Graduate Studies in Astrophysical Sciences & Technology

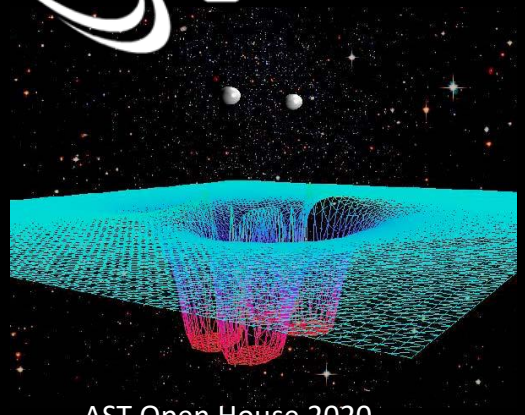
RIT | College of Science
Astrophysical Sciences and Technology

Astrophysical Sciences & Technology

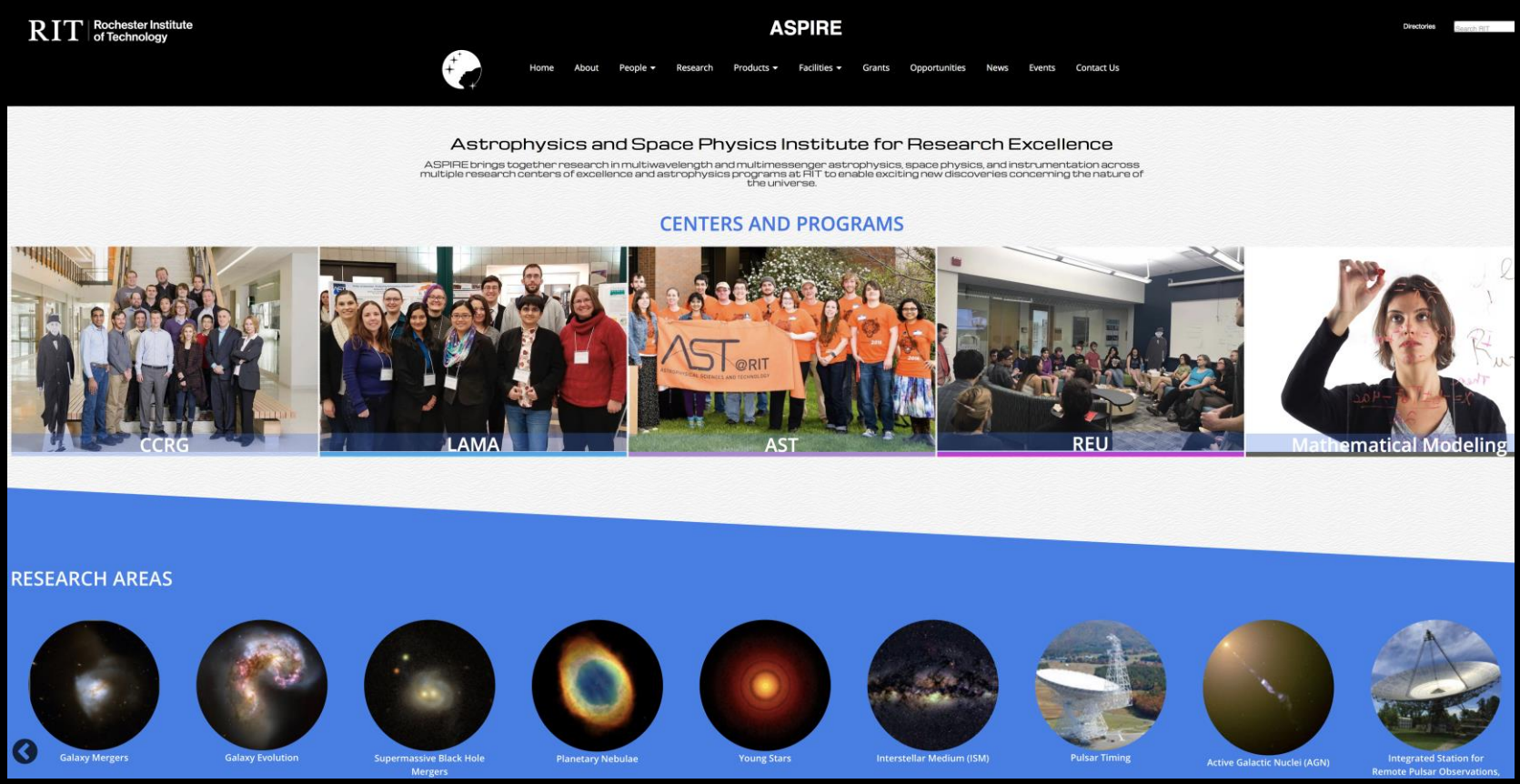
- PhD & MS programs
- BS Physics/MS AST
- Three Research Centers
- ~ 60 faculty, post-docs & grad students

