

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

EP.11.21

Office of the Provost and Vice Chancellor
for Academic Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820



January 5, 2011

Abbas Aminmansour, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Aminmansour:

Enclosed is a copy of a proposal from the College of Liberal Arts and Sciences to revise the Ph.D. in Astronomy

This proposal has been approved by the Committee on Courses and Curricula in the College of Liberal Arts & Sciences and the Graduate College Executive Committee. It now requires Senate review.

Sincerely,

A handwritten signature in cursive script that reads "Kristi A. Kuntz".

Kristi A. Kuntz
Assistant Provost

KAK/njh

Enclosures

c: Y. Chu
L. Looney
A. Mester

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN



Graduate College
204 Coble Hall, MC-322
801 South Wright Street
Champaign, IL 61820-6210
www.grad.illinois.edu

November 30, 2010

Kristi Kuntz
Assistant Provost
Office of the Provost
207 Swanlund, MC-304

Dear Kristi:

Enclosed are two proposals entitled "Revision to the M.S. in Astronomy" and "Revision to the Ph.D. in Astronomy." The Graduate College Executive Committee did vote unanimously to approve both of them.

We send them to you now for further review.

Sincerely,

Andrea Golato
Associate Dean, Graduate College

Enclosure

cc: Y. Chu
L. Looney
M. Lowry
A. Mester
P. Santic

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Office of the Dean
College of Liberal Arts and Sciences
294 Lincoln Hall
702 South Wright Street
Urbana, IL 61801-3631



RECEIVED
OCT 20 2010
GRADUATE COLLEGE

October 19, 2010

Andrea Golato
Associate Dean
Graduate College
204 Coble Hall MC-322

Dear Dean Golato:

The Committee on Courses and Curricula, on behalf of the Dean's Cabinet, and Executive Committee has voted to approve the following proposals:

Revision to the M.S. in Astronomy
Revision to the Ph.D. in Astronomy

Please address all correspondence concerning these proposals to me. The department is requesting a proposed effective date of Fall 2011.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Ann M. Mester'.

Ann M. Mester
Associate Dean

enclosures

C: Professor Leslie Looney
Professor You-Hua Chu



Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE: Revised Ph.D. of Astronomy, in the Department of Astronomy,
College of Liberal Arts & Sciences

SPONSOR: Leslie W. Looney, Associate Professor of Astronomy, 244-3615, lwlo@illinois.edu

COLLEGE CONTACT: Ann Mester, Associate Dean, College of Liberal Arts & Sciences,
333-6622, mester@illinois.edu

BRIEF DESCRIPTION: The following changes are proposed for the Ph.D. curriculum in
Astronomy:

1. Institute a new 4-section placement exam for incoming graduate students. Each section is based on material from the Department of Astronomy's four advanced-undergraduate level survey of astrophysics, ASTR 404, 405, 406, and 414. If a student fails a section of the exam, they are expected to take the appropriate 400-level course to demonstrate proficiency with a B or better grade in the course. This placement exam replaces the current qualifying exam for the Ph.D. in Astronomy.
2. Change the required "core" classes of the Ph.D. curriculum. Currently, the Ph.D. curriculum has three core classes, ASTR 502 (Astrophysical Dynamics), 503 (Observational Astronomy), and 504 (Theoretical Stellar Physics). This revision will make ASTR 503 and 504 elective classes and make ASTR 501 (Radiative Processes, a newly created course) and ASTR 502 the new "core" of the Ph.D. curriculum.
3. Reduce the total number of formal lecture courses required for a graduate student to advance to candidacy to 24 hours (i.e. 8 courses), plus demonstrated proficiency of the four 400-level courses (404, 405, 406, and 414). Up to 8 hours of the 24 hours, may be in 401, 404, 405, 406, or 414 courses. The "cognate course" rules will also be simplified. Instead of a list of specific non-ASTR elective courses that can be taken, students will be required to take a minimum number of hours in the Department of Astronomy. The department will ensure that scheduled astronomy electives will not conflict with astrophysics courses offered by the Physics Department.
4. This revision is being proposed concurrently with the addition of a suite of graduate-level elective courses to the course catalog. These courses are designed as research-level courses, intended to prepare graduate students to conduct research in the subfield. ASTR 503 and 504 will be on the list of these research-level electives.

