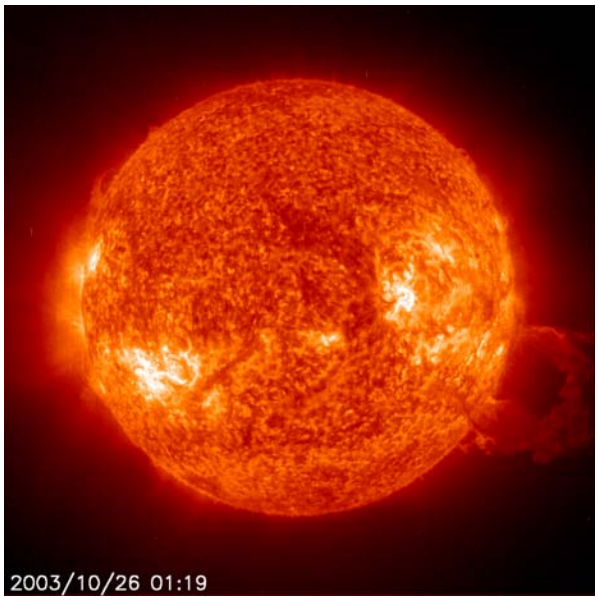
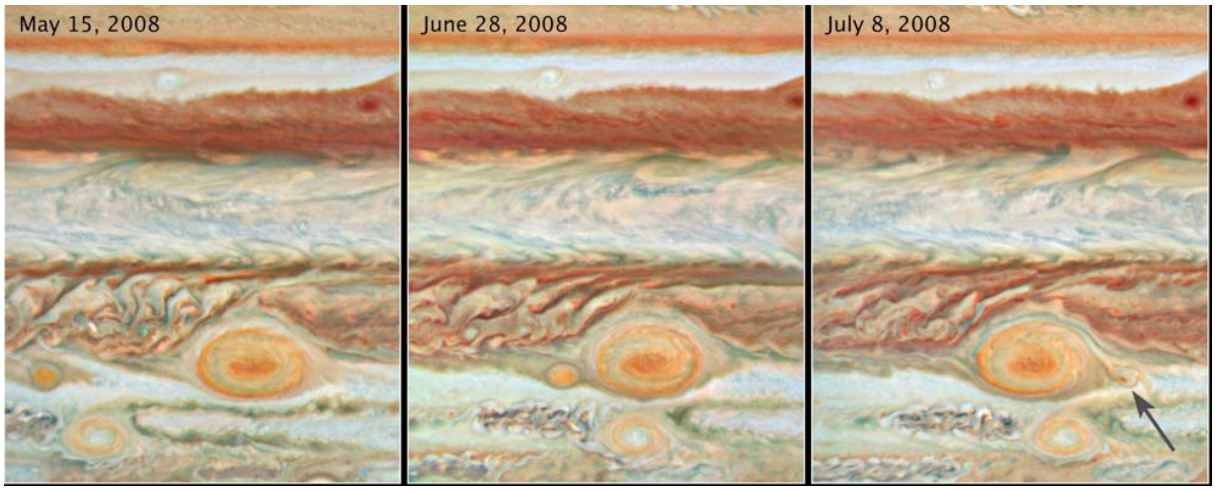
NEW MEXICO STATE UNIVERSITY

DEPARTMENT OF ASTRONOMY

ACADEMIC REQUIREMENTS AND PROCEDURES

2008-2009





OVERVIEW

Welcome to the NMSU Department of Astronomy. You are part of a vigorous, exciting program of research and education in Astronomy and Astrophysics, covering a broad range of interests, from giant planets and extra-solar planets, to cosmology. With the ARC 3.5-m and NMSU 1-m telescopes at the Apache Point Observatory, as well as the Sloan 2.5 meter telescope, we offer exciting opportunities for observational projects. These telescopes combined with the National Solar Observatory at Sacramento Peak, the National Radio Astronomy Observatory near Socorro, NM, the Los Alamos and Sandia National Laboratories, Kirtland Air Force Base, Kitt Peak National Observatory, as well as the in-house NASA Planetary Data System Atmospheres data archive Node, offer excellent opportunities for research on the MS and Ph.D. levels.

