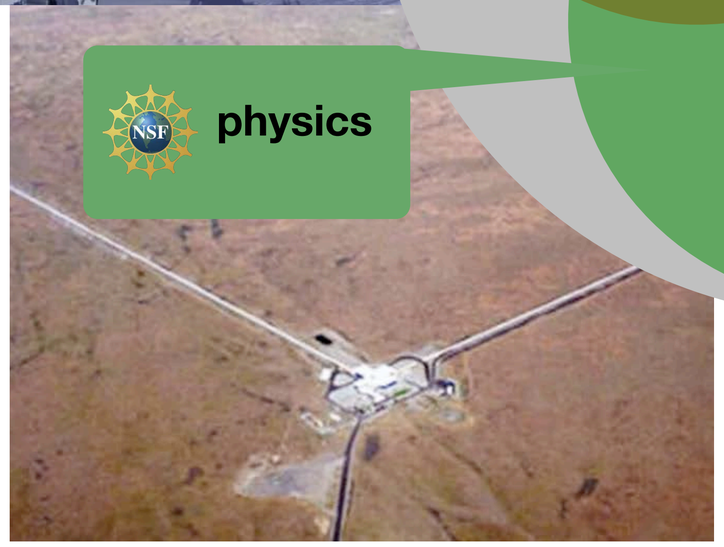
transients
catalogs

GRBs

GWs

LIGO
IceCube
MMA

astro



physics

NCSA
Survey Science

ILLINOIS

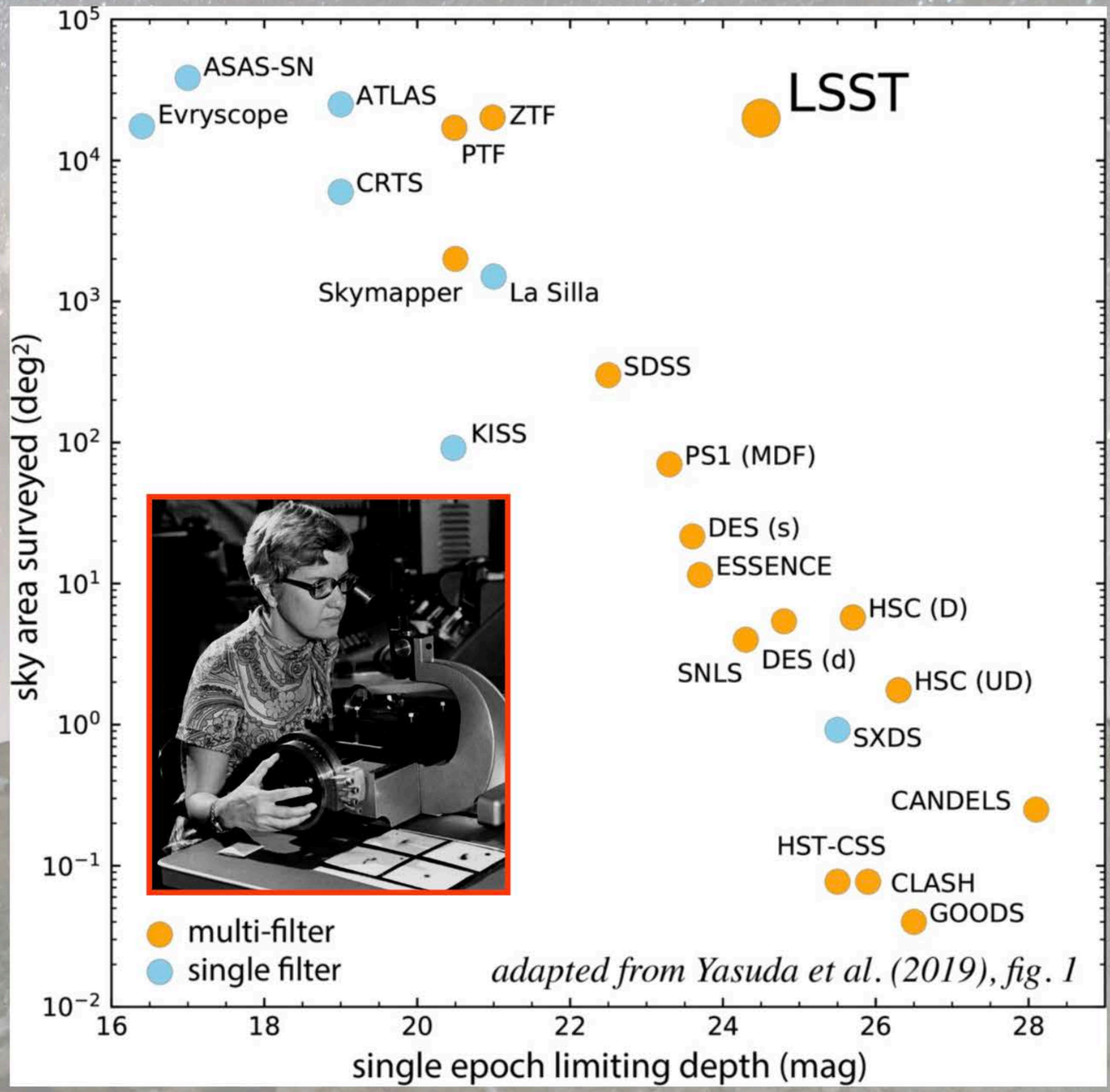
NCSA | National Center for Supercomputing Applications
CAPS | Center for AstroPhysical Surveys