LAMA
LAboratory for Multi-wavelength Astrophysics

CENTER FOR COMPUTATIONAL RELATIVITY AND GRAVITATION



ASPIRE



Astrophysics and Space Physics Institute for Research Excellence

https://aspire.rit.edu

An inter-disciplinary program

- AST is part of the School of Physics and Astronomy
- The 16 Program Faculty are drawn from 4 academic units:
  - School of Physics & Astronomy
  - Center for Imaging Science
  - School of Mathematical Sciences
  - Department of Science & Mathematics, National Technical Institute for the Deaf
- Students may select research topics in
  - Multiwavelength observational astronomy, gravitational wave astronomy
  - Computational & theoretical astrophysics, numerical general relativity
  - Detector & instrument technology

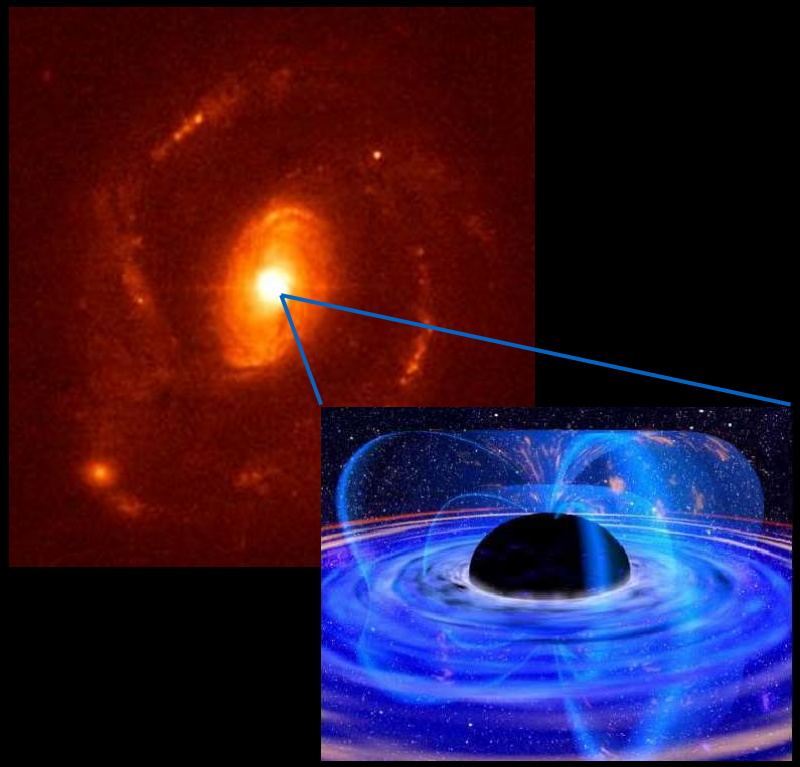
Philosophy & Values

- Inclusive
  - Respect & empathy for each other regardless of gender/sexual orientation/skin color/etc…all the things that make us unique individuals
  - Professional behavior expected
- Supportive
  - Emphasis on mutual support (not competition)
  - No “weeding out”
- Student-centered
  - Faculty are here to help you achieve your potential (not their goals…)

