

NASSP Course Template

Course Title: Extragalactic Astronomy (EGA)

Course Lecturer: L. Barchiesi

Course credits: 1

Lecturer contact hours: 24

Tutorial/practical hours: 6

1) Course overview

The course aims at providing a coherent and modern view of extragalactic astrophysics, formation and evolution of galaxies and clusters, galaxies in the cosmological context, and the observational approaches that are now possible to study the distant Universe directly. Notably: 1. A basic understanding of galaxies and the realm they live in, 2. Formation and evolution of galaxies, 3. Structure and classification of active galactic nuclei and their interaction with the host galaxies, 4. Research methods, problem solving and practical considerations for studying galaxies at the professional level.

2) Course breakdown/syllabus:

- Recap on galaxy structure, components. Statistical evaluation of galaxies properties. Scaling relations of star-forming and elliptical galaxies.
- Active galactic nuclei. Structure, components, and classification. Multi-wavelength properties. Radio view of AGN, radio-galaxies, and SKA. AGN feedback and AGN-galaxy co-evolution.
- From BB to galaxy formation. DM halos and collapse. Primordial nucleosynthesis, Recombination, cooling, and PopIII stars. First galaxies. Hot and Cold accretion modes, Disk and spheroidal galaxy formation.
- Galaxy evolution. Hubble Sequence Evolution, Merger rate, Size, Colour bi-modality, Main Sequence, Downsizing, Cosmic SFR
- High-redshift galaxies. Observing high-z galaxies, selection methods and biases. The advent of JWST. Little Red Dots.
- Cluster, Groups, and galaxy interactions.
- Gravitational Lensing
- SED-fitting as a tool to statistically study local and high-z galaxies.

3) Resources:

- Refereed Journals, including ApJ, MNRAS, AA, and astro-ph.
- Slides and lesson notes
- Optional readings:
 - Galactic Astronomy, J. Binney, M. Merrifield, Princeton Univ. Press, 1998 [BM]; ISBN 3-540-41927-6
 - Introduction to Galaxy Formation and Evolution; A. Cimatti, F. Fraternali, C. Nipoti; ISBN:9781107134768

4) Practical / Tutorials

- Exercises will include working with databases and catalogues, and introduction to AGN and galaxies SED-fitting.

5) Additional skills to be developed during the course:

- You will learn how to read, decode and absorb journal articles. Particular emphasis will be given to interpreting graphs, plots and images, and creating your own professional level graphics.

6) Assessment

- Quiz's and short assignments: 30%, paper presentation: 30% endterm exam: 40%