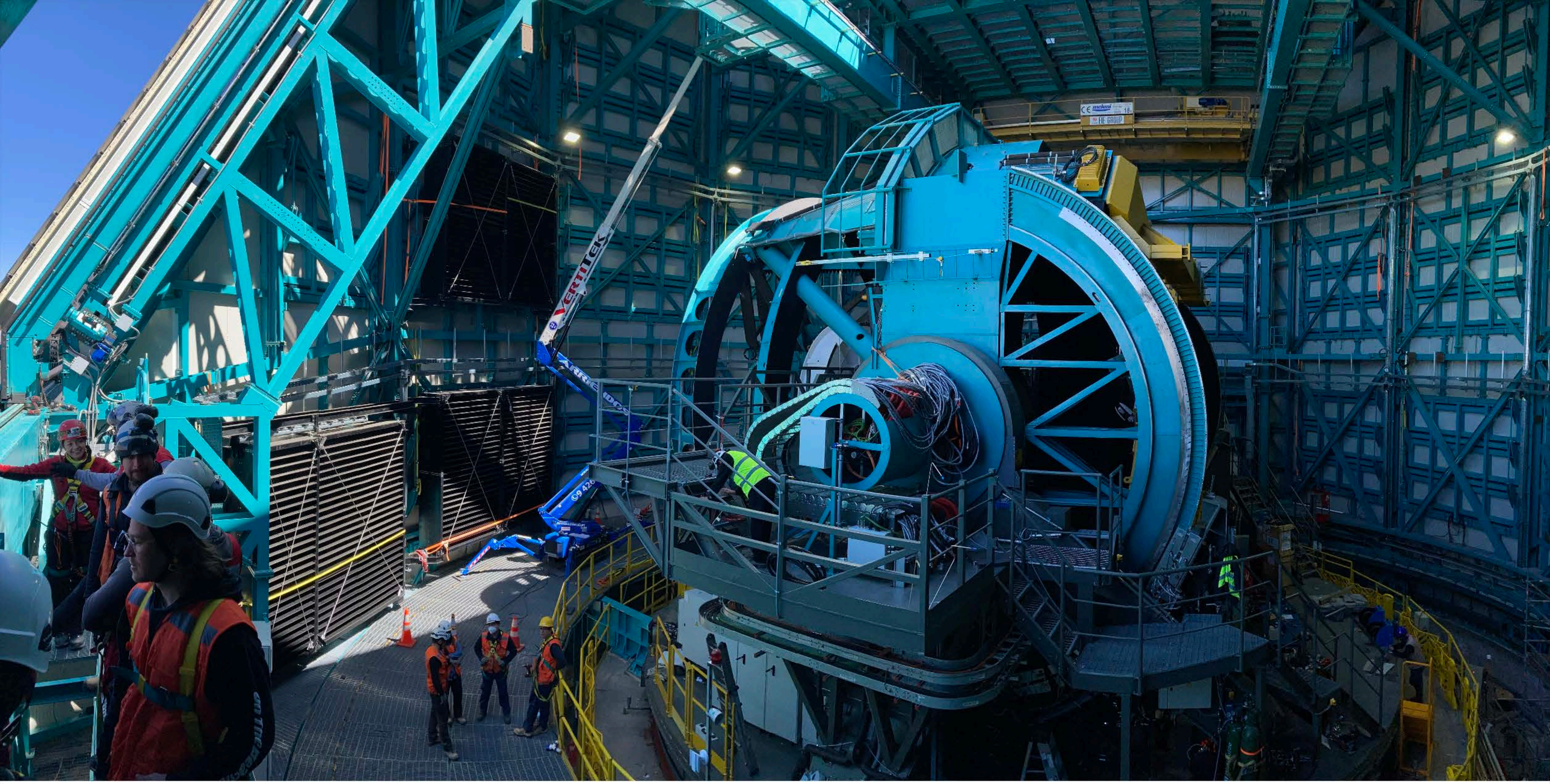
Projects currently working on:

- **Dark Energy Survey (DES)** — We are in charge of data processing and management.
- **Vera Rubin Observatory (VRO)/LSST** — Under Construction, we designed and built the prototype for the data facility. Efforts are ramping down as VRO transitions to Operations.
- **South Pole Telescope (SPT)** — We are building a data interface and server. This is used for point sources and transients. Right now it is for internal use within the project, but the idea is that this will become the interface for public access to the data.
- **CMB Stage IV (CMB-S4)** — We are working on data management for sources and transients.
- **Scalable Cyber-Infrastructure to support Multi-Messenger Astrophysics (SCIMMA)** — Data management.
- Software readout and control for **next-generation long wavelength detectors**.
- Looking to engage with ground-based **radio surveys**

THE VERA RUBIN OBSERVATORY WILL MAKE A MOVIE OF THE SOUTHERN SKY

- 10 year survey, full scan ~every 3 nights, repeat in a different filter - ~800 visits for any given object with single-epoch depth of ~25 mag - 20 TB/night
- 37 billion sources in the 10 yr catalog - will be the most exciting data source this decade
- Multiple sub-surveys - primary is “Wide-fast-deep” (WFD). Also 4+1 deep-drilling fields (DDFs) - small area high cadence, 2-3% of the time for time-domain followup
- Several Illinois faculty involved in LSST science - talk with e.g. Narayan about joining science collaborations, and students like Alex Gagliano and Amanda Wasserman about their experience!