***Your primary goal as a Graduate Student in the NMSU Astronomy program is to learn how to conduct research and how to convey the results of that research to other scientists via publications and presentations, and to students via teaching*. The skills that you will learn along the way, including problem definition and problem solving, working in groups, teaching, and making presentations on your research, will be of benefit to you in a variety of possible careers, be they in astronomy or in another area. There are many steps along the way to obtaining your MS or Ph.D. in science. This guide is intended to help you through the procedures required by NMSU to achieve an advanced degree in Astronomy. You should read it carefully and then feel free to ask your faculty advisor any questions that arise. This document is constantly evolving, so any comments that you have to improve it would be appreciated.**

The policies and procedures outlined in this guide will be effective for the 2008/2009 entering class. More senior students may choose to follow these guidelines or those given to them upon entrance into the program.

Jim Murphy
Department Head
August 21, 2008

FACULTY AND POSTDOCTORAL FELLOWS

For the 2008/2009 academic year, there are thirteen faculty, one emeritus professor, four research staff, two professional office staff, twenty-seven Apache Point Observatory staff, and thirty-one graduate students in the Astronomy Department. In addition, there are twenty-six adjunct faculty affiliated with the department from various other institutions, and we typically have numerous visitors throughout the year. Please feel free to talk with any and all of them on a regular basis. We are here to help you through your course work and to advise you on your research. Below, the names and research areas of our faculty are listed. If you have an interest in one of the research areas of these individuals, seek him/her out and begin discussions about her/his field and possible research problems. We encourage you to start working with the faculty as soon as possible on problems of interest in research.

Faculty and Research Staff

Kurt Anderson - Apache Point Observatory Site Director; Galaxy Morphology, Active Galactic Nuclei, Stellar Evolution.

Reta Beebe - Planetary atmospheres; HST, Voyager, and Galileo space-based observations; Director of the Planetary Data System Atmospheres node

Nancy Chanover - Planetary Atmospheres, Instruments, PDS Atmospheres Node

Chris Churchill – Quasar Absorption Lines, Intergalactic Medium

Tom Harrison - High Energy Astrophysics; Optical Counter Parts of Gamma-Ray Sources; Novae; Cataclysmic Variables

Jon Holtzman – Stellar Population in Galaxies; Star Formation Histories in Galaxies; Globular Clusters, Instrumentation.

Jason Jackiewicz – Helioseismology, Solar Physics, Space Weather, Condensed matter physics

Anatoly Klypin - Cosmology and Numerical Simulations of Structures in the Universe, Galaxy Formation.

Bernard McNamara - Stellar Astrometry; Stellar Variability; Ground-Based Observations of High Energy Objects; Binary Stars.

Jim Murphy - Atmospheric Science, Martian Atmosphere, Mars Exploration Missions

Nicole Vogt - High Redshift Galaxies, Galaxy Evolution

René Walterbos - The Interstellar Medium of External Galaxies, Galaxy Evolution, Massive Stellar Populations, Galactic Structure.

William Webber – Cosmic Ray Astrophysics

Emeritus Professor

Herbert Beebe - Solar and Stellar Atmospheres; Solar Astrophysics, History of the NMSU Astronomy Department, Clyde Tombaugh Archive.

Research Associates

Dave Glenar – Planetary Atmospheres
Paul Higbie –Space and Cosmic Ray Astrophysics
Lyle Huber – Planetary Atmospheres Data Node
Joni Johnson – Cataclysmic Variables, PDS Atmospheres Node

