Astronomy Research Exams

The overall goals of the astronomy research exams are to:

- evaluate whether the student is positioned for success in completing their PhD,
- provide an opportunity for a student to assess whether the overall research process is something they wish to pursue, both in terms of their specific project but also whether they wish to pursue their PhD,
- identify areas in which a student should seek growth or outside support (such as taking additional courses, attending summer schools, etc.),
- give constructive feedback to the student, to the advisor, and on the project overall.

The research exams consist of a written report, and an oral presentation which is followed by a question and answer session. The examining committee consists of three faculty members, one of whom is the candidate's research advisor. The exams are given at the end of the summer term, or just prior to the start of the fall term.

Students who have completed their first or second year will prepare a written report (in the style of a refereed paper) which provides an introduction to their research project, the methods/observations/data that were used in the research and a summary of the key results of their research. For the first year exam, it is expected that this report will be approximately 8 pages in length (single spaced, excluding the reference list). For the second year exam, it is expected that the report will be 10-12 pages in length (single spaced, excluding the reference list). This written document must be given to the examining committee a minimum of 3 working days prior to the oral presentation.

The oral presentation will follow the general outline of the written report. The presentation should be geared at the level of a beginning graduate student in astronomy. For the first year exam, it is expected that the presentation will be 20-30 minutes in length (without questions), while for the second year exam, the presentation is expected to be 30-40 minutes in length. The presentations are open to all members of the astronomy group. At the end of the presentation, there will be a time for general questions from the audience.

After the general questions have finished, everyone except for the examination student and the examining committee will leave the room and examining committee will question the student. For the first year exam, questions will focus on the research project and basic astronomical knowledge in the sub-field of the research project. For the second year exam, questions will be on the research and its broader context (including the history of the topic, motivation for the current research and the current status in the field). Typical lengths of this session will be $20 - 40$ minutes for the first year exam, and $30 - 50$ minutes for the second year exam.

After the committee questions are completed, the student will leave the room and the examining committee will discuss the student's performance and assign a consensus grade, using the rubric given below. During this discussion committee members will provide feedback to the candidate's advisor. Once a consensus grade has been determined, the student will be invited back into the room, where they are given their grade and a brief overview of the key feedback points. In the next week, the student will meet individually with their research advisor to discuss the committee feedback in more detail. A student who receives a failing grade will have to leave the program at the end of the fall term. A student who receives a Low Pass in the first year research exam will be provided with specific guidance from the committee on what areas they must improve upon. Such a student will need to obtain a Pass or higher in their subsequent research courses to maintain good standing in the program.

First Year Exam Rubric

Criteria	Fail	Low Pass	Pass
Scientific Knowledge	Student's knowledge of the research field is poor.	Some deficiencies, but has basic understanding of the research field.	Possesses good knowledge of the research field and on track for PhD level research.
Research Skills	Unable to perform research at a basic level. Has not acquired the skills required for the project.	Student took a long time to learn new skills. Often, work is lacking in scientific accuracy.	Student was able to learn new skills in a reasonable amount of time and produced accurate results.
Level and Quality of Research	The level and quality of research did not surpas that expected of a project in a single course.	The level and quality of research were adequate, but some results may be flawed.	Fullfilled the goals of the research project and obtained reliable results.
Student Motivation	Periods of absence without reason. Student was not interested in research.	Completed project with minimum effort, and showed little interest. Time spent on research barely sufficient.	Consistently worked on research and demonstrated an interest in research. Made use of advice and criticism.
Written Report	Key figures or tables are missing or unclear. Vague and imprecise writing which is difficult to follow. Many grammatical errors.	All results are presented, but lacking coherence. Writing can be difficult to follow. Some grammatical errors	Well presented results with good quality figures and tables. Clearly written, in good scientific language.
Presentation	Unstructured, with little coherence. Figures are unclear. Poorly timed.	Reasonably well structured, but some results are difficult to understand. Did not provide wider context.	Well structured, with introduction that provides the wider context, methods/observations/data are described in adequate detail and key results are summarized in an easy to understand manner.
Journal Club	Rarely attended journal club.	Attended journal club most of the time.	Nearly always attended journal club and was an active participant.

The final overall grade will be based upon combining these individual grades. Students who receive a fail in two of more categories will Fail the exam. Students who receive a low pass in two or more categories, or a single fail, will receive a Low Pass.

Rubric modified from the Leiden Observatory Master Research Project Assessment Form.

Second Year Exam Rubric

Criteria	Fail	Pass
Scientific Knowledge	Student's knowledge of the research field is poor.	Possesses good knowledge of the research field, including its history and motivation for current research. On track for PhD level research.
Research Skills	Student took a long time to learn new skills, or has not acquired the skills required for research. Often, work is lacking in scientific accuracy.	Student was able to learn new skills in a reasonable amount of time and produced accurate results.
Level and Quality of Research	The level and quality of research were inadequate, and some results may be flawed.	Fullfilled the goals of the research project and obtained reliable results.
Student Motivation	Showed little interest, and put in minimum effort. Time spent on research insufficient, or barely sufficient.	Consistently worked on research and demonstrated an interest in research. Made use of advice and criticism.
Written Report	Results are presented, but lacking coherence. Vague and imprecise writing which can be difficult to follow. Some grammatical errors.	Well presented results with good quality figures and tables. Clearly written, in good scientific language.
Presentation	Unstructured, with little coherence. Figures/explanations are unclear. Poorly timed. Did not provide wider context.	Well structured, with introduction that provides the wider context, methods/observations/data are described in adequate detail and key results are summarized in an easy to understand manner.
Journal Club	Attended journal club less than 70% of the time with few, if any excused absences.	Nearly always attended journal club and was an active participant.

The final overall grade will be based upon combining these individual grades. Students who receive a fail in two of more categories will Fail the exam.

Students who have received a positive referee's report on a first author manuscript based upon a research project at Dartmouth will Pass the exam.

Rubric modified from the Leiden Observatory Master Research Project Assessment Form.