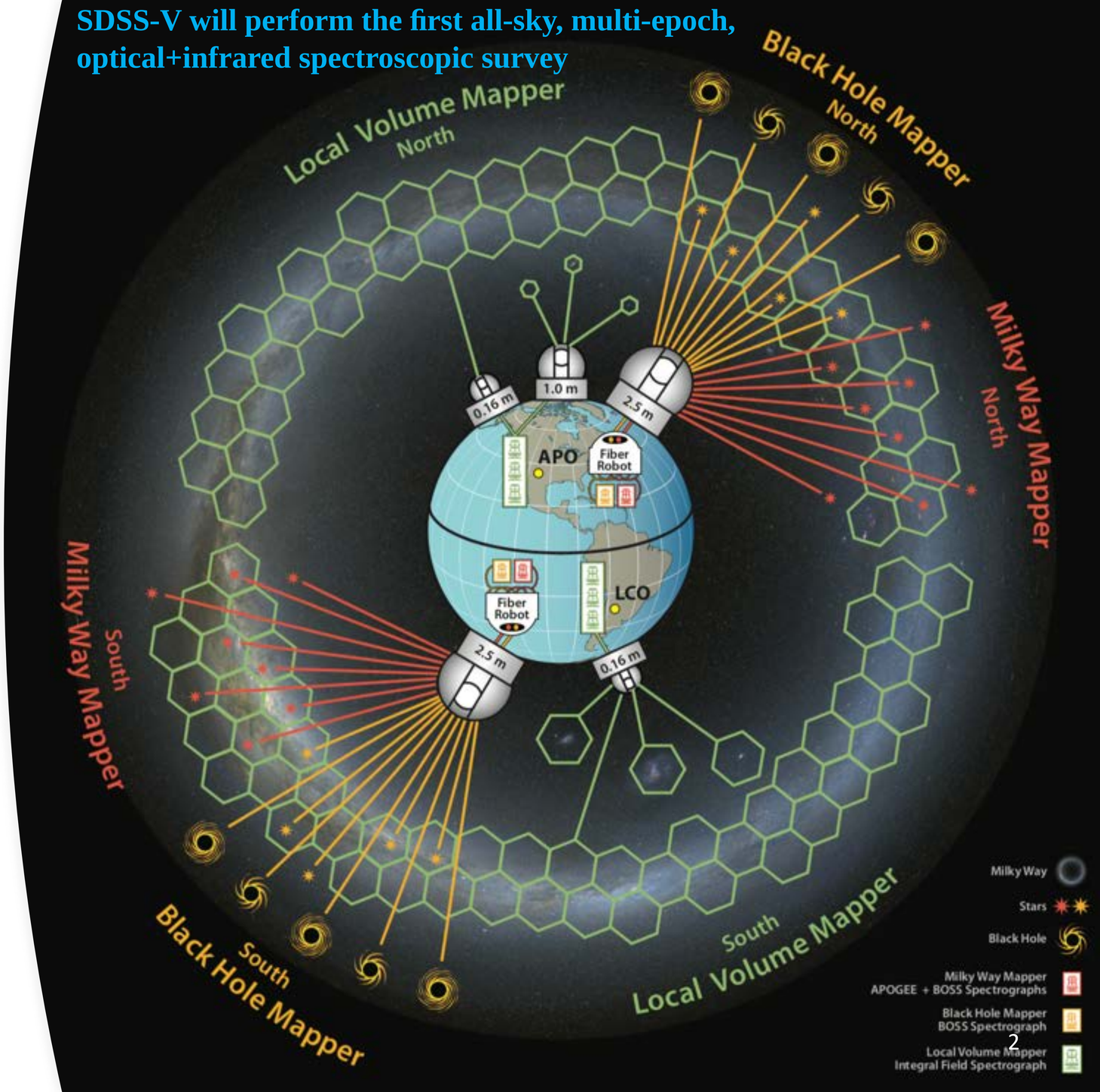
- The most exciting thing about this and the previous LSST image is that they aren't CG renders! The project is commissioning!! Get involved!

Courtesy: Chris Walter (Duke)

SDSS-V

- **Sloan Digital Sky Survey (SDSS) is one of the most influential astronomical surveys since ~2000.**
- **SDSS-V (2020-2025): Pioneering Panoptic Spectroscopy survey is its 5th generation with more than 50 member institutions across the world.**
- SDSS-V will provide groundbreaking insight into the formation and evolution of galaxies—like our own Milky Way—and of the supermassive black holes that lurk at their centers.
- UIUC astronomy is an associate institutional member of SDSS-V, with faculty, postdocs and students working on both the science and infrastructure.
- UIUC is leading **one of the key science programs** on supermassive black holes, as well as leading the software effort to process/calibrate the optical spectroscopic data for the entire collaboration.

SDSS-V will perform the first all-sky, multi-epoch, optical+infrared spectroscopic survey

