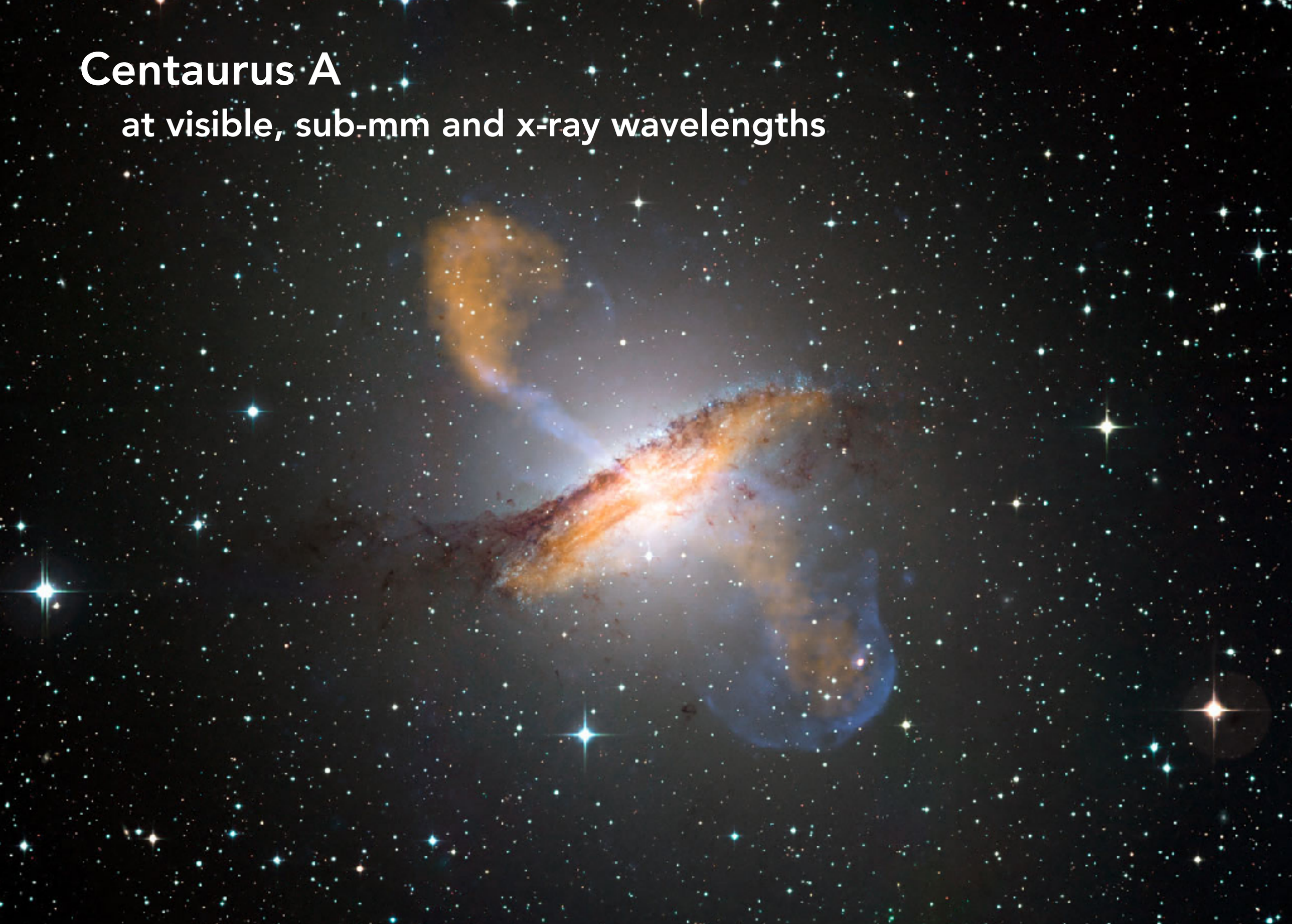
Physics 239
Radiative Processes in Astrophysics

Lecture #1: Class Introduction &
the Macroscopic Description of Radiation

Centaurus A

at visible, sub-mm and x-ray wavelengths



Credit: ESO/WFI (visible); MPIfR/ESO/APEX/A.Weiss et al. (microwave); NASA/CXC/CfA/R.Kraft et al. (X-ray)

