Welcome and course introduction

Welcome to our online course 'Imaging in Astronomy'! In the following we would like to give you a brief summary of this course and its structure:

In contrast to other natural scientists, astrophysicists cannot directly experiment with the objects of their interest. With a few exceptions, all knowledge of the physics of objects in the Universe must be obtained from the electromagnetic radiation emitted by them. Besides the analysis of spectra and lightcurves, the investigation of images is therefore one of the most important tools in astrophysics. In addition to images in visible light, imaging instruments are used in all wavelength ranges, i.e., from radio to gamma-rays.
This course is divided into four blocks: Introduction, basic methods of image processing, advanced methods and outlook. The components of these blocks vary depending on the respective content.
The fundamental concept of this online course is the close interaction between the theory as well as tutorials and hands-on exercises using data of ground- and space-based instruments. This happens through the combination of interactive lectures, which cover the theoretical basics, complemented by step-by-step tutorials where the student gets used to data processing, and the implementation and application via Python (JUPYTER Notebooks).
Hands-on exercises are used as learning objective test, which will be corrected by the course supervisor. In addition, frequent learning quizzes throughout the lecture (e.g., multiple-choice tests, sorting tasks, …) provide feedback about personal learning success.
The aim of the course is to provide a basic understanding of imaging methods using examples from modern astronomy with measurements from ground-based telescopes and satellites.
The processing time of this course is 15 weeks.
NOTE: *The registration of the course has to be done online via the VHB-homepage!*
Please also check the informations about dates and deadlines announced by the VHB in the course description. You are requested to ***inform yourself whether and how credit points*** *or certificates of performance for this course* ***will be taken into account*** *by your home university. The examination office at your home university will be happy to answer your questions.*

Students will acquire the following skills:

- Image processing and interpretation using the example of astronomical measurements
- Data reduction and analysis according to current scientific methods
- Mathematical principles of image analysis
- Development and application of algorithms
- Programming basics and application of image processing in Python
- Intensified handling of English as a scientific language
- Independent preparation of a scientifically structured paper (protocol of results)
- Transfer of the methods used in astronomy to other areas

Also, please check out the 'Welcome Video' on the front page to get a guiding tour of our course.

Thanks for participating! Best wishes,
Your supervisor-Team
Marcus Langejahn, Katha Leiter, Annika Kreikenbohm, Paul-Ray Burd, Matthias Kadler, & Joern Wilms

Exercise Guideline

Structure:

- There are 5 exercises for the entire online course 'Imaging in Astronomy'.
- The content of these exercises is coordinated with the lectures and tutorials.
- The exercises are stored in the respective 'Exercise'-folder of each chapter in the form of editable JUPYTER notebooks
  → An introduction on how to access and use the JUPYTER notebooks can be found in the folder 'How-to-start-this-course/**installation-instruction-anaconda**' of this course!
- The content of the exercises is as follows:
  → 50% comprehension questions on the content of the lecture
  → 50% programming tasks based on the content of the tutorials
- **NOTE:** The completion of the exercises is not a prerequisite for the admission to the final exam, but it guarantees a continuous self-monitoring of your individual learning progress and provides an appropriate preparation for the final exam. *Therefore, they are highly recommended!*

Submission/Correction Procedure:

- All exercises are available from the beginning of the course and stored in the respective chapter
- Each exercise has an individual deadline for submission.
  NOTE: Only exercises that were submitted via the submission tool before the end of the deadline will be corrected.
- You can find the individual submission deadlines for all exercises in the 'Exercise Submission timetable'-file at the front page of this course.
  → In this file there is also specified which lecture contents and tutorials are necessary to complete the exercises.
- Your tutor will post a reminder in the forum for announcements one week before each upcoming exercise submission deadline.
- In each chapter, there is a corresponding submission tool for every exercise in order to upload your edited version.
- It is possible to work on the exercises in groups of two. If you plan to do so:
  → **NOTE:** *Prior consultation with the tutor* of this course is a prerequisite!
  → Although it is possible to work together, each student must submit his or her exercise version individually.
- Correction of the exercises:
  → One day after the corresponding submission deadline, a general sample solution will be stored in the 'Exercises' -folder of the respective chapter for all course participants.
  → Within one week, you will receive individual feedback and corrections of the exercise you submitted through the submission tool (feedback file).

Prerequisites for passing the course

The only prerequisite for the final examination is enrollment in the online course.
Continuous monitoring of your learning progress is made possible by regular learning quizzes and exercises during the course. The completion of the listed learning quizzes and exercises is not a prerequisite for admission for the final exam. However, it guarantees a continuous self-monitoring of the individual learning success and provides an appropriate preparation for the final project.
The final project will consist of a report (4-6 pages) in which each student will document the analysis of a data set provided by us. The submission of this report, which records the methods used and the scientific evaluation of the given data, is the basis of the final grade.
The preparation time for the report is 2 weeks. The submission date of the report will be announced by the supervisor in the appropriate forum of this course. An example report will be provided.
For more detailed information plaese check the 'Examination' folder of this course.

Examination modalities

Authorized examiners: Prof. Dr. Matthias Kadler, Prof. Dr. Joern Wilms
Type of exam: Project (report)
Examination material: The project refers to the contents of the online lecture 'Imaging in Astronomy' as well as the accompanying tutorials and exercises.
Examination literature: Online-lecture and the literature listed within (see also the bibliography provided on the front page of this course), as well as tutorials
Number of SWS: 3+1
ECTS credits: 6
Preperation time for the report: 2 weeks
Submission date: Will be announced via course forum

NOTE: *The registration of the exam (report) has to be done at your home institution accordant to its examination formalities! In addition, please write an email to the tutor of the course and Prof. Dr. Matthias Kadler.*