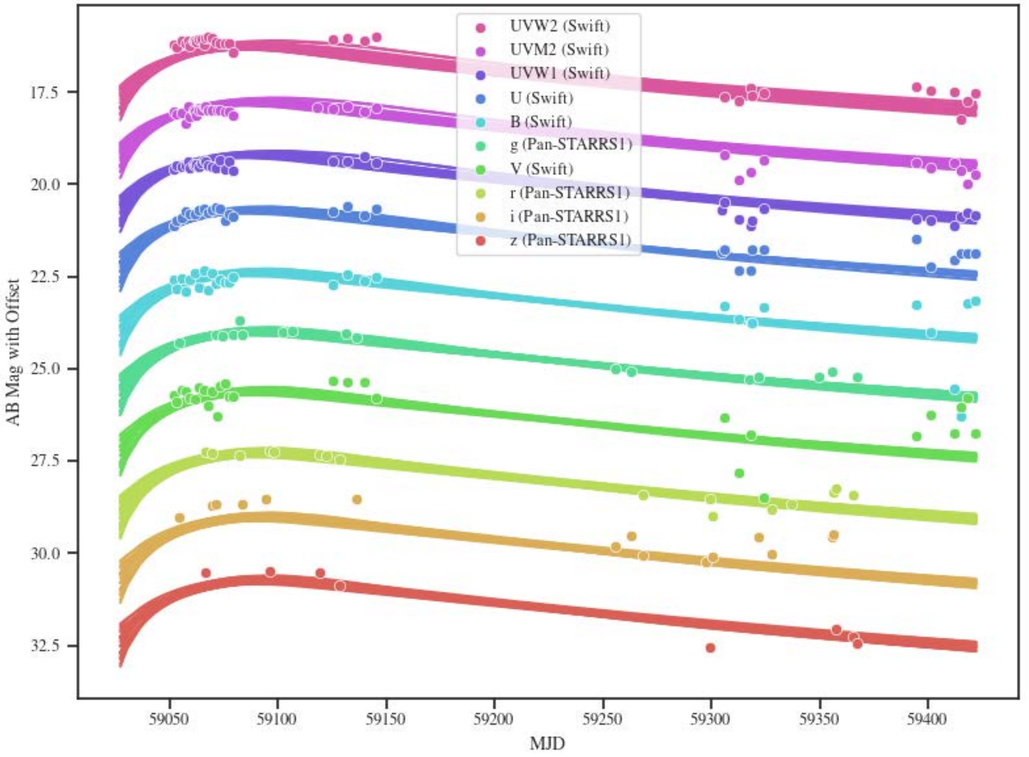


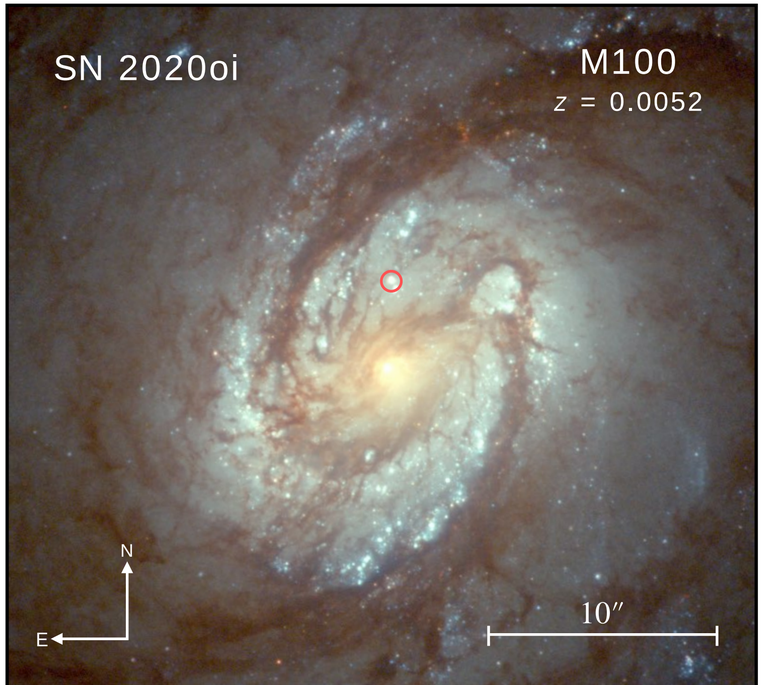
THE YOUNG SUPERNOVA EXPERIMENT (YSE)

- **Decker French** and **Gautham Narayan** represent UIUC in YSE along with others from UC Santa Cruz, UC Berkeley, Cambridge, U. Copenhagen, U. Hawaii, Penn State, U. Toronto, and Washington State. **14 UIUC students & postdocs (plus undergrads)!**

- YSE uses 15% of the time on Pan-STARRS 1.8m telescopes in Hawaii with 3.2 Gigapixel cameras (some of the biggest in the world) to **study the time-varying Universe** in the optical spectrum - YSE members get **exclusive access** to data!

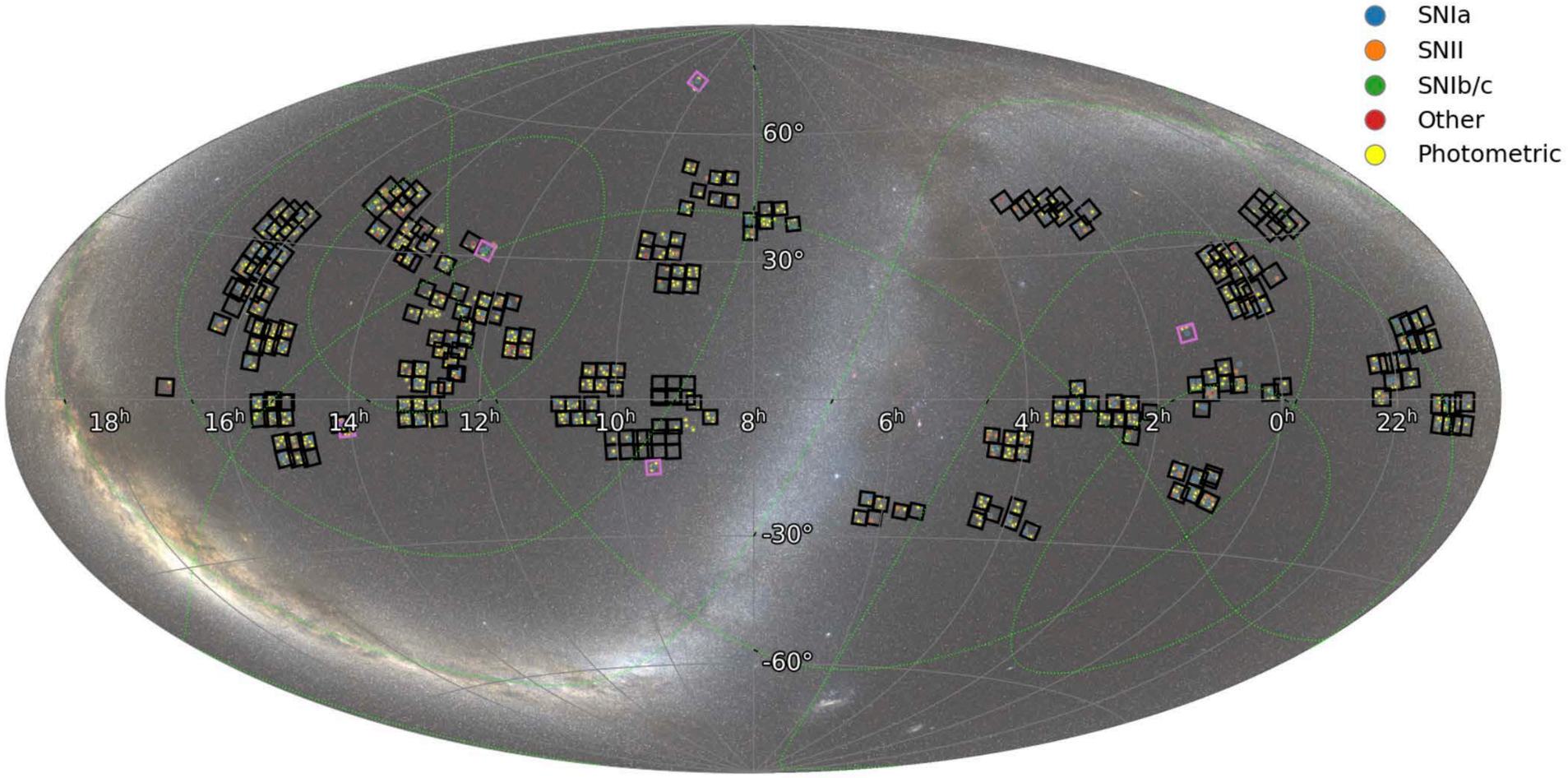
- UIUC **leading** several major YSE papers, including first data release (grad P. Aleo), first cosmology (Narayan), tidal disruption of a star by a black hole (2020nov, top right - grad N. Earl), exotic nearby SN (2020oi, bottom right, grad A. Gagliano) and more!