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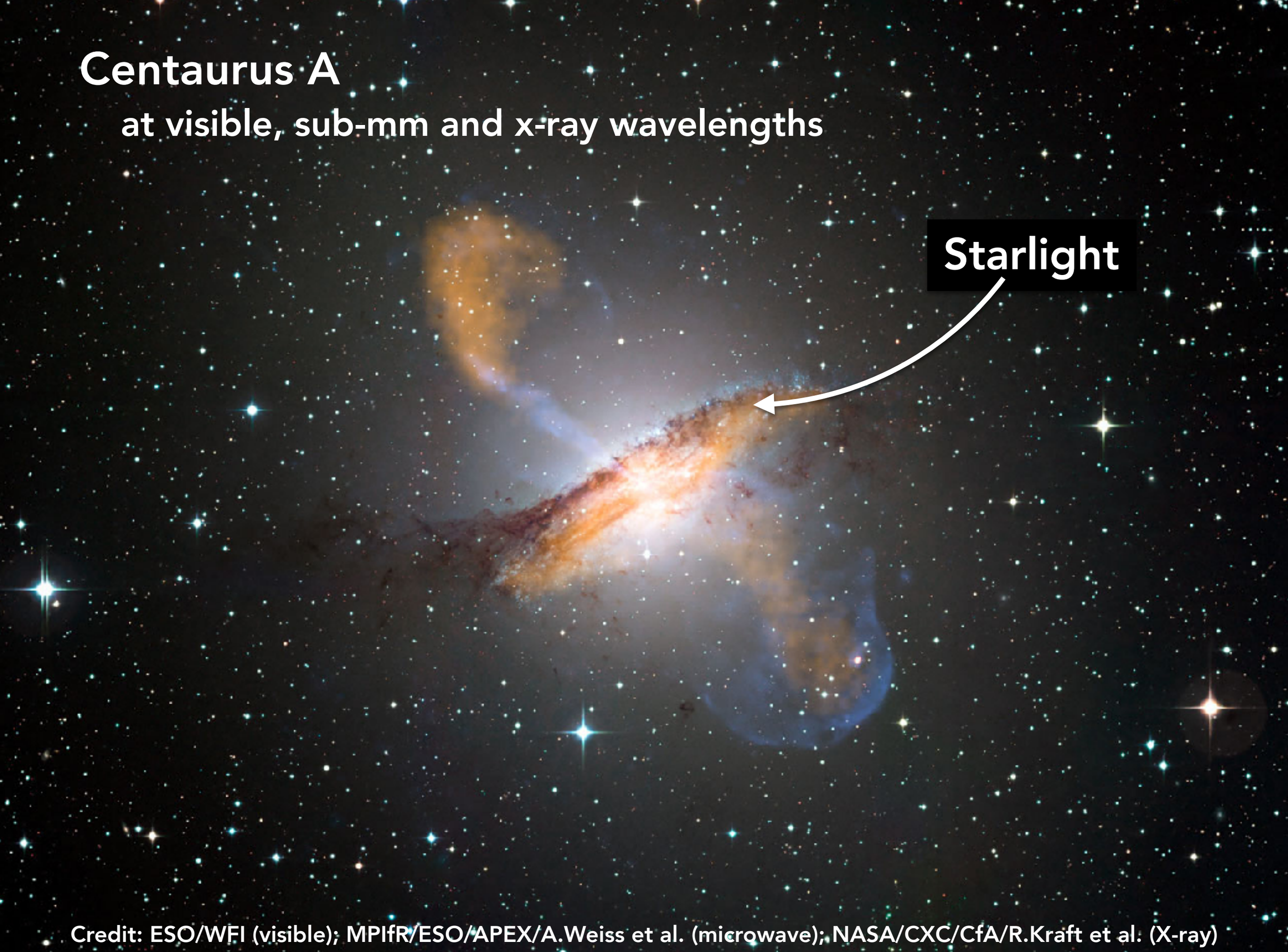

