

# Observational Astrophysics – 3<sup>d</sup>-4<sup>th</sup> year (MSc) Physics

Description pilot course (Spring 2022)

Register to: FY3490 Fysikk, spesialpensum (2022 VÅR)

## Course Content:

The goal of the course is to familiarize the students with the instruments, methods and techniques used in modern observational astrophysics.

In the first part of the course, we introduce the basic tools and concepts needed to observe the Universe from the Earth. We review different types of telescopes used to collect light throughout the electromagnetic spectrum, both from space and from the ground. We present detectors designed to precisely measure different properties of the collected photons (time of arrival, energy/frequency/wavelength and angular position in the sky). We then review the main astronomical techniques used to extract such information, with the final goal of determining physical parameters of planets, stars and galaxies.

Sections planned:

- 1. Introduction: observing the Universe from Earth**
- 2. Telescopes: collecting (and focusing) light**
- 3. Detectors: recording (and measuring) light**
- 4. Multi-messenger Astronomy**
- 5. Astronomical Techniques (AstroLAB sessions)**
- 6. Observing Project: Nordic Optical Telescope**

## Learning outcome:

**Knowledge:** Upon successful completion of this course, students should understand the different time and coordinate systems used in astronomy, and learn how the main telescopes and detectors work across the electromagnetic spectrum.

**Skills:** The students should develop data analysis skills applied to astronomical observations. They should master optical photometric and spectroscopic techniques, as well as Fourier techniques applied to astronomical time series.

**General Competence:** The students should learn how to understand and interpret real data from astronomical sources. They should also learn how to design, develop and present a research project working in a team.

## Learning methods and activities:

Lectures and problem sessions (including one session at the planetarium). Hands-on data analysis (Astro-LAB) sessions. Observation project (including one night in April 20-30): optical observations of astronomical sources designed, performed (remotely) and analyzed by the students.

**Evaluation:**

Written exam (50%), observing project (30%) and Astro-LAB (20%). All three must be passed to complete the course. Attendance to the Astro-LAB sessions and observing project is compulsory. When lectures are given English, the exam will be given in English only. The re-sit examination (in August) may be changed from written to oral.

**Recommended previous knowledge:**

Knowledge of physics and mathematics equivalent to about three years study of university physics. FY2450 Astrophysics and TFY4195 Optics, or similar.

**Course materials:**

Astronomy Methods: A Physical Approach to Astronomical Observations. H. Bradt, Cambridge University Press (2003). Astrophysical Techniques. CR Kitchin, Institute of Physics Publishing (2003).

**Schedule:**

Tuesdays 10-12h & Fridays 12-14h.

**Classrooms:**

C4-118 (lectures), D1-102 (lab).

**Course coordinator and lecturer:**

Manuel Linares, [manuel.linares@ntnu.no](mailto:manuel.linares@ntnu.no)

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