Department Staff

Lorenza Sanchez - Accountant
Ofelia Ruiz – Administrative Secretary

Adjunct (Affiliate) Professors

Krzysztof Belczynski (Los Alamos National Lab)
Jon Brinkmann (Apache Point Observatory)
Tim Dowling (University of Louisville)
Stefan Gottlober (Astrophysical Institute, Potsdam)
Michael Harvanek (Apache Point Observatory)
Paul Higbie (New Mexico State University)
Steve Howell (WIYN Observatory)
John J. Keady (Los Alamos National Laboratory, Los Alamos)
Steve Keil (National Solar Observatory, Sunspot)
Jurek Krzesinski (Apache Point Observatory)
Mark Marley (Ames NASA Research Center)
Donald F. Neidig (National Solar Observatory, Sunspot)
Sally Oey (University of Washington)
Frazer Owen (National Radio Astronomy Observatory, Socorro)
Davor Palle (Institute Ruder Boskovic, Zagreb, Croatia)
Kaike Pan (Apache Point Observatory)
Francisco Prada (Centro Astronomico Hispano-Aleman, Spain)
Richard R. Radick (National Solar Observatory, Sunspot)
George Rhee (University of Nevada Las Vegas)
Axel Schwope (Technical University, Berlin)
Stephanie Snedden (Apache Point Observatory, Sunspot)
William L. Stein (Physical Science Lab, NMSU)
John Stocke (University of Colorado, Boulder)
Paula Szkody (University of Washington)
James Ulvestadt (NRAO, Socorro)
Tom Vestrand (Los Alamos National Laboratory)

DEPARTMENTAL PROCEDURES

The Astronomy Building

Your primary base of operation will be the Astronomy Building. All students are assigned an office, and given keys to their office and the outside doors by the Department Administrative Secretary, Ofelia Ruiz. Please get to know Ofelia and respect her rules for the building.

In addition to the offices and the departmental office in Room 100, there are several other rooms in the Astronomy Building with which you should become acquainted.

The copying machine is located in Room 116 (across the hall from the Department office). Code numbers are needed to operate the copying machine, for use of making personal copies, Astro class/lab copies and research copies, see Ofelia for code numbers. Please note personal copies are $0.06 each, you will be billed monthly.

Across from the mailboxes is the coffee and snacks room. Please keep it clean! There is a charge of $3.00/month for coffee and tea for those who drink it (please see Ofelia for details).

The primary computer facilities for the department are located in Rooms 118 and 217 (see below).

The Astronomy Conference Room is in Room 119; it is the site of graduate Astronomy classes and noontime seminars.

The department library, containing a variety of Astronomy journals and preprints, is located in Room 207.

Building security is an issue with which we must all be concerned. *After 5:00 pm and on the weekends, the Astronomy Building is to remain locked.* In these off hours, please close and lock the library and computer room doors before leaving the building. Your care and attention to building security will prevent any loss of personal or department property.

The Astronomy department will be your home for the next few years. Please treat it with care and respect. Over the past years, the building has been completely remodeled, and we wish to keep it looking good for years to come. So, please do not place any taped pictures on the walls. Do not put your feet on the walls. We have tried to place bulletin boards in most of the offices and hallways where you can post appropriate materials.

It is likely that construction of a new elevator at the southeast entrance to the building will be occurring during this 2008-2009 academic year. You will be kept informed about the progress of that effort and any implications that work has upon building usage.

There are several other buildings in proximity to Astronomy with which you should also become familiar. The first is the main library in Branson Hall just to the north of the Astronomy Building. You should acquaint yourself with the generally good Astronomy book and periodical collections there on the third floor. Our regular class and colloquium room is Biology Annex 102. The Biology Annex is located immediately opposite the Astronomy building, to the south.

Campus Observatory and Laboratories

The Tombaugh on-campus observatory is located next to the large student parking lot and neighboring running track just off of Williams Street. The observatory is mainly used for our undergraduate ASTR 105G and 110G labs and other public viewing events. Before using this facility, you are to be trained and checked-out on the equipment by Dr. Tom Harrison.

Most of the ASTR 105G and 110G lab equipment is located in the auxiliary room in the back of Biology Annex 102. This room contains slide, video, and overhead transparency projectors, as well as other lab equipment. These projectors, in particular, are ***never*** permitted to leave Biology Annex 102. Other slide and overhead projectors are available for checkout (for use elsewhere on and off campus) see Ofelia Ruiz in Room 100A.

The Department has an Astronomy slide and video collection in the machine room (Room 110). The slides and videos are available for labs or for public talks that you may give to school groups, etc. *Please return these slides and videos to their proper location immediately following your presentation.* These items are used by many people for different classes, so it is important that you not delay in returning them.

Computers

Over the past several years, the department has acquired a series of advanced Linux computer workstations. All Linux computers in the building are networked through a file server machine. There is a variety of workstations and PC's located within the computer rooms, including a CD-ROM writer. Contact Dr. Jon Holtzman for your computer log-on; please change your password after logging on for the first time.

