

# Module: Elective Advanced Lectures: Observational Astronomy

Module No.: astro840

Course:  universität**bonn**

## Multiwavelength Observations of Galaxy Clusters

Course No.: astro849

| Category | Type                   | Language | Teaching hours | CP | Semester |
|----------|------------------------|----------|----------------|----|----------|
| Elective | Lecture with exercises | English  | 2+1            | 4  | ST       |

### Requirements for Participation:

#### Preparation:

Introductory Astronomy lectures

#### Form of Testing and Examination:

Written or oral examination, successful exercise work

#### Length of Course:

1 semester

### Aims of the Course:

To introduce the students into the largest clearly defined structures in the Universe, clusters of galaxies. In modern astronomy, it has been realized that a full understanding of objects cannot be achieved by looking at just one waveband. Different phenomena become apparent only in certain wavebands, e.g., the most massive visible component of galaxy clusters - the intracluster gas - cannot be detected with optical telescopes. Moreover, some phenomena, e.g., radio outbursts from supermassive black holes, influence others like the X-ray emission from the intracluster gas. In this course, the students will acquire a synoptic, mulitwavelength view of galaxy groups and galaxy clusters.

### Contents of the Course:

The lecture covers galaxy cluster observations from all wavebands, radio through gamma-ray, and provides a comprehensive overview of the physical mechanisms at work. Specifically, the following topics will be covered: galaxies and their evolution, physics and chemistry of the hot intracluster gas, relativistic gas, and active supermassive black holes; cluster weighing methods, Sunyaev-Zeldovich effect, gravitational lensing, radio halos and relics, and the most energetic events in the Universe since the big bang: cluster mergers.

### Recommended Literature:

Lecture script and references therein