- YSE has lots of great data already - **students and postdocs have led every YSE paper to date** - will extend into LSST operations, giving us incredible overlap with the major astrophysical experiment of this decade.

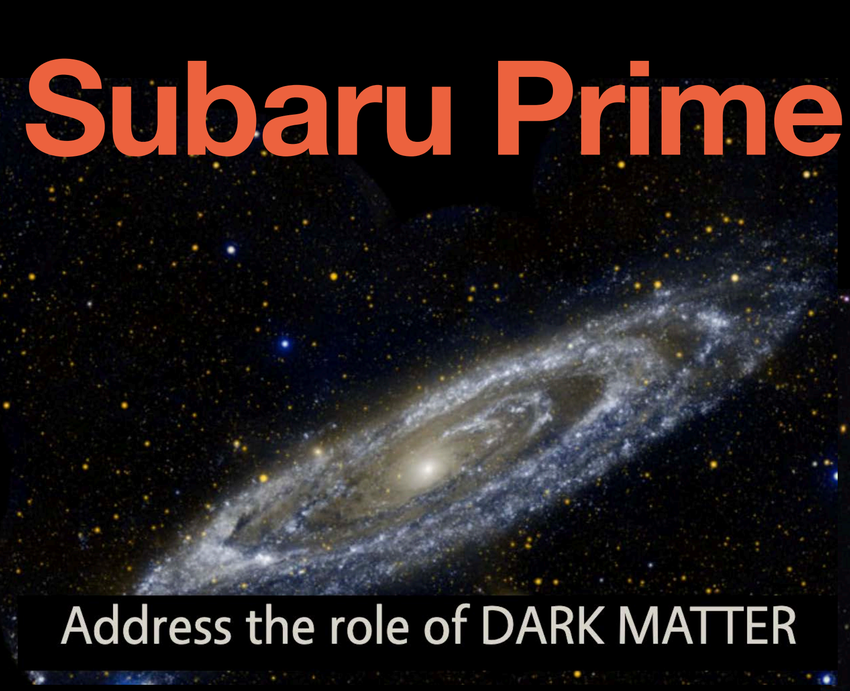
- Undergrads also welcome - talk with Jason Vasquez (led YSE paper on 2019mhm and working on second paper on IIp supernovae) or Sammy Sharief (3rd author on YSE data release paper).



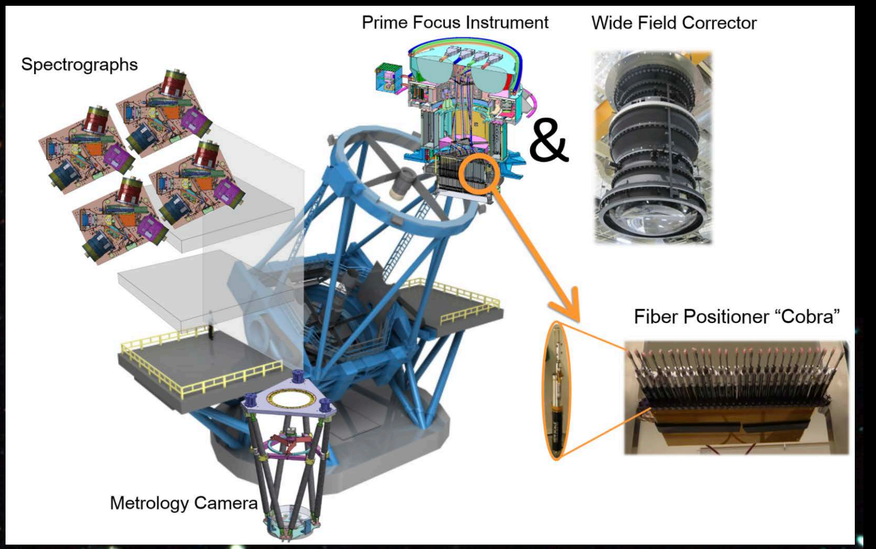
~2000 YSE TRANSIENTS IN DATA RELEASE 1 (LED BY GRAD PATRICK ALEO)

Subaru Prime Focus Spectrograph Survey

(2024— 2029)