You should not use any public workstation for over two hours at a time if others are waiting. Please be considerate of your colleagues in use of these consoles. Backups of the disks are performed daily for short files. Incremental tape backups of the Charon disks are done weekly. You can also transfer files to a selected disk area that will be backed up. Ask other department members for details.

Each of these workstations can be used for computations and image processing. Many of these computers run the NOAO image processing package IRAF, the NRAO VLA/VLBA data analysis package AIPS, CfA's PROS software for ROSAT reductions, and ESO's image processing software MIDAS. In addition, the technical word processing packages Tex, LaTex, and WordPerfect, the plotting packages Mongo & Supermongo, and the image processing package IDL are available on these machines. There are manuals available for IRAF, AIPS, PROS, and MIDAS in the back room of the downstairs computer room. A number of La Tex manuals and Unix manuals can be found in the upstairs computer room among the graduate student-bought books. There are also instructions for backing up your files, and use of other software in a binder notebook in the computer machine room. **Please do not reboot any of the computers without first checking with Dr. Jon Holtzman, holtz@nmsu.edu or Dr. Anatoly Klypin, aklypin@nmsu.edu** (via E-Mail or telephone); instructions for rebooting must be

carefully followed. If you have any questions about manuals, please check with Professor Holtzman who is the chair of the department's computer committee.

Department Library

The Astronomy Department maintains a small library in Room 207. All of the most recent Astronomical journals plus recent preprints of papers from institutions around the world can be found here. In addition, the last ten years of the major Astronomy journals, such as the *Astrophysical Journal* and *Astronomy & Astrophysics*, and the last two years of more general science journals, such as *Nature*, are stored in our library. Older issues of most of the science journals can be found in the Branson Hall Library. Also, some of the older volumes of the Astronomy journals can be found in Room 217. Finally, star and galaxy atlases, the Palomar Sky Survey, and the ESO Southern Hemisphere Survey can also be found in the library. CD ROMs containing the digitized POSS I survey, the digitized southern sky survey, ROSAT and Einstein observatories images, etc. are located in the Computer Machine Room.

Books and older journals can be checked out of the Department's library using the check-out sheet. *However, new journals are not to be removed from the library except for copying*. This should be done quickly and the journal should be returned promptly.

Requests for additional books for the main library should be made to Professor Anatoly Klypin and for the Astronomy Department library to Professor Kurt Anderson.

Public Outreach

Most of the monies which support the department are derived from state and federal tax dollars, and thus from residents of the state and country. In return for this support, it is our responsibility to 'give back' our knowledge to the public. The department has a good reputation in the local community for such efforts, and we wish to continue this. As such, you will be expected to become an active member of this outreach program. These outreach activities include presentations to: schools in Las Cruces and the surrounding southern New Mexico communities, local civic groups, local astronomical interest groups, etc.

We expect that each student (and faculty member) will participate in at least two such outreach activities each semester. Local groups will generally approach the department with a request for a speaker on a particular topic. Such inquiries are directed at the current time to Mr. Jeff Coughlin, the current Astronomy Graduate Student Organization (AGSO) Vice-President, who oversees the arranging of speakers to meet specific requests.

An additional outreach activity which each student and faculty member will participate in each year is our monthly Observatory Open House. These events are held on the Friday evening nearest in time to first-quarter moon each month of the academic year. These events, well known and well attended, offer the community the opportunity to view the skies through our 8" and 12"

telescopes here on campus at the Tombaugh observatory. A schedule of participation will be developed at the start of the Fall semester.

While you might feel pressed for time preparing for these outreach activities (we do realize that you are very busy with other activities too), it is most important to convey your enthusiasm for the astronomical work you are involved in. The public in general finds what we do very exciting and interesting (and fun!), and above all else your demonstration of such.

DEPARTMENTAL SEMINARS

Attendance at departmental and university-sponsored seminars is an important component of your educational experience (and will be so during your entire career). The department sponsors several seminar series. While your attendance at these events is not mandatory (except for those first and second year students registered for ASTR 500, discussed below) since no grade is received, ***you are expected to attend whenever possible***. Attendance offers exposure to topics you might not otherwise see, the opportunity to observe what characteristics make for a good or not-so-good seminar presentation (important skills to develop!), and the chance to make professional contacts which could be important in your future. Seminars are well advertised with bulletin board postings and email reminders. Faculty will also 'roam the halls' prior to seminars to remind you as well.