AST@RIT
ASTROPHYSICAL SCIENCES AND TECHNOLOGY

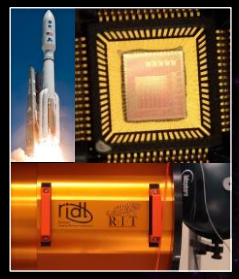
Current research interests

- Computational general relativity
- Gravitational wave astronomy
- Multi-messenger Astrophysics
- Time domain astrophysics
- Experimental cosmology
- Supermassive black holes
- Active Galaxies
- Galaxy evolution & galaxy clusters
- Proto-stars & proto-planetary disks
- Planetary nebulae
- Binary stars
- Stellar evolution
- Sub-orbital Astrophysics
- Next generation infrared detectors
- Zero read-noise detectors



Research Areas

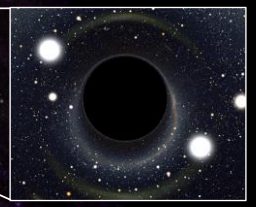
Development of novel detectors and instruments can open our eyes to the wonders of the universe. Creating new detector technologies and instruments for a wide variety of missions over different wavelengths can provide better data to help us learn more about phenomena in the universe, leading to new discoveries.



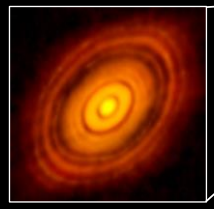
Small stars, like our Sun, throw off their outer layers to form "planetary nebulae." This colorful ejection of ionized gases gives us a critical look at the materials that formed inside the star before its demise.

During growth phases, supermassive black holes in the centers of galaxies accrete interstellar gas and release vast amounts of energy. By studying the light emitted by these “active galactic nuclei" at different wavelengths (e.g., optical, infrared, X-ray), we investigate their properties and their interactions with the host galaxies.

Massive celestial bodies (e.g. black holes, neutron stars) warp the fabric of space and time, producing gravitational waves. Numerical simulations from supercomputers, combined with real observations of gravitational waves, allow us to infer the properties of the bodies involved in these extreme phenomena.



A star and its planets form out of a collapsing cloud of gas and dust. Infalling material begins to spiral around the young star and flattens into a “circumstellar disk,” which eventually clumps to form planets. Studying young stars and disks helps us to understand the origins of our solar system.



There are three major types of galaxies: spiral, elliptical, and irregular. Studying these different types of galaxies helps us determine their fundamental properties. Multiwavelength methods can help us examine how the most massive to the smallest of galaxies interact with each other.

Images from NASA; Pat Corkery, United Launch Alliance; ALMA; Alain Riazuelo; RIT

Research Facilities

CCRG Black Hole Lab (computer clusters)

CfD: Suborbital Astrophysics Laboratory

CfD: Rochester Imaging Detector Lab (RIDL)

External Facilities

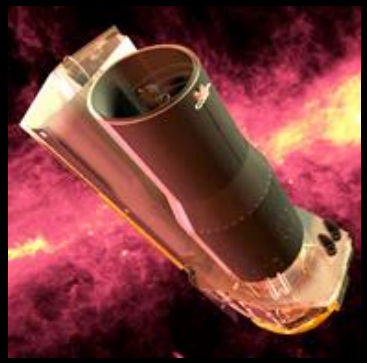
- Faculty & students frequently awarded time on major observing & computing facilities

Gemini 8-m Telescopes

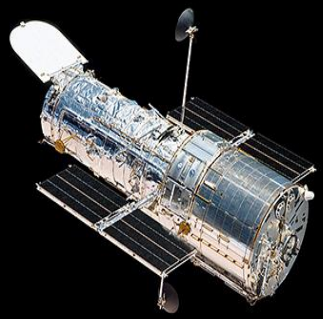
National Center for Supercomputing Applications