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Centaurus A

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Starlight

Dust Extinction
& Thermal Emission

Credit: ESO/WFI (visible); MPIfR/ESO/APEX/A.Weiss et al. (microwave); NASA/CXC/CfA/R.Kraft et al. (X-ray)

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H recombination
lines, Free-Free

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Dust Extinction
& Thermal Emission

H recombination
lines, Free-Free

HI 21-cm
Molecular lines

Credit: ESO/WFI (visible); MPIfR/ESO/APEX/A.Weiss et al. (microwave); NASA/CXC/CfA/R.Kraft et al. (X-ray)

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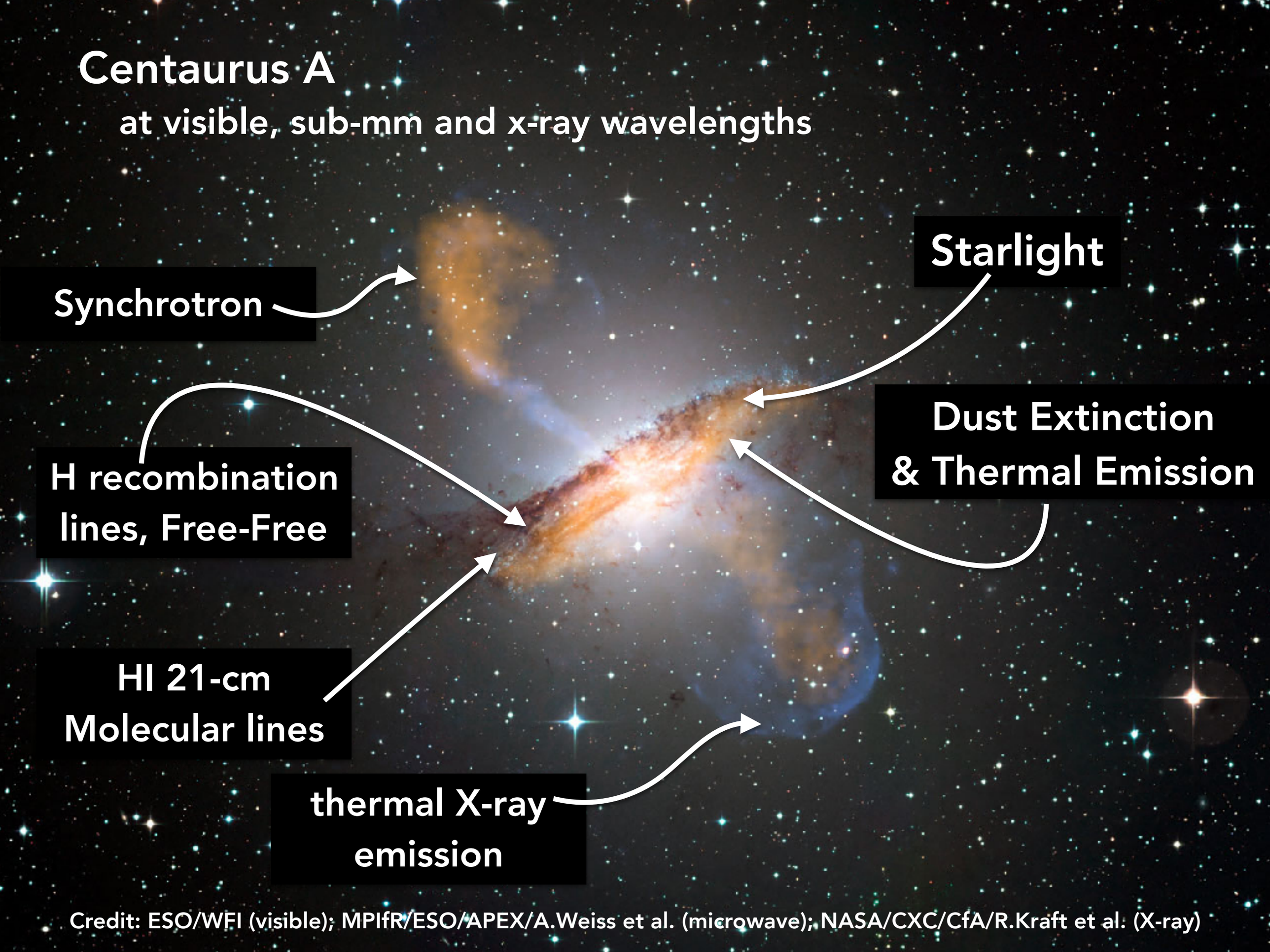

