

Astronomy 512: Extragalactic Astronomy
Spring 2019

Julianne Dalcanton
PAB-C305
x5-2155

jd@astro.washington.edu
jdal@uw.edu

Extragalactic Astronomy is a big, complex, messy, and thus wonderful thing. Galaxies are the domain where nearly every kind of astrophysics interacts, with small scale physics often changing the large scale behavior in measurable ways. While this makes galaxies delightful laboratories in which to explore intellectually, it also makes them difficult to master. There is no narrow “standard canon”, and you instead must learn about most everything – stars, gas, dark matter, dust, cosmology, and how they all interact. This can be frustrating as a student, because there are a seemingly endless series of facts and terminology you need to become fluent with to effectively engage in the broad, synthetic thinking that is a hallmark of extragalactic science.

In this class, we will do both in parallel – mastering the “ingredients” of galaxies while building higher-level skills in tandem. The specific skills I hope to encourage over the course of the class include:

- Fluency/literacy with terminology and physical scales
- Efficiency at reading the literature
- The ability to interpret spectra and spectral energy distributions at all wavelengths
- The ability to interpret images at all wavelengths
- Understanding of how selection effects shape what’s observed
- Intuition for basic physical processes
- Knowledge of major correlations and their physical origins
- Ability to derive the base correlations, w/ sensible analysis of drivers of scatter
- Ability to craft tight, logical arguments or experimental approaches, even in the face of galaxies’ innate complexity.
- Familiarity with important catalogs and SSP tools

The major processes for which I expect you to gain intuition are:

- Gravitational equilibrium
- Star formation
- Interaction
- Mergers
- Environmental effects
- Black hole feedback
- Star formation feedback
- Gas outflow, inflow, and removal
- Internal instabilities
- Self-regulation
- Chemical evolution
- Dynamical heating

Lectures: We will meet 2x week. I am a pretty fast talker, but I *really* enjoy questions and discussion. Never, ever hesitate to bring up issues or questions for discussion or clarification.

PDFs of slides and copies of assignments: <https://github.com/jdalcanton/A512-Spring-2019>

Live copy of class topics (need to be logged in with your UW id):
https://docs.google.com/drawings/d/1chGm4OD5NAKA8FUFaw0PgQoJKuNwPm_gVd2fH1v4yKg/edit?usp=sharing

Anonymous content requests: <https://forms.gle/oB2QE6w5keLwBTEFA>

Shared notes: You may want to consider starting a collaborative google doc for note taking, with a principal note taker each class in rotation

Problem Sets: Due Friday of Weeks 1, 2, 4, 6, 8, and 10, to avoid conflict with Cosmology

Collaboration Policy: Science is often at its best when it is most collaborative, so please feel free to work together and support each other on assignments. However, it is important that the final product you turn in is yours alone, so that you benefit from the final grappling and synthesis of the material as you write up your work independently. You should not be referring to written work of other students (current or past) while you work to write up your solutions, nor should you reference past solutions from the work of previous students at any point in the process. I care more about your intellectual growth as you work to master material than I do about final accuracy.

Deadlines: Problem sets should be in my box or under my office door by Friday at noon. It is better to turn in what you can at the deadline, rather than letting assignments build up and ruining your needed weekend. Late assignments also prevent me from grading in a timely manner. If something exceptional comes up, please let me know sooner rather than later – life is a thing that happens.

Structured reading: Starting in your second week, you will begin a quarter-long literature reading project to develop expertise in an extragalactic topic of interest to you. The larger goal is to help support you as you develop the skills needed to efficiently digest papers and the habit of regularly reading the literature. There will be no formal due dates associated with this during the quarter, beyond an expectation that you will (1) read consistently, (2) check in with me about what you're reading on a regular basis (every two weeks at a *minimum*), so that we can talk over what you're learning, what's confusing, and what directions you might want to go in next, and (3) keep a viewable google doc listing the papers you've read or skimmed.

Final: There will be a final oral exam discussing your readings for the quarter and related topics from the course. These are one-on-one and can be scheduled individually.

Grading: Problem Sets: 60%, Reading consistency & discussions: 20%, Final oral exam: 20%

Disability accommodations: If you face any issue that is interfering with your ability to participate fully in class and/or to learn the material, please don't hesitate to reach out so that we can find a solution that can work for you.

Office hours: As Chair, my schedule is often a dumpster fire. Tyneshia Valdez has access to my calendar and can let you know when I'm free on any given day, if you're having difficulty finding me. Do not let my ridiculous schedule dissuade you from dropping in – talking science with students is almost always the best part of my day and I'll be happy to have the excuse.