Chandra X-ray Observatory

Very Large Array



Spitzer Space Telescope



Hubble Space Telescope

Large Collaboration/Consortium Memberships

- LIGO Scientific Collaboration
  - Gravitational wave observatory
- LISA Consortium
  - Space GW observatory
- LSST Corporation
  - Large optical sky survey
- NANOGRAV
  - Pulsar timing array GW detector
- SPHEREx
  - Space spectral survey mission
- NY Space Grant Consortium
  - NASA funded Education & Outreach

SPHEREx: An All-Sky Spectral Survey

2020-21 student body

	New students	Total
PhD	6 (5)	31 (21)
MS	4 (-)	7 (2)
BS/MS	-	2 (1)
Total	10 (5)	40 (24)*

(#) = number of women

* 1 PhD, 1 BS/MS expected to complete in Fall

AST Faculty

AST Program Faculty

	LAMA	CCRG	CfD			Total
Research Center	5 (1)	8 (2)	3 (-)			16 (3)
	SoPA	**SMS**	**CIS**	**NTID**	**COS**	
Home Dept	6 (2)	6 (1)	2	1	1	16 (3)

(#) = number of women

Leadership/Admin

Name	Role	RIT email*
Andy Robinson	AST Director	axrsps
Josh Faber	AST Grad Program Coordinator	jafsms
Cheryl Merrell	Snr Staff Ass. (AST)	camsps

* @rit.edu

Graduates & Placements

Graduates

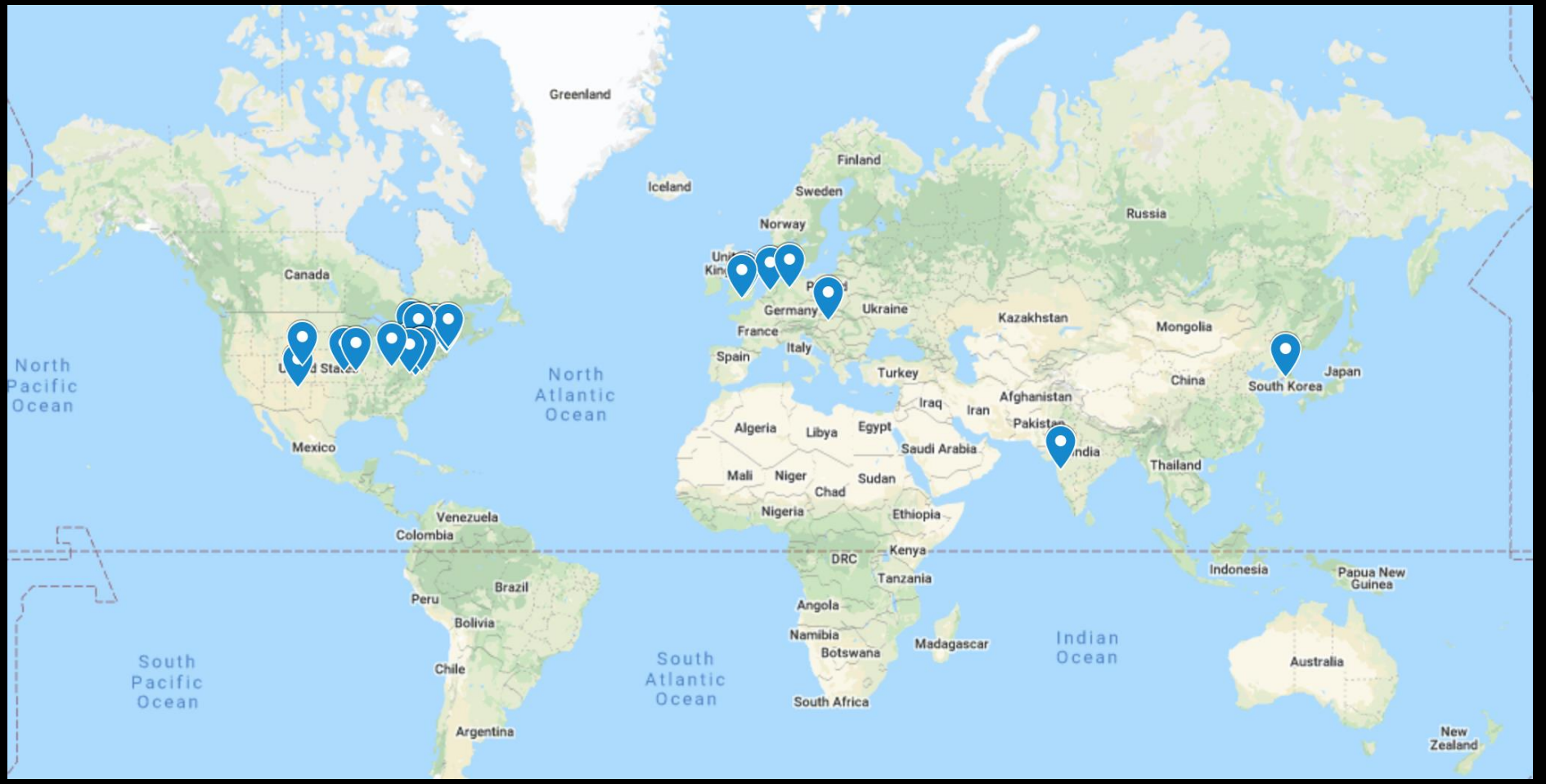
Degree	Total since 2008	2019-20	2020-21 (antic)
PhD	24 (6)	4 (1)	3-4
MS (terminal)	3 (1)	2 (BS/MS)	3-5 inc 2 BS/MS
MS (–> PhD)	4 (1)	-	1+?
MS ("on the way")	4 (+2 IMGS)	3	1+?