JUSTIFICATION:

1. Many incoming graduate students come from undergraduate programs without a large astronomy program (often just a few courses in the Physics curriculum). This leaves these students with potentially large gaps in their undergraduate preparation in astrophysics. The new placement exam assesses students' background at the advanced undergraduate level and provides students recommendations for courses to take to complete their background. The faculty have decided a placement exam to identify incoming graduate student weaknesses is more beneficial to the students than a high-stakes qualifying exam.
2. The Department of Astronomy's research focus has grown to include a strong focus on cosmology (observational, theoretical, and computational). Recognizing this growth means that ASTR 503 and 504 are not appropriate for every graduate student. The Department has revised ASTR 502 to reflect the modern research topics of astrophysical dynamics and has created a new core course, ASTR 501, in radiative processes, a course that is core-building for astronomy graduate students but has been missing from our curriculum. These base courses are meant to strengthen a student's understanding of fundamental astronomy issues, but they are not required for elective courses. However, students with the additional background will be at an advantage in the elective courses.
3. Reducing the number of hours of formal coursework from 11 courses (44 credit hours) to 8 courses (32 credit hours) brings the requirements for a Ph.D. in Astronomy to a comparable level with astronomy programs at peer institutions (See Appendix A). Easing the restrictions on courses taken outside of the unit allows for students to take courses offered by other departments that benefit their education (e.g., particle astrophysics students taking quantum mechanics in Physics, computational astrophysics students taking Computational Science and Engineering courses, etc..)
4. The Astronomy Department will offer, on an every-other-year basis, the following research-level electives for graduate students (additional graduate-level courses are offered as cross-lists from Physics and Chemistry, i.e., PHYS/ASTR 515, 516, 540, 541 and CHEM/ASTR 450, 451). See Appendix B for information on staffing the electives.
 - ASTR 503 – Observational Astronomy
 - ASTR 504 – Theoretical Stellar Physics
 - ASTR 505 – Star Formation
 - ASTR 506 – Galaxies
 - ASTR 507 – Cosmology
 - ASTR 510 – Computational Astrophysics

BUDGETARY AND STAFF IMPLICATIONS:

- a. Additional staff and dollars needed – No additional staff will be needed. The department currently teaches 2 graduate-level courses per semester (not counting cross-listed courses). That will continue under this curriculum revision.
- b. Internal reallocations (e.g., change in class size, teaching loads, student-faculty ratio, etc.) – No changes in class sizes or teaching loads are anticipated. The new electives have each been “piloted” more than once as seminar courses (ASTR 596) to refine each course's syllabus and test demand.
- c. Effect on course enrollment in other units and explanations of discussions with representatives of those departments. – No changes are anticipated.
- d. Impact on the University Library – No impact anticipated.
- e. Impact on computer use, laboratory use, equipment, etc. – No impact anticipated.

DESIRED EFFECTIVE DATE: Fall 2011

STATEMENT FOR PROGRAMS OF STUDY CATALOG:

Doctor of Philosophy

Required Courses:	Required Hours – Entering with approved M.S./M.A. degree	Required Hours – Entering with B.S./B.A. degree*
Formal Coursework:		
ASTR 501, ASTR 502	8 ¹	8
Additional formal coursework (excluding thesis research, non-thesis research, and independent study credit hours, e.g., ASTR 599, ASTR 590)	0	24
Of the additional coursework, the minimum number of hours in the unit (excluding thesis research, non-thesis research, and independent study credit hours)		8
Of the additional coursework, the minimum number of 500-level hours (excluding thesis research, non-thesis research, and independent study credit hours)		8 (4 in the unit)
Based on Placement Exam results, students may be required to complete ASTR 404, 405, 406, and/or 414 during their first year. A maximum of 8 hours of these courses may be applied to the degree.	Max 8	Max 8
Research/Project/Independent Study Hours (e.g., ASTR 590; min/max applied toward degree):	4-24	4-32
Thesis Hours Required (min/max applied toward degree):	32-52	32-60
Total Hours	64	96
Other Requirements:*		
Minimum GPA	3.0	3.0
Masters Degree Required Before Admission to PhD?		No
Qualifying Exam Required	No	No
Preliminary Exam Required	Yes	Yes
Final Exam/Dissertation Defense Required	Yes/	Yes
Dissertation Deposit Required	Yes	Yes

1. Students entering with an approved M.A. or M.S. degree may proficiency out of ASTR 501 and 502 with departmental approval. Other 500-level graduate courses must be taken in the unit for substitute credit hours.

