Astronomy Careers:

What can I do with an Astronomy Degree?

ASTR 199 CIA

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What can I do with an Astronomy Degree?

FiveThirtyEight

Analysis
America

MAJOR	CATEGORY	NUMBER OF MAJORS	MEDIAN EARNINGS
1	Engineering	2,339	$110,000
g.	Engineering	756	75,000
		856	73,000
ng		1,258	70,000
		32,260	65,000
		2,573	65,000
usiness		3,777	62,000
sical nces		1,792	62,000
cal Eng.	Engineering	91,227	60,000
trical Eng.	Engineering	81,527	60,000

Lessons:

Astronomy/Astrophysics degrees are valuable and valued

Astro graduates go on to many different careers

You need to prepare

Our job is to provide tools and opportunities that help to prepare

Astr
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Astro unemployment: 2.1%

http://fivethirtyeight.com/features/the-economic-guide-to-picking-a-college-major/

i>Clicker Poll
Career Questions

Who has asked you what you plan to do with an astronomy degree?

(A) family

(B) friends

(C) me!

(D) more than one of the above

(E) nobody—graduation is a long way off

Astro Careers

Q: What jobs require an Astronomy/Astrophysics degree?

Q: What are jobs that don't require an Astro degree but are where astro grads work?

A Sample of Jobs done by actual Illinois Astronomers

Academia:
Colleges and Universities

Q: what departments do Astronomers teach in?

Astronomy, Physics & Astronomy, Physics, Planetary Science

Q: what do College/University faculty do?

- teaching: classroom courses, student research, student mentoring
- research: amount varies on kind of school
- service: outreach, administration work

Colleges and Universities vary widely: different fit and feel for students and faculty

- U of Illinois: "Research 1" —heavy research component
- smaller colleges—e.g., Williams, Oberlin, Augustana: more teaching, less time for research
- community colleges: entirely teaching, no research, usually Physics as well as Astro

Academia:
Colleges and Universities

Q: what is needed to get a faculty job?

PhD usually required

Community College: Master's, sometimes just BA/BS

usually: research experience

sometimes: teaching experience

Academia:
K-12 Schools

Q: how is K-12 different from colleges and U?

no research, all teaching (usually)

Bachelor's required, Masters and PhD a plus

Q: what do K-12 astronomers teach

all science and math!

Planetariums and Museums

Q: examples?

Planetariums: Adler in Chicago, Haden in NYC (Neil de Grasse Tyson!)

Museums: Air & Space in DC

Q: duties?

develop shows and exhibits, interact with public

largest Planetariums and Museums include research Astronomers

National Laboratories

Q: Examples?

Dept of Energy: Fermilab and Argonne in Chicagoland, Los Alamos in NM, Livermore in CA

NASA: Goddard Space Flight Center in MD, Jet Propulsion Lab in CA

Q: Duties?

Research and development in support of lab mission: NASA spacecraft, Fermilab particle astrophysics and cosmology

U of I Astronomy grads have helped build and fly space missions, and one has driven a Mars Rover!

Requirements: Bachelors, Masters, or PhD depending on the job

Observatories

Q: examples of modern research observatories?

Ground-based:

- Optical = collect and detect visible light
  - examples: Keck in Hawaii, Blanco/Dark Energy Survey in Chile
- Radio = collect radio waves from space, e.g., VLA in New Mexico

Space-based: Hubble (optical/infrared/UV), Fermi (gamma), Chandra (X-ray)

Q: what do observatory staff do?

a wide range of activities and responsibilities

•schedule, operate, and repair the telescope, instruments, and dome

•develop data analysis software

•take and use observations in their own reslear

i>Clicker Poll

New Astro Alums

Take your best guess: **What percentage of graduating Illinois Astronomers go straight to graduate school for Masters/PhD?**

(A) < 10%

(B) 10%-30%

(C) 30%-60%

(D) 60%-90%

(E) > 90%

about 50%

Data Science

Astronomers are leaders in "**Big Data**" — an Illinois specialty!

gathering and understanding enormous datasets

- example: we are data home for the **Large Synoptic Survey Telescope** (under construction, 3.2 Gigapixel = 3200 Megapixel camera)

- Chile-based telescope will map entire night sky every few days

LSST flood of data begins in 2-3 years:

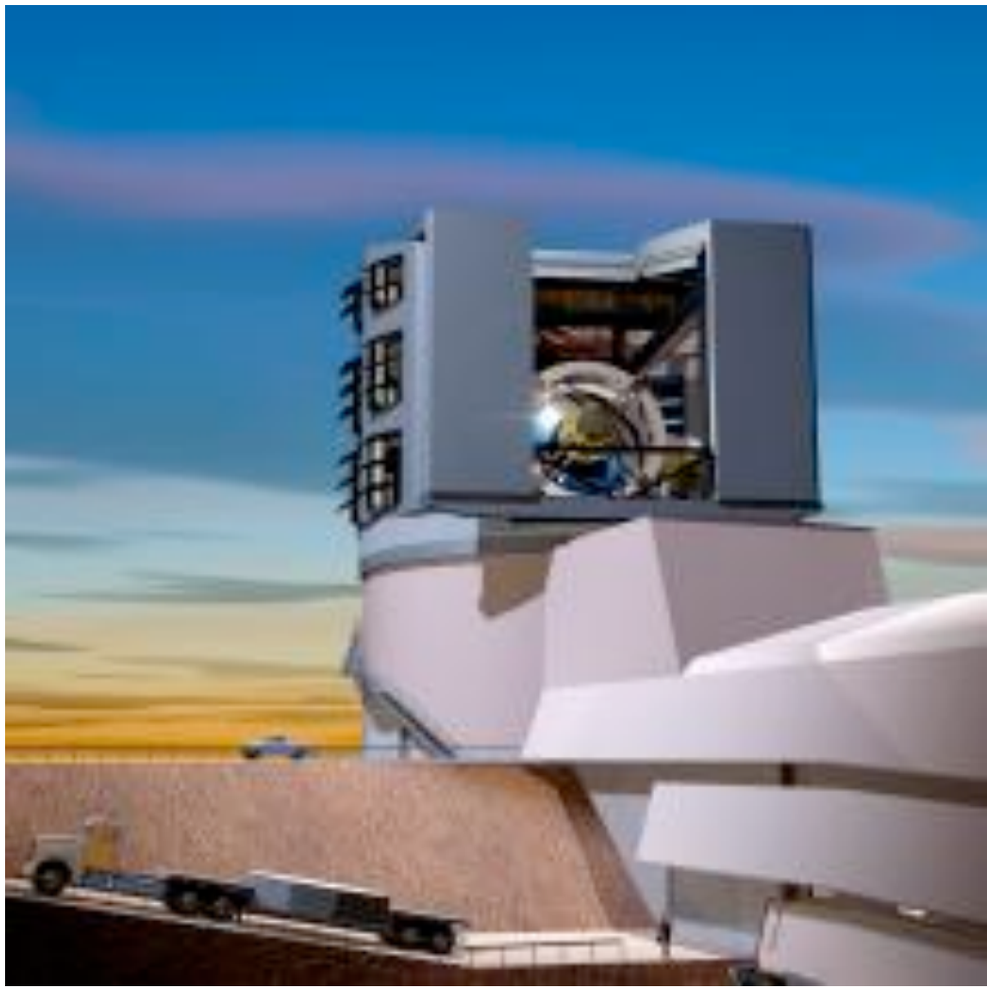
- 15 Terabytes = 15,000 GB per **day**

- 60 Petabytes = 60 million GB total

- about 20 billion galaxies, and 20 billion stars

goal: mine this catalog to make discoveries

a huge challenge! requires sophisticated computing and statistics



Data Science

Q: other applications of data science?

Anybody who uses large data sets

= most technology-based companies

examples: Google, Apple, Facebook, Twitter, insurance, auto manufacturers, pharmaceuticals, ….

Aerospace and Defense

Illinois graduates are working in the military and in defense companies

- e.g., threat assessment and reduction

Illinois grads work in civilian aerospace

- e.g., satellite design, testing, and manufacturing

Health and Medicine

Illinois Astronomers have gone on to be

- Medical doctors
- Dentists
- Pharmacists

Other Examples

Science Writing

- newspapers, magazines, websites, popular books

Environmental Science

Finance

- Wall Street applications for model building, testing, and refinement

Public Policy

- examples: Congressional staff, Union of Concerned Scientists, National Science Foundation

Trends:

What do these have in common?

The Value of an Astronomy Degree

Astronomers are trained to understand the Universe that obeys a set of precise mathematical laws that combine in often complex ways

breadth: Astronomy embraces all sciences—physics, chemistry, even bio

handy with **technical tools**: math, physics, statistics, data analysis

problem solving skills: finding the most important aspects of a problem, **building, testing, and refining mathematical models**

able to **link data and theory**

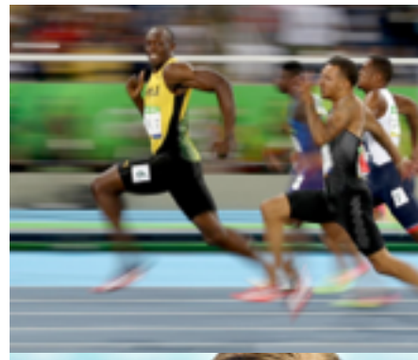
communication skills: written, formal talks, informal discussion

ability to work in a **team**

computing: programming, simulation, visualization

What can you do to prepare?

Building your Astro Muscles



You are in Training! visit many stations in gym

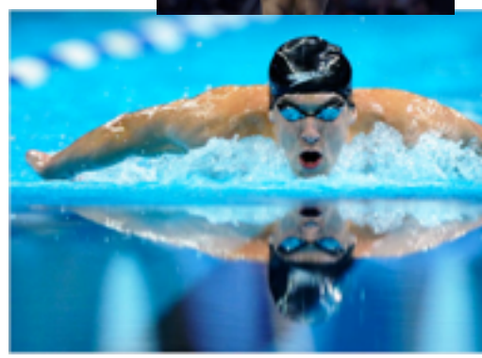
become a great problem solver: get practice solving lots of problems

become familiar with a wide range of tools: physics, math, statistics, computing

learn how to communicate effectively: get practice writing, speaking, and conversing about science

learn scientific programming! python is the language of choice nowadays

get to know your fellow astronomers now! form study groups, learn from each other (but you are responsible for your own work!)



The good news:

- Astronomy curriculum designed to get you into shape and to develop these skills!
- Developing these skills leaves open many career options!