(#) = number of women
PhD median time to graduation: 60 months

Placements

Degree	Total	Astro Research	Comp. Research	Education /outreach	Tech/SW industry	Fed. Gov.
PhD	28	17	2	4	3	2
Term. MS	5	2		2	1	

Locations of AST Graduates

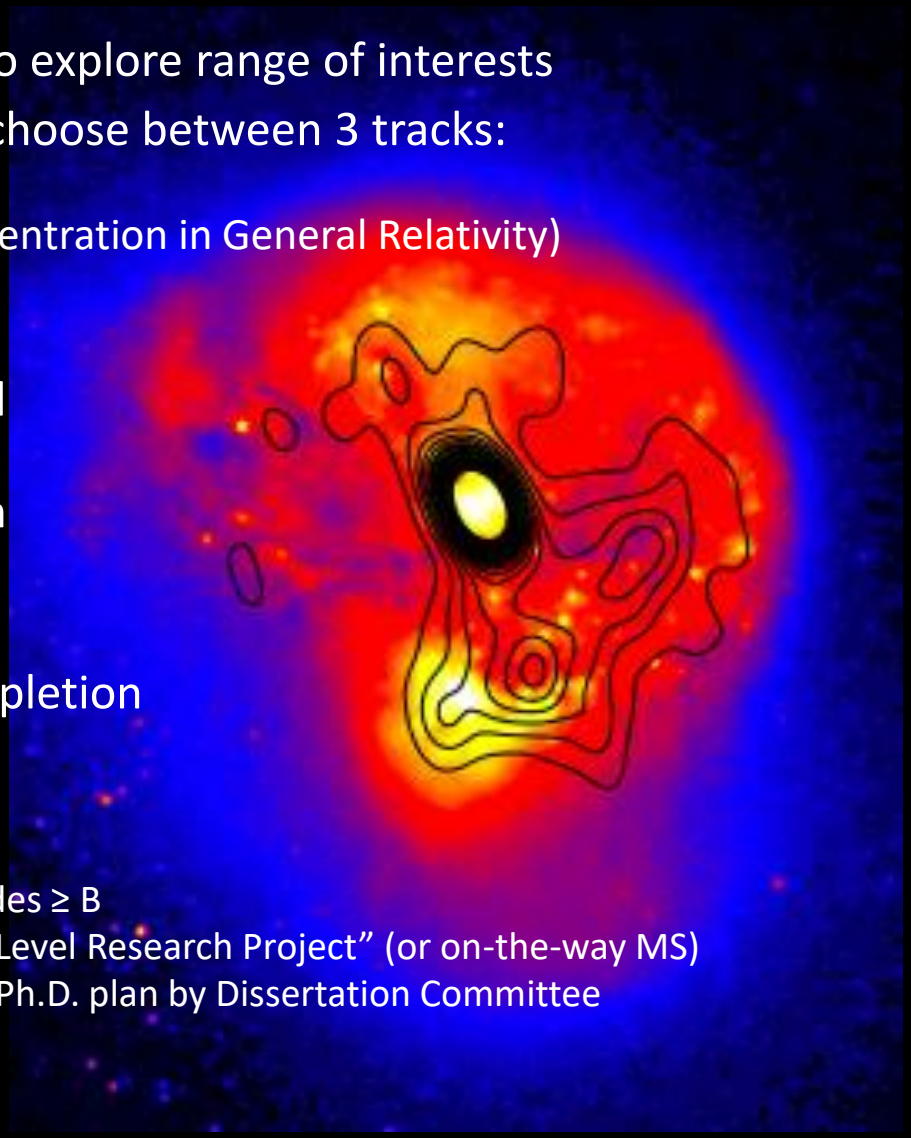


Program structure