Demonstrated Proficiency in Astronomy (ASTR 404, 405, 406, and 414)

Students must show proficiency in the four courses by one of the following options:

- A. Pass the appropriate section of the placement exam (four sections aligned to the four courses), which is offered at the start of every Fall semester. A student can petition to take the exam once more the following year. The decision on petition approval by the graduate advisor will depend on the student's background and proficiency plan.
- B. Pass the course with a B grade or better.
- C. Students who have had an equivalent course at other institutions (B grade or better) may petition for those courses to count as proficiency.

First Summer Research Project (4 hours)

During the first summer in residence, each student will enroll in ASTR 590 (Independent Study) and will complete a research project with an Astronomy Department faculty member. A paper reporting the results is required, which must be prepared in scientific journal style and approved by the faculty member.

Preliminary Examination


Ph.D. Preliminary Examination consists of a written preliminary paper on the Ph.D. research topic and an oral examination. It must be passed by the end of the third year of study.

Dissertation/Final Examination

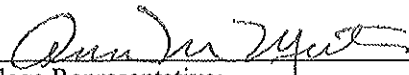
Completion of an original research project culminating in a dissertation publishable in whole or in part is required. The final examination is a defense of the doctoral dissertation.

CLEARANCES: (Clearances should include signatures and dates of approval) - - These signatures must appear on a separate sheet. If multiple departments or colleges, add lines.)

Signatures:


Unit Representative: LESLIE LOONEY, Curriculum Committee chair, Astronomy

SEPT 19 2010
Date:


College Representative:

10/19/10
Date:


Graduate College Representative:

11/30/10
Date:

Provost Representative:

Date:

Educational Policy Committee Representative:

Date:

Appendix A: Degree Requirement Comparisons

Current Astronomy PhD Course Requirements at Illinois

- 11 courses required, maximum of 2 in Physics (or other approved cognate courses), plus a 1st summer research project, and a qualifying exam.
- 3 required courses: Theory Diffuse Matter Dynamics, Observation Astronomy, Theoretical Stellar Physics
- 6 numbered courses (all cross-lists): Astrochemistry, Astrochemistry Lab, General Relativity I, General Relativity II, Astrophysics, Physics of Compact Objects
- Other electives offered as “Seminar in Special Topics”.

Proposed Astronomy PhD Course Requirements at Illinois

- Demonstrated proficiency in general Astronomy topics (ASTR 404, 405, 406, and 414).
- 8 courses required, minimum of 4 in Astronomy, plus a 1st summer research project.
- 2 required courses: Radiative Processes, Astrophysical Dynamics
- 6 numbered electives: Observational Astronomy, Theoretical Stellar Physics, Star Formation, Galaxies, Cosmology, Computational Astrophysics
- 6 numbered cross-lists with Physics or Chemistry: Astrochemistry, Astrochemistry Lab, General Relativity I, General Relativity II, Astrophysics, Physics of Compact Objects

Astronomy PhD Course Requirements at Peer Institutions

University of Maryland:

- 10 courses required, 6 in Astronomy and at least 1 in Physics, plus a 2nd year project, and a 3rd year qualifying exam.
- 9 numbered Courses: Radiative Processes, Computational Astrophysics, Galaxies, Planetary Science, Astronomical Instrumentation and Techniques, Stellar Structure and Evolution, Cosmology, Interstellar Medium and Gas Dynamics, High Energy Astrophysics
- References:
 - <http://www.astro.umd.edu/graduate/gradcourses.html>
 - <http://www.astro.umd.edu/graduate/pdf/PhD.pdf>
 - <http://www.astro.umd.edu/graduate/pdf/AppendixA.pdf>
 - <http://www.astro.umd.edu/graduate/pdf/AppendixB.pdf>

University of Michigan:

- 8-9 courses required, all 7 Astronomy courses, plus a 3rd year qualifying exam.
- 7 numbered Courses: Modern Astronomical Techniques, The Structure and Content of Galaxies, The Extragalactic Universe, Astrophysics of the Interstellar Medium, Stellar Astrophysics I, Stellar Astrophysics II, The High Energy Universe
- Reference: <http://www.astro.lsa.umich.edu/grad/coursework.php>

University of Texas:

- 9 courses, >6 in Astronomy classes plus a 3rd year oral qualifying exam.
- 18 numbered courses: Radioactive Processes and Radiative Transfer, Theoretical Astrophysics, Gravitational Dynamics, Astrophysical Gas Dynamics, Stellar Astronomy, Stellar Atmospheres, Stellar Structure and Evolution, Current Studies in Astronomy for Teachers, Extragalactic Astronomy, Properties of Galaxies, Dynamical Astronomy, Mathematical Techniques in Astronomy, Optical Techniques in Astronomy, Observing Techniques in Astronomy, Astronomical Instrumentation, Survey of the Interstellar Medium, Elements of Cosmology, Supervised Teaching in Astronomy
- Reference: <http://registrar.utexas.edu/catalogs/grad09-11/ch04/ns/grad09.ast.crs.html>

Harvard University:

- Placement exam passed or take 1 undergraduate course. Plus 1 course in Graduate Quantum or GR. And finally, 5 core astronomy classes plus one elective course.
- 5 core courses (half semester): Stellar and Planetary Astrophysics, Radiative Processes in Astrophysics (tech an undergrad course), Interstellar Medium and Star Formation, Galaxies and Dynamics, Cosmology.
- 6 other courses (half semester): Radio Astronomy, High Energy Astrophysics, Solar System Dynamics, Formation of Stars and Planets, Quantum Mechanics for Astrophysics, Atomic and Molecular Astrophysics
- References:
 - <http://webdocs.registrar.fas.harvard.edu/courses/Astronomy.html>
 - <http://www.cfa.harvard.edu/ast/acad/grad.html#dept>
 - <http://www.cfa.harvard.edu/ast/acad/gradcourse1.html>

Princeton University:

- 1 graduate course per semester for the first 2 years. Oral qualifier at the end of the second year on 4 student selected topic from the courses. Plus attend graduate seminars (every students presents a talk on a topic) every semester except their last semester.
- 5 courses: Stellar Systems, Extragalactic Astronomy, Stellar Structure, High-energy Astrophysics, Diffuse Matter in Space
- References:
 - <http://www.princeton.edu/astro/graduate/overview/>
 - <http://www.princeton.edu/astro/graduate/current-courses/>

California Institute of Technology:

- Placement exam of undergrad physics courses or take them.
- 7 astronomy courses plus 4 physics courses.
- 13 Courses (some geology really): Radiative Processes, Astronomical Measurements and Instrumentation, Structure and Evolution of Stars, Structure and Dynamics of Galaxies, High-Energy Astrophysics, Interstellar Medium, Cosmology and Galaxy Formation, Atomic and Molecular Processes in Astronomy and Planetary Sciences, The Formation and Evolution of Planetary Systems, Planetary Physics, Planetary Evolution and Habitability, Extragalactic Astronomy, Extrasolar Planets and Stellar Seismology, Element Abundances from the Big Bang to the Present

- References:
 - http://www.astro.caltech.edu/~george/option/Catalog_Ay_grad.pdf
 - <http://pr.caltech.edu/catalog/courses/listing/ay.html>

University of Chicago:

- 9 courses in the first year (6 of which are astronomy), a 2nd year qualifying exam (on 1st year courses and advanced undergrad), then 8 more electives, four of which must be astronomy
- 6 Core courses: Astrophysics I, Radiative Processes in Astrophysics, Astrophysics II, Radiation Measurements in Astrophysics, Astrophysics III, Astrophysics IV
- 9 Elective courses: Extragalactic Studies, Dynamics I (Fluids), Dynamics II (Particles), Relativistic Astrophysics, Cosmology, Computational Astrophysics, Statistical Methods in Astrophysics, Interstellar Matter, History of Astronomy
- Reference: <http://astro.uchicago.edu/gradprogram/index.shtml>

University of California, Berkeley:

- 6 courses, 3 of which from astronomy, 3rd year oral qualifying exam (3 student chosen subfields)
- 13 courses: Radiative Processes in Astronomy, Astrophysical Fluid Dynamics, Astrophysical Techniques, Numerical Techniques in Astronomy, Interstellar Matter, Radiative Astrophysics: Stars, Disks, and Winds, Stellar Dynamics and Galactic Structure, Extragalactic Astronomy and Physical Cosmology, Solar System Astrophysics, Stellar Structure and Evolution, High Energy Astrophysics, Computational Astrophysics, Plasma Astrophysics
- Reference: <http://astro.berkeley.edu/academics/graduate/requirements.html#courses>

Appendix B: New Graduate Level Course Staffing

New core courses

This proposal changes the Astronomy graduate program “core courses” to two courses, ASTR 501 (Radiative Processes) and ASTR 502 (Astrophysical Dynamics). These two core courses will be taught every other year. Possible instructors include:

- ASTR 501: Gammie, Fields, Kemball, Mouschovias, Wong
- ASTR 502: Brunner, Fields, Gammie, Ricker, Mouschovias, Wong

Graduate level electives

The main reasons for adding these courses is to guarantee that classes will be taught regularly and to advertise our research interests to prospective graduate students. The courses are research level classes, and should reflect the diversity of research interests in the Department. As they must be taught regularly, more than 2 professors need to be able to teach each listed course.

- ASTR 503 (Observational Astronomy): Brunner, Chu, Kemball, Looney, Sutton, Thompson, Wong
- ASTR 504 (Theoretical Stellar Physics): Gammie, Mouschovias, Ricker
- ASTR 505 (Star Formation): Chu, Gammie, Looney, Kemball, Mouschovias, Sutton, Thompson, Wong
- ASTR 506 (Galaxies): Brunner, Chu, Fields, Ricker, Thompson, Wong
- ASTR 507 (Cosmology): Brunner, Fields, Ricker
- ASTR 510 (Computational Astrophysics): Brunner, Gammie, Mouschovias, Ricker

Doctor of Philosophy

CURRENT		PROPOSED			
Required Courses	Required Hours-Entering with approved M.A./M.S. degree	Required Hours-Entering with approved B.A./B.S. degree	Required Courses	Required Hours-Entering with approved M.A./M.S. degree	Required Hours-Entering with approved B.A./B.S. degree
ASTR 502, 503, 504, and 590	16	16	ASTR 501 and 502 ¹	8	8
ASTR graduate courses (up to 8 hours of approved cognate, non-ASTR graduate courses may be substituted)	0	32	Additional formal coursework at the 500-level in ASTR (excluding thesis research, non-thesis research, and independent study, e.g. ASTR 590, ASTR 599)		4
			Additional formal coursework (excluding thesis research, non-thesis research, and independent study, e.g. ASTR 590, ASTR 599)		20 (4 in ASTR and 4 at the 500-level)
			Based on Placement Exam results, students may be required to complete ASTR 404, 405, 406 and/or 416 during their first semester. A maximum of 8 hours of these courses, in which a grade of B or higher is earned, may be applied to the degree.	Max 8	Max 8
Research/Project/Independent Study Hours (min/max applied toward degree):	4-20	4-20	Research/Project/Independent Study Hours (min/max applied toward degree):	4-24	4-32
Thesis Hours Required ASTR 599 (min/max applied toward degree):	32-48	32-48	Thesis Hours Required ASTR 599 (min/max applied toward degree):	32-52	32-60
Total Hours	64	96	Total Hours	64	96

Minimum Hours Overall Required Within the Unit:	48	72		
Minimum 500-level Hours Required Overall:	48	48		
Other Requirements:*				
Minimum GPA:	3.0	3.0	3.0	3.0
Masters Degree Required for Admission to PhD?	No	No	No	No
Qualifying Exam Required	Yes	Yes	No	No
Preliminary Exam Required	Yes	Yes	Yes	Yes
Final Exam/Defense Required	Yes	Yes	Yes	Yes
Dissertation Deposit Required	Yes	Yes	Yes	Yes

1. Students entering with an approved M.A. or M.S. degree may proficiency out of ASTR 501 and 502 with departmental approval. Other ASTR graduate courses at the 500-level must be taken for substitute credit hours.

Insert Demonstrated Proficiency..., Research Project, Prelim and Final text from original proposal

Students may add a graduate concentration in Astrochemistry.