Address the role of DARK MATTER



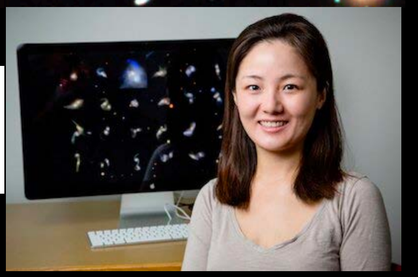
Reveal the nature of DARK ENERGY

Explore the history of GALAXIES

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

College of Liberal Arts & Sciences
Department of Astronomy

Faculty contact: Xin Liu



Core Theory @ Illinois Astronomy

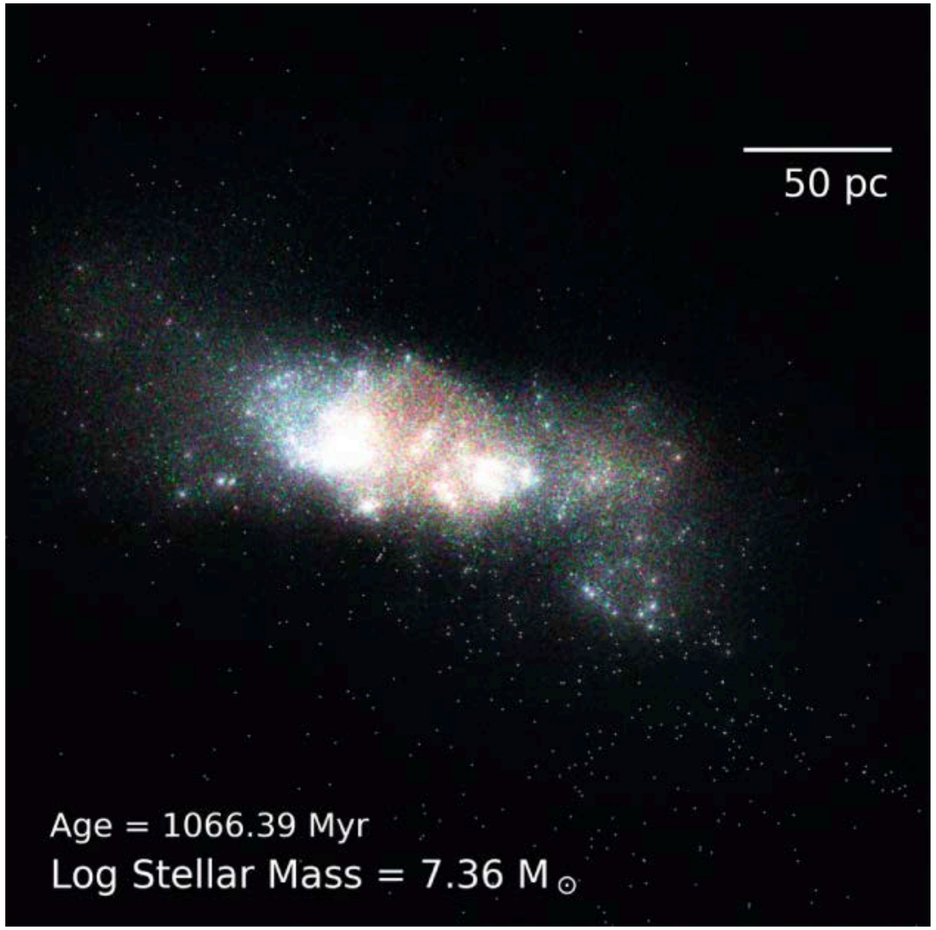
- **Kirk Barrow** Computation, black hole, galaxy, and star formation
- **Brian Fields** Nuclear and particle astrophysics
- **Charles Gammie** Computation, black holes, planets, turbulence
- **Telemachos Mouschovias** Star formation
- **Paul Ricker** Computation, common envelope evolution, clusters

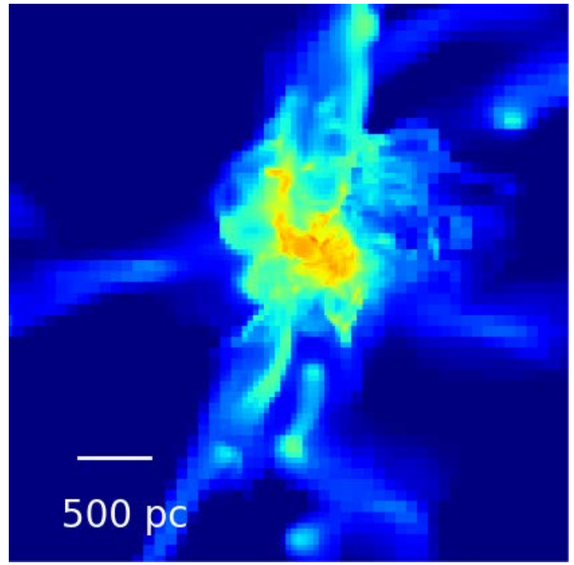
Key themes: computation, stellar evolution, black holes, and cosmology

Illinois Center for Advanced Studies of the Universe

Barrow

Computational Astrophysics, Formation of Galaxies and Stars





Simulating ionizing radiation from high redshift galaxies, z ~ 11 galaxies with JWST

