Astronomy 730

Course Outline

Outline

- Course Overview
  - Introductions
  - Expectations
  - Goals

Introductions

- Course Web Page and email list:
  - user.astro.wisc.edu/~mab/education/astro730/
  - astron730-1-f23@g-groups.wisc.edu
- Instructor:
  - Matthew Bershady / 6215 Chamberlin
  - Office Hours: W by appointment
  - mab@astro.wisc.edu
- Grading
  - General class participation: 20%
  - Short assignments: 20%
  - Research project: 60%

Optional:

If you are looking for additional problems to work for practice see Sparke & Gallagher. These will not be graded.

Materials

- Classroom Notes:
  - posted web
- Readings
  - Required Textbook: none
  - On Reserve in the Library*
    - Roughly a dozen texts on galaxies, cosmology and AGN.
    - See web page for list and description
  - Topical articles
    - Largely from professional, peer-reviewed journals such as AJ, ApJ, A&A, MNRAS
  - Course web page will give reading assignments, updated as the course progresses.
- Data:
  - see later slide in this presentation
- Acknowledgements
  - Thanks to Eric Wilcots (UW) and Chris Mihos (CWRU) for material used in this course.

*Working on it.

Expectations

- Classroom discussion
  - Class notes are for reference and will not be presented as lectures, except for brief introductions.
- Short assignments
  - Analytic & numerical, given in class
  - For classroom presentation and discussion
- Course Project
  - Define a research project using data from SDSS-IV/MaNGA on themes in or directly related to this course (other SDSS public data may be used if suitably justified).
    - The project must be original and of your own design
    - The project should be modest in scope
  - Undertake preliminary analysis using your own or available software and plotting tools.
  - Present results in class
  - Meet milestones along the way
  - Projects can be discussed with anyone, but each student must define, execute and present their own project.

Project Milestones

- Learn to access SDSS-IV/MaNGA data – 11 Sep
  - Explore Marvin and present result in class – 13 Sep
- One-paragraph research topic – 25 Sep
- One-page research plan – 16 Oct
  - You may modify your research topic up to this point
- Interim status: 06 Nov
  - Two page report with text and figures
  - 'Lightning Talk' – one pptx or pdf slide
- Final report and presentation: 27 Nov – 13 Dec
  - Up to 5-page (ApJL style) written summary
  - presentation slides with figures and images
  - 10 min oral presentation

Project Milestones (continued)

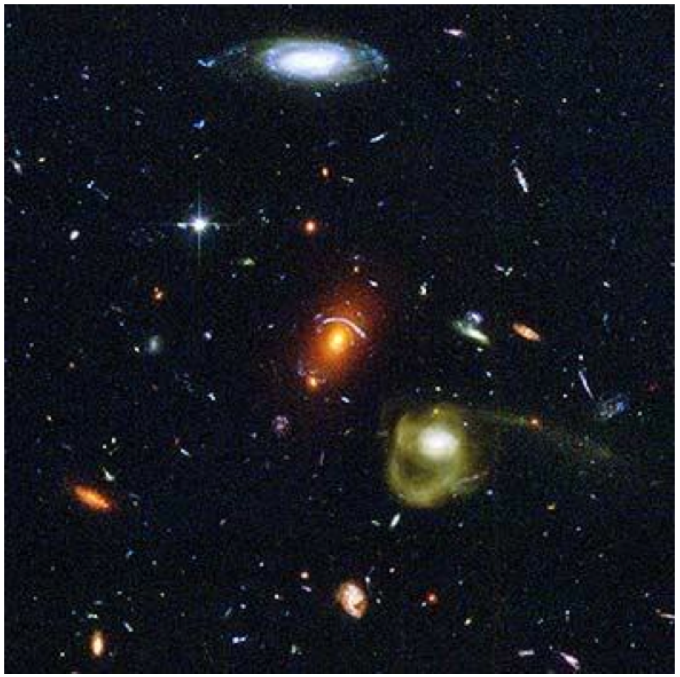
- Interim status: 06 Nov
  - 1 minute per person oral presentation
  - 1 slide max
  - Send slide in pdf or pptx to mab@astro.wisc.edu
  - Written (2-page) report should:
    - VERY BRIEFLY AND SUCCINCTLY explain the high-level science goal (no need for background)
    - Identify key analysis steps
    - Present result of analysis on a small subset of data, e.g., a single galaxy

SDSS-IV Data Access

- Public data
  - All surveys:
    - http://www.sdss.org
  - SDSS-IV/MaNGA:
    - https://www.sdss4.org/dr17/manga/
    - https://www.sdss4.org/dr17/data_access/value-added-catalogs/
  - Marvin:
    - https://www.sdss4.org/dr17/manga/marvin/
    - https://dr17.sdss.org/marvin/

Course Goals

- Obtain Overview of Galactic and Extragalactic Astronomy
  - Basic properties of galaxies and large scale structure
  - Evolution and the underlying astrophysics
  - Unresolved Issues – the assembly and growth of galaxies
- Develop Research Skills
  - using proprietary and state-of-the art data
  - that *may* lead to publication



The coin of the realm

Course Arcs

I. Overview

Thematic development:

II. Stellar Populations
III. Dynamics
IV. Evolution
V. Chemo-dynamics

Other key ingredients:

VI. ISM
VII. Environment

Case studies:

VIII. Milky Way as Galaxy
IX. ETGs ~ Spheroidal-dominated systems
X. LTGs ~ Disk-dominated systems
XI. Dwarfs

- We will do a quick first pass on all topics, and then return to each as needed.
- The schedule will be fluid.

Today's Assignment: Read these

- **The Story of Our Universe May Be Starting to Unravel**
  - NYT article, 02 Sep 2023

- Follow up on the age problem:
  - **The James Webb Space Telescope discovers enormous distant galaxies that should not exist**
    - Article for popular consumption
  - **A population of red candidate massive galaxies ~600 Myr after the Big Bang**
    - Labbe et al. 2023, Nature, 616, 266
  - **Stress testing ΛCDM with high-redshift galaxy candidates**
    - Boylan-Kochin 2023, Nature Astronomy
  - See also Melia, F 2023 (MNRAS, 521, L85)

- Follow up on the H_0 tension:
  - **New JWST data confirms, worsens the Hubble tension**