

Extragalactic astronomy and cosmology Educational subject description sheet

Basic information

| Study programme Astronomia | | Didactic cycle 2023/24 | |
|---|--|-------------------------------------|--------------------------------------|
| Speciality - | | Subject code 04ASTS.24K.02193.23 | |
| Organizational unit Faculty of Physics | | Lecture languages English | |
| Study level Second-cycle programme | | Course type Obligatory | |
| Study form Full-time | | Block Major subjects | |
| Education profile General academic | | | |
| Subject coordinator | Michał Michałowski | | |
| Lecturer | Michał Michałowski | | |
| Period Semester 3 | Activities and hours • Lecture: 30, Exam; includin • Synchronous lecture: 30 • Classes: 30, Graded credit | g sub-activities: | Number of ECTS points 6 |

Goals

| Code | Goal |
|------|---|
| G1 | To familiarise students with research methods used in astronomy to study galaxies |
| G2 | Transfer of knowledge on basic dynamic characteristics and physical properties of the Galaxy and other galaxies |
| G3 | Transfer of knowledge about the structure and evolution of the Universe |

Subject learning outcomes

| Code | Outcomes in terms of | Learning outcomes | Examination methods |
|-------------------------------|--|--|----------------------------------|
| Knowledge - Student: | | | |
| W1 | knows the history of the research on the Galaxy and galaxies | AST_K2_W02 | Oral exam |
| W2 | knows the dynamic and physical properties of the Galaxy and other galaxies | AST_K2_W01, AST_K2_W02 | Oral exam, Written colloquium |
| W3 | knows the Big Bang theory | AST_K2_W02 | Oral exam, Written colloquium |
| W4 | knows theories describing the structure and evolution of the Universe | AST_K2_W02, AST_K2_W05 | Oral exam, Written colloquium |
| W5 | knows current research directions in extragalactic astrophysics and cosmology | AST_K2_W02, AST_K2_W04, AST_K2_W05 | Oral exam |
| Skills - Student: | | | |
| U1 | can read and understand literature on extragalactic astrophysics and cosmology | AST_K2_U05, AST_K2_U06 | Oral exam |
| U2 | can make basic calculations connected with extragalactic astronomy and cosmology | AST_K2_U05, AST_K2_U06 | Written colloquium |
| Social competences - Student: | | | |
| K1 | can critically evaluate scientific publications | AST_K2_K01 | Oral exam |

Study content

| No. | Course content | Subject learning outcomes | Activities |
|-----|---|-------------------------------|------------------|
| 1. | Morphological classification of galaxies The structure of the Galaxy The Local Group of galaxies | W1, W2, U2 | Lecture, Classes |
| 2. | Properties of elliptical and spiral galaxies | W1, W2, W5, U1, U2, K1 | Lecture, Classes |
| 3. | The large-scale structure of the Universe The expansion of the universe The Hubble's law | W1, W3, W4, W5, U1, U2, K1 | Lecture, Classes |
| 4. | The Big Bang Theory Cosmic Microwave Background | W1, W3, W4, W5, U1, U2, K1 | Lecture, Classes |
| 5. | Gravitational lensing | W1, W5 | Lecture |
| 6. | General Theory of Relativity, curvature of space-time and the metric of the Universe Friedmann equation | W1, W3, W4, W5, U2 | Lecture, Classes |
| 7. | Cosmological constant Models of the Universe The standard model of the Universe | W1, W3, W4, W5, U1, U2, K1 | Lecture, Classes |

| No. | Course content | Subject learning outcomes | Activities |
|-----|--|-------------------------------|------------------|
| 8. | Dark matter Acceleration of the expansion of the Universe Nucleosynthesis in the early universe Inflationary Universe | W1, W3, W4, W5, U1, U2, K1 | Lecture, Classes |

Additional information

| Activities | Teaching and learning methods and activities | |
|------------|---|--|
| Lecture | Lecture with a multimedia presentation of selected issues, Discussion | |
| Classes | Solving tasks (e.g. computational, artistic, practical) | |

| Activities | Credit conditions |
|------------|--|
| Lecture | Knowledge and ability to discuss topics discussed during the lecture |
| Classes | Correct solving of problems |

Literature

Obligatory

- 1. B. Ryden, 2003, Introduction to Cosmology, Addison Weslley, San Francisco
- 2. L.S. Sparke, J.S. Gallagher, 2000, Galaxies in the Universe. An Introduction, Cambridge University Press

Optional

1. J. Binney, M. Merrifield, 1998, Galactic Astronomy, Princeton University Press

Calculation of ECTS points

| Activities | Activity hours* |
|----------------------------------|------------------|
| Lecture | 30 |
| Classes | 30 |
| Preparation for classes | 60 |
| Reading the indicated literature | 20 |
| Preparation for the assessment | 20 |
| | |
| Student workload | Hours |
| | 100 |
| Number of ECTS points | ECTS 6 |

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

| Kod | Treść |
|------------|---|
| AST_K2_K01 | The graduate is ready to critical evaluation of gained knowledge and received content |
| AST_K2_U05 | The graduate can plan and carry out learning independently, understands the need of lifelong learning and is able to inspire and organise the process of learning of other people |
| AST_K2_U06 | The graduate can independently search for professional information and astronomical data, knows the most important astronomical journals and databases, which allows proper selection of sources and information from these sources used to solve complex and unusual research problems |
| AST_K2_W01 | The graduate knows and understands the physical foundations of astronomical phenomena sufficiently enough to describe, study and understand them |
| AST_K2_W02 | The graduate knows and understands in depth selected problems in the scope of advanced astrophysics |
| AST_K2_W04 | The graduate knows and understands in depth modern tools, techniques and methods of observational astronomy |
| AST_K2_W05 | The graduate knows and understands the main development directions and the most recent discoveries in astronomy |