Fields

Nuclear and Particle Astrophysics

Brian Fields

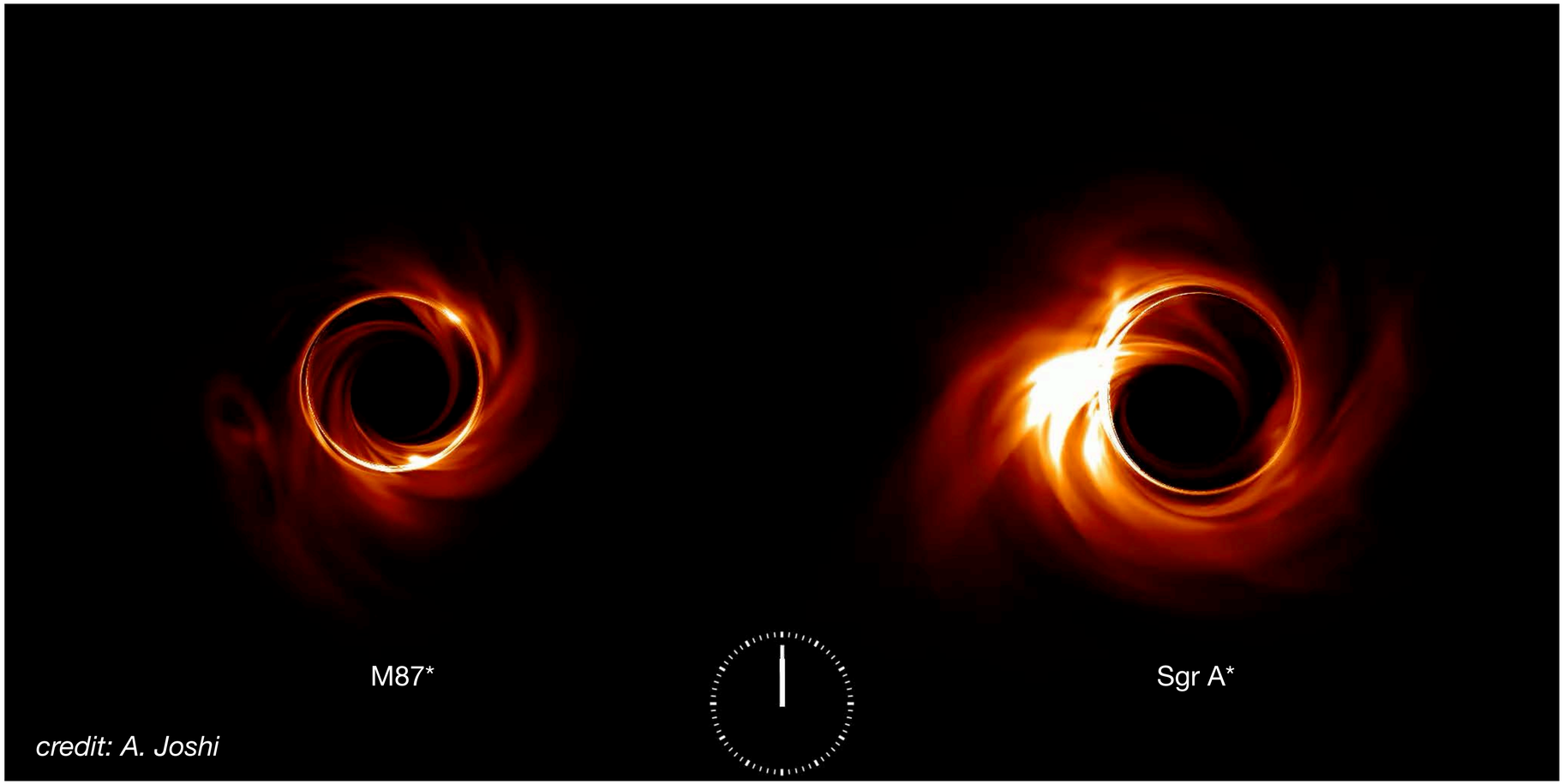
“interesting theory” -Elon Musk

Big bang nucleosynthesis, especially the lithium problem, gamma-ray background, supernovae and terrestrial planets

Gammie

Computational Astrophysics

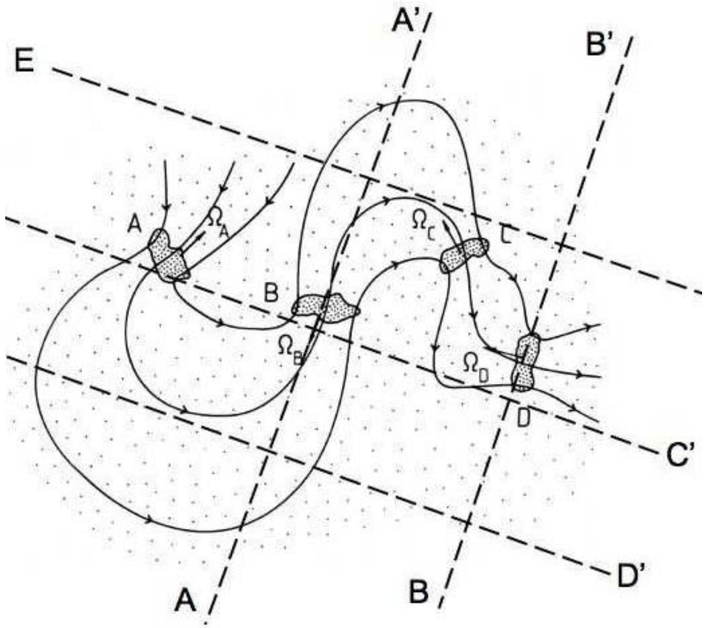
Charles Gammie



Protoplanetary disks, turbulence in disks, GRMHD, Event Horizon Telescope models, interstellar turbulence

Mouschovias

Star Formation



3. THE SIX-FLUID RMHD DESCRIPTION OF MAGNETIC STAR FORMATION

The RMHD equations governing the behavior of the six-fluid system (neutrals, electrons, ions, negative, positive, and neutral grains) are

$$\frac{\partial \rho_n}{\partial t} + \nabla \cdot (\rho_n \boldsymbol{v}_n) = 0, \tag{3a}$$

$$\frac{\partial (\rho_{g_-} + \rho_{g_0} + \rho_{g_+})}{\partial t} + \nabla \cdot (\rho_{g_-} \boldsymbol{v}_{g_-} + \rho_{g_0} \boldsymbol{v}_{g_0} + \rho_{g_+} \boldsymbol{v}_{g_+}) = 0, \tag{3b}$$

$$\frac{\partial (\rho_n \boldsymbol{v}_n)}{\partial t} + \nabla \cdot (\rho_n \boldsymbol{v}_n \boldsymbol{v}_n) = -\nabla P_n - \rho_n \nabla \psi + \frac{1}{c} \boldsymbol{j} \times \boldsymbol{B} + \frac{1}{c} \chi_{\mathcal{F}} \boldsymbol{\mathcal{F}}, \tag{3c}$$

$$0 = -e n_e \left(\boldsymbol{E} + \frac{\boldsymbol{v}_e}{c} \times \boldsymbol{B} \right) + \boldsymbol{F}_{en}, \tag{3d}$$

$$0 = +e n_i \left(\boldsymbol{E} + \frac{\boldsymbol{v}_i}{c} \times \boldsymbol{B} \right) + \boldsymbol{F}_{in}, \tag{3e}$$

$$0 = -e n_{g_-} \left(\boldsymbol{E} + \frac{\boldsymbol{v}_{g_-}}{c} \times \boldsymbol{B} \right) + \boldsymbol{F}_{g_- n} + \boldsymbol{F}_{g_- g_0, \mathrm{inel}}, \tag{3f}$$

$$0 = +e n_{g_+} \left(\boldsymbol{E} + \frac{\boldsymbol{v}_{g_+}}{c} \times \boldsymbol{B} \right) + \boldsymbol{F}_{g_+ n} + \boldsymbol{F}_{g_+ g_0, \mathrm{inel}}, \tag{3g}$$