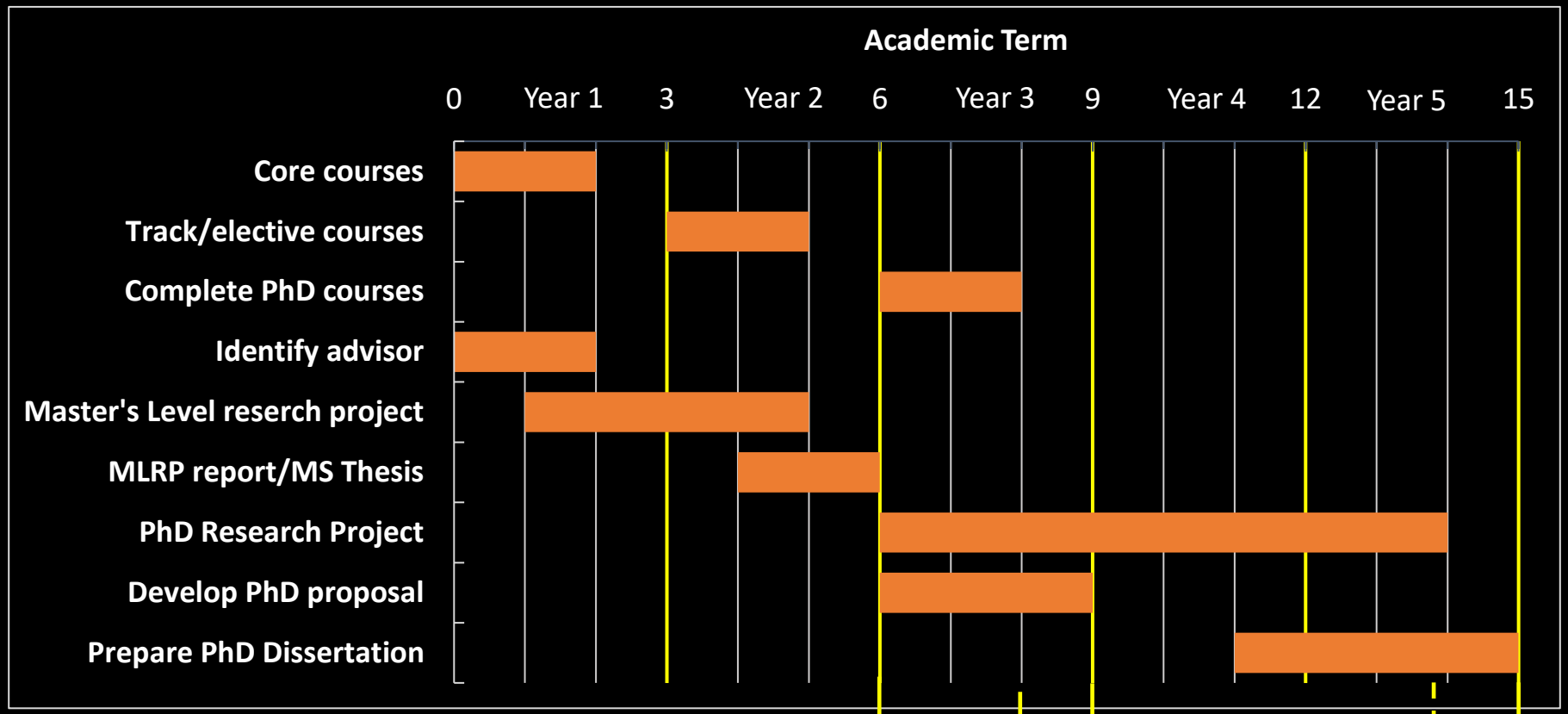
- Flexible structure allows students to explore range of interests
- Students take common core, then choose between 3 tracks:
  - Astrophysics
  - Computational Astrophysics (concentration in General Relativity)
  - Astronomical Instrumentation