Our most formal series is the **Departmental Colloquia**. These seminars are often presented by visitors to the department, and thus offer insight into work being performed elsewhere in the astronomical / planetary communities. These events are usually scheduled for Friday afternoon's at 3:45 PM in BX102. Coffee, tea, and cookies are usually provided at 3:30 PM in advance of the talk. When a visitor comes to town to present a colloquium, we generally try to arrange for students to spend time with that visitor. This can include a group of students taking the speaker to lunch or dinner.

A less formal but no less important series is our **Pizza Lunch**. This series has as its purpose the opportunity for presentation of new results in a relaxed setting. This can include presentations by departmental visitors, students 'practicing' a talk which they will give at an upcoming conference etc. These sessions begin with 5-10 minutes of discussion on recent topics in the news which we might all not yet be familiar with. One aspect of this series is the pizzas which are delivered prior to each meeting, thus the name Pizza Lunch. Slices of pizza are available at the cost of $1.00 per slice.

ASTR 500, referred to as 'Seminar class', is a 1 credit class in which first and second year students registered each of their first four semesters. This class meets weekly, at which time one of the registered students will present a talk on material covered in an assigned paper. This paper is assigned by the faculty member overseeing Seminar for that semester. Generally, there will be a particular theme for the semester. These seminar presentations are open to the entire department, and faculty and third-year and above students are encouraged to attend and participate in the discussions.

ACADEMIC REQUIREMENTS

The Astronomy Department offers a series of 500 and 600 level Astronomy courses which will provide you with much of the essential background needed for your research. In your first year, you will be taking primarily 500-level classes which will provide you with an overview of astrophysics and observational techniques. The 600 level classes are more specialized and are at a somewhat higher level. You will also be required to take several semesters of ASTR 598 and 600 which will allow you to begin some research with an individual faculty member. In addition, you will be required to take a minimum of 2 graduate level classes in graduate programs other than Astronomy, such as Physics, Electrical Engineering, Mathematics, Geology, Geophysics, Chemistry, etc. These course selections should be made in consultation with faculty advisors and career/research path plans.

Each student enrolled in the PhD Program must pass a qualifying examination/assessment within the first two years at NMSU. This involves a meeting with your committee (initially assigned by the Dept. Head & faculty) to review your progress through the program including class work, research, teaching, Comprehensive written exam (cume) progress, and outreach. In place of a single written comprehensive exam, the Astronomy Department offers a series of monthly written 'cume' exams. You will be required to pass six of these exams within five semesters, and then a two-part oral exam in order to further advance to Ph.D. candidacy. Finally, after completing your dissertation, you will orally defend this work before your committee.

If deficiencies exist in your physics or mathematics background upon entry in to the graduate program, you may be asked to take some undergraduate classes to rectify these deficiencies. Courses taken in such a rectification framework will not count to your graduate degree course requirements. You should plan to review your undergraduate course work with your faculty advisor during your first meeting to decide if some remedial work is required. If so, the time scale for the above examination procedure can be modified.

With the above outline in mind, we now consider the specific details of the academic requirements.

Course Offerings and Requirements

500-Level Classes

The Department of Astronomy offers seven courses at the 500 level in the basic areas and techniques of contemporary Astronomy. Most are 3 credits and some are two-semester sequences. The course numbers and titles are as follows:

ASTR 500 Seminar (1 credit)
ASTR 505/506 Astronomy & Astrophysics I & II
ASTR 515 Stellar Atmospheres
ASTR 535/536 Observational Techniques I & II
ASTR 545 Stellar Spectroscopy

ASTR 565 Stellar Interiors
ASTR 598 Special Research Programs

ASTR 505, 506, and 535 courses are offered every year. All incoming students must take ASTR 505/506 during their first year and ASTR 535 unless they receive a special waiver from their committee (due, for example, to similar courses completed as part of a previous M.S. degree). Astronomy 536, or a suitable alternative, will be offered every other year.