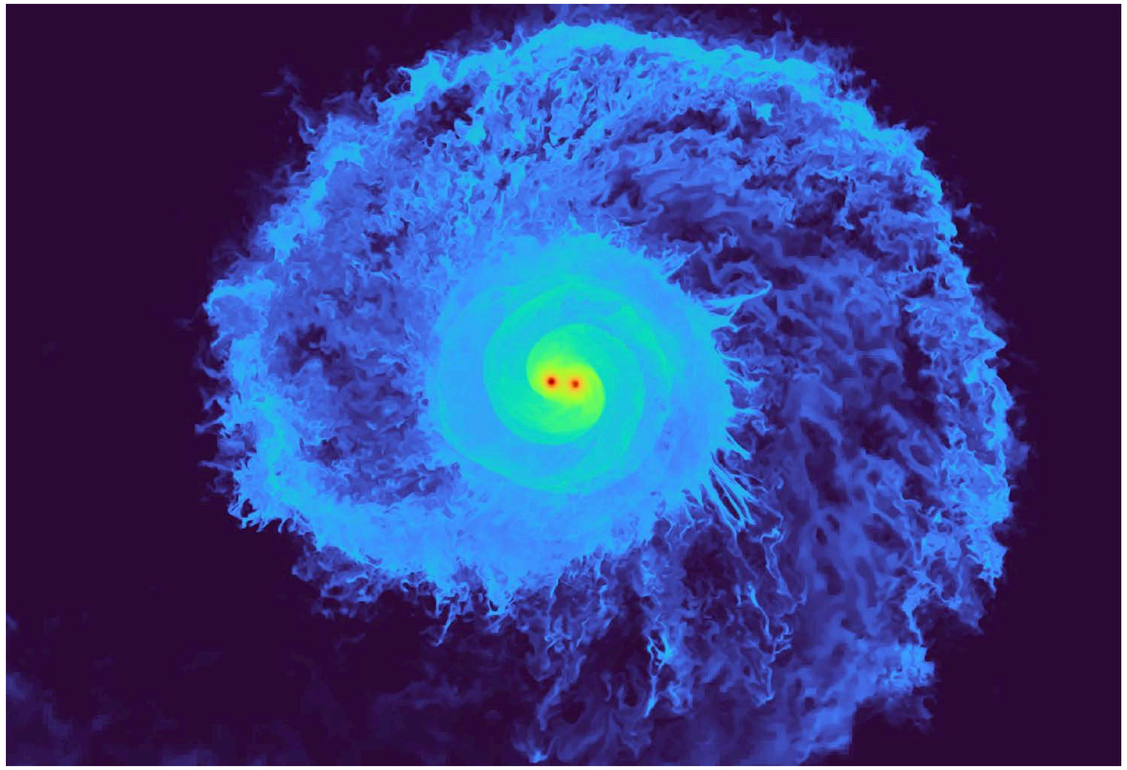
magnetic fields and ambipolar diffusion in star formation

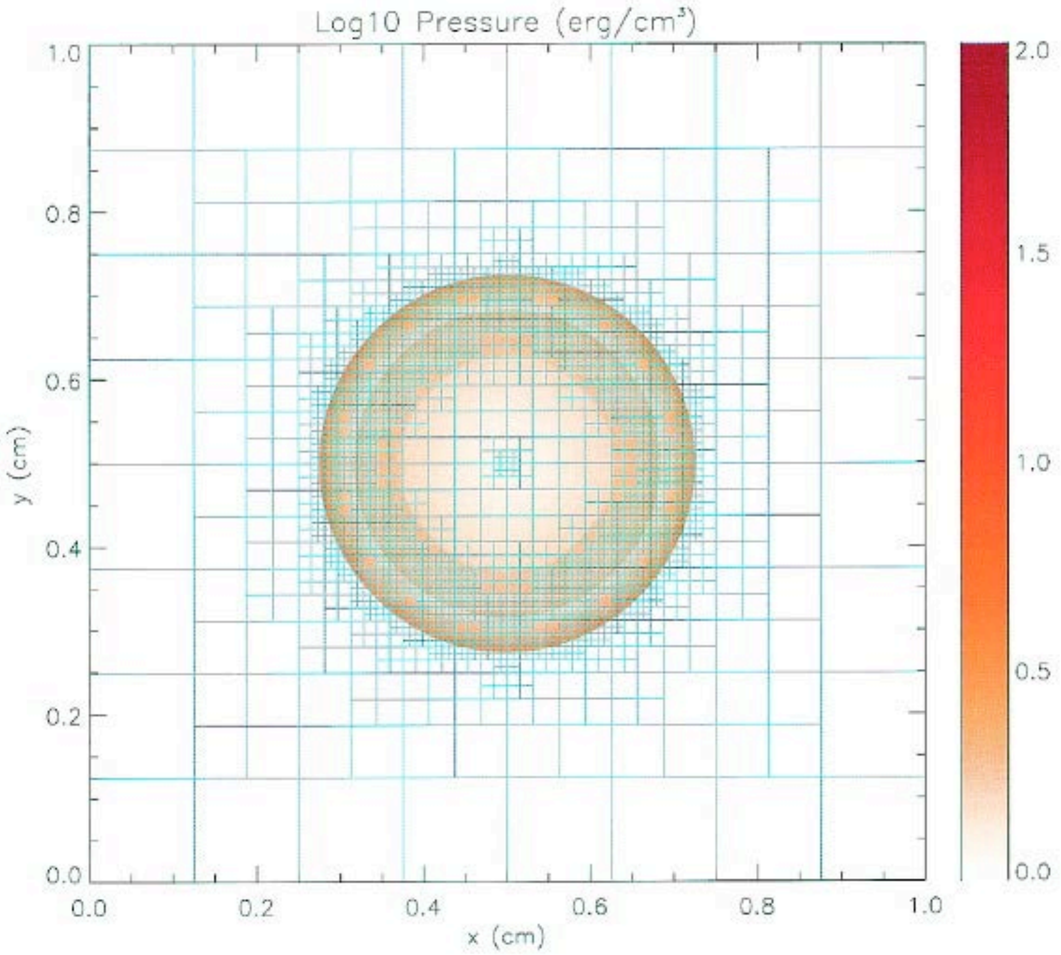
Telemachos Mouschovias

Ricker

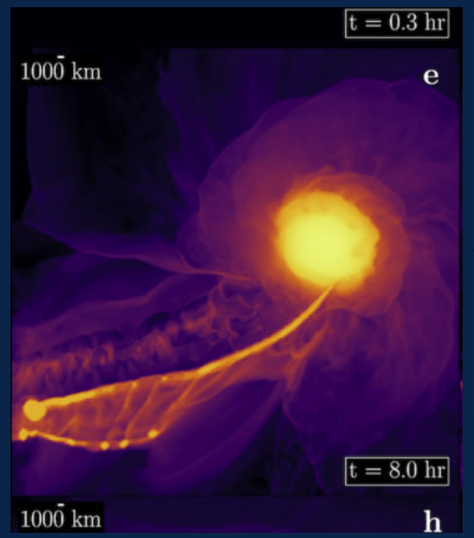
Computational Astrophysics

Paul Ricker





Galaxy clusters, FLASH code, numerical methods, common envelope evolution



Department of Astronomy