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Centaurus A

at visible, sub-mm and x-ray wavelengths

Synchrotron

Starlight

H recombination lines, Free-Free

Dust Extinction & Thermal Emission

HI 21-cm Molecular lines

thermal X-ray emission

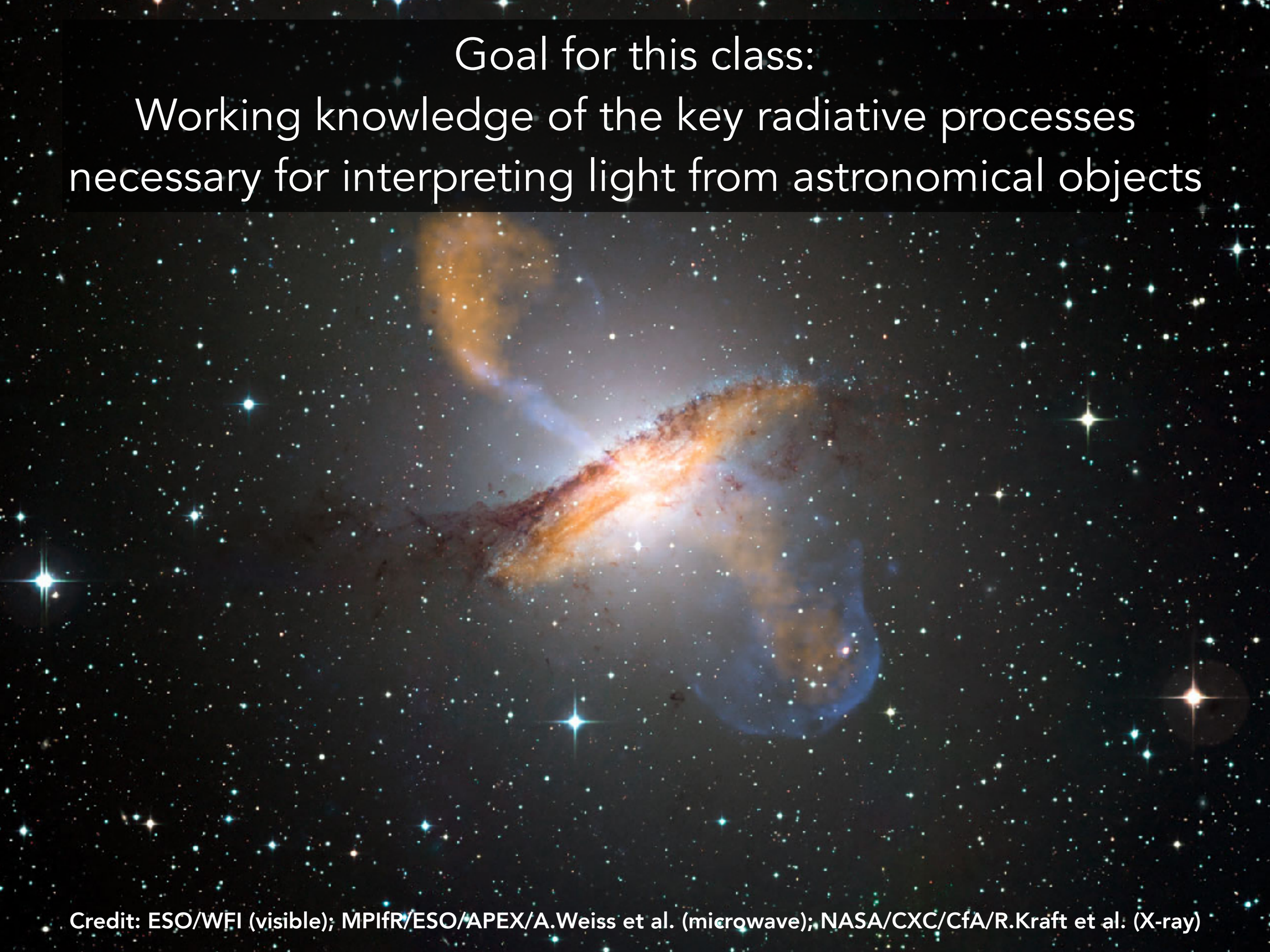
Inverse Compton and Synchrotron Self-Compton Scattering