600-Level Classes

Somewhat more advanced and specialized courses on the 600 level (generally 3 credits) are also offered. They include:

ASTR 600 Predissertation Research
ASTR 605 Interstellar Medium
ASTR 610 Radio Astronomy
ASTR 615 Galactic Structure
ASTR 616 Galaxies
ASTR 620 Planetary Science I
ASTR 621 Planetary Science II
ASTR 625 Cosmology
ASTR 675 Star Formation & Stellar Evolution
ASTR 698 Special Topics

ASTR 605, 615, 616, 620, 621, 625, and 675 are typically offered every other year. The remaining 600 level classes are offered on an occasional (as per demand) basis.

Out-of Department Courses

Physics Classes

Astronomy graduate students are required to take two graduate level classes from departments other than Astronomy. Traditionally, these have been in the area of physics, selected from the following list:

PHYS 462 Intermediate Electricity & Magnetism II
PHYS 511 Methods of Theoretical Physics I
PHYS 551 Classical Mechanics (4 credits)
PHYS 554 Quantum Mechanics I / PHYS 555 Quantum Mechanics II
PHYS 562 Electromagnetic Theory (4 credits)
PHYS 571 Advanced Experimental Optics (Lab, 2 credits)
PHYS 576 Advanced Comput. Phys.
PHYS 584 Statistical Mechanics
PHYS 590 Nuclear Physics

Other Physics courses, or courses offered by other departments such as Engineering, Geology, or Math, are also viable as out-of-department courses. A listing of recently taken non-Physics out-of-department courses is shown below. Please discuss with your committee and the department head which out-of-department courses would best meet your needs.

Possible courses students have recently select instead of the traditional physics curriculum:

EE 528 Radiometry and Infrared Detectors
(solid course on detectors and S/N considerations, taught from an engineering standpoint)
EE 577 Fourier Methods in Electro-Optics
CS 579 Introduction to Computational Science
May be an excellent course for students wishing to learn more advanced programming techniques, including algorithm designs, numerical methods, data bases, use of parallel

Additionally, for those students intending to specialize in planetary science, courses taught in the Geology department and Geophysics courses taught in the Physics department should be considered, with input from your faculty advisor.

The NMSU Computer Science Department does offer some 400-level programming language courses (C, C++, etc.). While these courses are generally offered at a level (< 500) below that required of our graduate students, taking these courses as an 'extra' course can be worthwhile since many of the Astronomy graduate courses and certainly student research require knowledge of a programming language.

PhD DEGREE PROGRAM

Summary of Course and Credit Requirements

The **MINIMUM** course and credit-hour requirements of the NMSU Department of Astronomy toward completion of the Ph.D. program are summarized in the following table:

ASTR 500 (Seminar)	4 credits (4 semesters)
ASTR >500 and <598	15 credits (5 courses)
ASTR >600 and <699	12 credits (4 course)
'PHYS' > 500 and < 598 and/or > 600 < 700	6 credits (2 courses)
ASTR 598 (Special Research Programs)	3 credits
ASTR 600 (Pre-dissertation Research)	6 credits
ASTR 700 (Doctoral Dissertation)	18 credits
Minimum Total Credits	64 credits

All students are also expected to attend and participate in the departmental seminars and colloquia during all semesters.

The 'PHYS' course identifier above refers to out-of-department courses deemed by the student and her/his committee to be appropriate to the student's program-of-study.

A maximum of one 3-credit course numbered between 450 and 499 can be applied to the minimum external 'PHYS' (out-of-department) course/credit-hour requirement, but only with the approval of the student's Committee. The course must be numbered 450 or greater to satisfy NMSU Graduate School Requirements.

If a student should successfully petition to be required to have only one 'PHYS'/'out-of-department' course to satisfy their coursework requirement for the Astronomy Ph.D. degree, that 'PHYS/out-of-department' course must have a course number > 500 and must have been taken outside of the Astronomy Department.

'PHYS' or 'out-of-department' courses/credit hours acquired by the student in addition to the minimum required potentially count toward the required ASTR courses/credit hours, but only with the approval of the student's Committee.