- Graduate seminar develops general research skills & transferrable skills
- Students embark on initial research project within first semester

- **MS:** may transfer to PhD upon completion of MS requirements, subject to Program approval
- **PhD additional requirements:**
  - Core courses must be passed with grades ≥ B
  - Ph.D. Qualifier – defense of ”Master’s Level Research Project” (or on-the-way MS)
  - Ph.D. Proposal Review – evaluation of Ph.D. plan by Dissertation Committee



Timeline



Complete Core Courses

Pass PhD Qualifier/Defend MS Thesis

Recruit PhD Dissertation Committee

Present PhD Proposal

Defend PhD Dissertation

AST Research Talks Jamboree

- All students give oral presentation on research project
  - Every year end October (Oct 30, 2020)
  - Progress report, 12 + 3 mins
  - Exceptions: 1st years, 3rd years (just completed PhD Qual.)
  - Talk & costume prizes

RIT @ KPNO

- AST/SoPA/LAMA support membership of of the WIYN Telescope consortium
  - 6 nights/year access to 0.9-m telescope at Kitt Peak National Observatory in Arizona
  - Training & research opportunities for undergraduate & graduate students

Admission Requirements

PhD Deadline: 15 January

MS Deadline: 15 February

- Hold a baccalaureate degree (or equivalent) from an accredited university or college in the physical sciences, mathematics, computer science, or engineering.
- Submit official transcripts (in English) of all previously completed undergraduate and graduate course work.
- Have a minimum cumulative GPA of 3.2 (or equivalent) in course work in mathematical, science, engineering, and computing subject areas.
- ~~Submit scores from the GRE~~.
- Submit a personal statement of educational objectives.
- Submit a current resume or curriculum vitae.
- Submit two letters of recommendation from academic or professional sources directly to RIT. These must be confidential.
- International applicants whose native language is not English must submit scores from the TOEFL, IELTS, or PTE. A minimum TOEFL score of 79 (internet-based) is required. A minimum IELTS score of 6.5 is required. The English language test score requirement is waived for native speakers of English or for those submitting transcripts from degrees earned at American institutions.

End Goal

- Develop as an independent research scientist
  - Knowledge (courses, colloquia, self-study)
  - Skills/experience (research, training)
  - Communication (oral, written, conferences, pubications)
  - Personal development (initiative, resilience, responsibility, collaboration, confidence, leadership)
  - Transferable skills (communication, problem solving, coding, project management, team work)

Questions?