Credit: ESO/WFI (visible); MPIfR/ESO/APEX/A.Weiss et al. (microwave); NASA/CXC/CfA/R.Kraft et al. (X-ray)

Credit: I. Feain, T. Cornwell & R. Ekers (CSIRO/ATNF); R. Morganti (ASTRON); N. Junkes (MPIfR); S. Amy, CSIRO

Goal for this class:

Working knowledge of the key radiative processes necessary for interpreting light from astronomical objects



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Outline

- Part I: About this class
- Part 2: The Macroscopic Description of Radiation - Specific Intensity & its Moments

Syllabus & Website

Course webpage:
http://karinsandstrom.github.io/f18_phys239.html

Syllabus is on the webpage - still in progress!

About this class

- TTh 11:00-12:20pm meetings
- I will post lecture slides on the website.
- I will try to post lecture notes as well, but can't guarantee those.

Reading

The required textbook is:
Radiative Processes in Astrophysics
by Rybicki & Lightman

Suggested reading for each lecture is listed in the syllabus.

Try to read through the suggested chapters before lecture.

Homework

~3-5 homework assignments throughout the class

Some homeworks will be typical problem sets.

They should be turned in as a typeset pdf,
LaTeX is recommended, but not required.

Online LaTeX editors:
www.overleaf.com

Homework

You are encouraged to work together on the homework if you would like, but *each person must turn in their own individual write up!*

Use standard practice in our field for citing literature and relevant sources you used in your work.

If you do not feel like you know the standard practice yet, no problem - just ask and we can talk about it.

Homework

Some of the homeworks will involve solving problems with computer codes.

I recommend doing this in **python**, but any programming language you'd prefer is fine (IDL, matlab, etc).

If some of you would like to learn python (recommended) we can try to arrange for a workshop!

Homework

Coding homework will be turned in to me via **github**.
I will clone your repository and run the code.

Code should be 1) thoroughly commented
and 2) executable by me.

(i.e. you should create a program or script I can run to reproduce any plots or calculations)

Quick Overview of Git

Git is a version control program you can install on your computer or department computer resources if needed.

A tutorial on how git works is here:

https://www.codecademy.com/learn/learn-git

Quick Overview of GitHub

Github is a repository hosting service.

You can create a repository on github, clone it to your computer, make changes, push it back to github. Other people can interact with your repository through github.

For your homework, you will create a repository called *[lastname]_phys239* where you will store your code.

I will clone your repository and run the code after the homework is due.

Setting up github:
https://help.github.com/articles/set-up-git/

- Key steps: download git on your computer
- Get an account on github (free account is ok, can also get more private repositories if you'd like with educational account)
- Authenticate github from git (see instructions at link above)

Homework #1 due 10/3

- Get git and github set up for your work.
- Create the lastname_phys239 repository
- Make a directory hw1 and put in it a “hello world” program in whatever language you intend to use.
- Send a link to your github repository to me by email
- An example: https://github.com/karinsandstrom/sandstrom_phys239

Final Project

40% of your grade is based on a final project due in the last week of class.

10 minute presentation + 4-5 page write-up reviewing an aspect of radiative processes relevant to your research

Final Project

Goals of the project:

- outline the key physics for an important radiative process
- review the literature on this subject in that field
- describe key techniques or measurements relevant to the radiative process in question

Final Project

Some key dates:

Oct 30: abstract & bibliography due for project
Nov 1-2: meetings to discuss abstract & bib with me
Nov 30: final report write up due
Dec 6: presentations in class

I am available to talk about this throughout the quarter, just email to set up an appointment.

Grades

Your grade is based on:

60% homework
20% final project presentation
20% final project write-up

Any Questions?