Special Cases and Exceptions

The above course requirements are intended for those students entering the Department with a B.A. or B.S. and a typical background in Astronomy and Physics. Some students may have studied Physics or Astronomy at the graduate level at some other institution and / or will enter the program with an M.S. degree. In these circumstances, some of the specific course requirements might be waived upon concurrence of the student's committee. Students in this category must, before the end of their first semester with the Department, establish a special set of course and credit requirements with their committee.

Some entering students might have deficiencies in their academic background which would require their enrollment in advanced level undergraduate courses to remedy these deficiencies. These background or make-up courses must be taken in addition to the basic course requirements of the Department. That is, credits for these courses may not be used to satisfy any part of the Department's course and credit requirements for the Ph.D. program.

Course Sequences

Possible course sequences for three specific discipline 'paths' through the program (Stellar, Extragalactic, or Planetary) are indicated below. These 'paths' meet the minimum requirements as described above with ten (10) formal courses (30 credit hours) during the first two years (and leaving one course for the 3rd year). There are also collectively ten (10) credit hours of ASTR 500, ASTR 598, and ASTR 600 during the first two years, resulting in 40 credit hours (10 credit hours per semester) during the first two years. The eleventh formal course, and at least 3 credit hours of ASTR 600 would be needed in the 3rd year.

Sample EXTRAGALACTIC RESEARCH TRACK Course Selection:

i) ASTR 505 (Astronomy and Astrophysics I; first semester of first year)
ii) ASTR 535 (Observational Techniques I; first semester of first year)
iii) ASTR 506 (Astronomy and Astrophysics II; second semester of first year)
iv) ASTR 605 (Interstellar Medium)
v) ASTR 615 (Galactic Structure)
vi) ASTR 616 (Galaxies)
vii) ASTR 625 (Cosmology)
viii) ASTR 698 (Special Topics: Computational Astrophysics)
ix) Two (2) from among the following:
    a) ASTR 535 (Observational Techniques II)
    b) ASTR 545 (Stellar Spectroscopy)
    c) ASTR 565 (Stellar Interiors)
    d) ASTR 620 (Solar System Astrophysics)
    e) ASTR 698 (Special Topics: Planetary System Formation)
    f) Any other infrequently or newly offered ASTR course

x) Two (2) 'PHYS' courses
xi) Four (4) semesters of ASTR 500
xii) 3 credit hours of ASTR 598
xiii) 3 credit hours of ASTR 600

This suggested EXTRAGALACTIC course assemblage includes one course more than the minimum required. With the expectation that ASTR 598 would be taken during the first two years, at least one traditional course, and possibly two such courses if 3 credits of ASTR 600 are taken during the second year, would remain for the third year. Exactly how the course sequence works out will depend upon when specific courses of interest are offered.

Sample STELLAR RESEARCH TRACK Course Selection:

i) ASTR 505 (Astronomy and Astrophysics I; first semester of first year)
ii) ASTR 535 (Observational Techniques I; first semester of first year)
iii) ASTR 506 (Astronomy and Astrophysics II; second semester of first year)
iv) ASTR 545 (Stellar Spectroscopy)
v) ASTR 565 (Stellar Interiors)
vi) ASTR 605 (Interstellar Medium)
vii) ASTR 698 (Special Topics: computational Astrophysics)
viii) Two (2) from among the following:
    a) ASTR 536 (Observational Techniques II)
    b) ASTR 615 (Galactic Structure)
    c) ASTR 616 (Galaxies)
    d) ASTR 620 (Solar System Astrophysics)
    e) ASTR 698 (Special Topics: Planetary System Formation)
ix) Two (2) 'PHYS' courses
x) Four (4) semester of ASTR 500 (Seminar)
xi) 3 credit hours of ASTR 598 (Special Research Programs)
xii) 3 credit hours of ASTR 600 (Pre-dissertation Research)

This suggested STELLAR course assemblage accounts for 43 credit hours. With the expectation that 3 credits of ASTR 598 and 3 credits of ASTR 600 would be taken during the first two years, one traditional course would be required in the 3rd year. Exactly how the course sequence works out will depend upon when specific courses of interest are offered.

Sample PLANETARY RESEARCH TRACK Course Selection:

i) ASTR 505 (Astronomy and Astrophysics I; first semester of first year)
ii) ASTR 535 (Observational Techniques I; first semester of first year)
iii) ASTR 506 (Astronomy and Astrophysics II; second semester of first year)
iv) ASTR 620 (Planetary Science I)
v) ASTR 621 (Planetary Science II)
vi) ASTR 536 (Observational Techniques II)
vii) ASTR 605 (Interstellar Medium)
viii) Two (2) from among the following:
    a) ASTR 698 (Special Topics; Computational Astrophysics)
    b) ASTR 615 (Galactic Structure)
    c) ASTR 616 (Galaxies)
    d) ASTR 545 (Stellar Spectroscopy)
    e) ASTR 565 (Stellar Interiors)
ix) Two 'PHYS' courses
x) Four (4) semesters of ASTR 500 Seminar
xi) 3 credit hours of ASTR 598 (Special Research Programs)
xii) 3 credit hours of ASTR 600 (Pre-dissertation Research)

This suggested PLANETARY course assemblage accounts for 43 credit hours. With the expectation that 3 credits of ASTR 598 and 3 credits of ASTR 600 would be taken during the first two years, one traditional course would be required in the 3rd year. Exactly how the course sequence works out will depend upon when specific course of interest are offered.

Departmental Examinations for Ph.D. Students

In successfully completing the program leading to a Ph.D. in Astronomy, a student will be formally examined and / or evaluated on three occasions. The first is the **"Qualifying Examination"** which is an evaluation of the student's progress as determined by the faculty. Next is the **"Comprehensive Examination"** which involves written cumulative exams and an oral exam/thesis proposal. This is a major step leading to Ph.D. candidacy. Finally, upon completion of the dissertation work, the student undergoes a **"Final Examination"** which is an oral exam largely concerned with the dissertation itself.

Committee on Studies

Each entering student is assigned a departmental graduate Committee on Studies (consisting of 2 or 3 faculty members), with the Committee Chair member being designated as the student's 'Faculty Advisor'. This committee generally oversees the student's course work and academic performance, and advises the student. The student should meet at the beginning of each semester with the chair of her/his committee for advisement on the course of study. These regular meetings should continue until the student passes all the cumes (see below) and assembles a dissertation committee.

Qualifying Examination

The intent of the Qualifying Examination is to determine whether or not it is in the best interest of the student and the department for the student to proceed with graduate studies in Astronomy. The Department of Astronomy does not give an explicit or formalized qualifying exam. In place of such an exam, the Department substitutes an evaluation of the student by members of the faculty. The Qualifying Exam must be successfully passed by all students wishing to pursue a Ph.D. in Astronomy.

As a part of the qualifying procedure, the student's Committee on Studies will assess the student's academic record, interest, ability, enthusiasm, research efforts, teaching efforts, and performance on the cumulative examinations (see below). A minimum of two 'passed' Cume exams is expected in order for a 'PASS' on the Qualifying exam to be achieved. This Qualifying Exam evaluation will be, in part, based upon the assessments of other members of the faculty. *This evaluation of the student by her/his committee will normally be made following the completion of 12 credit hours of graduate-level course work for students entering with a B.S. or B.A. degree. Evaluation of students entering with an M.S. in Astronomy will normally be made at the end of the student's first semester.*

The student's committee will present to the full faculty of the Department a recommendation as to whether or not the student is qualified to proceed with additional PhD studies. If a majority of the faculty agrees that the student is qualified to proceed with such studies, the student and the Graduate School will be so notified (i.e., the student will be regarded as having "passed" her/his qualifying exam). If the faculty judge it to be in the best interest of the student and of the department, they may recommend that PhD graduate studies in Astronomy be discontinued. In cases in which the student's performance is judged to have been marginal, the faculty may require further written or oral examination of the student. Such further examination will be given by the student's committee.

In the event of additional examination of the student, the Graduate Committee will recommend that either:

1. The Graduate School be notified that the Qualifying Examination has been passed and the student's PhD program of study be filed with the Graduate School; or
2. The decision as to the student's qualification be delayed or deferred one semester; or
3. The student be classified as having NOT passed the qualifying examination.

In the last two instances, the student may ask that the faculty, as a whole, review the decision of the graduate committee.

Comprehensive Examination

The comprehensive exam consists of both written and oral portions. The written portion is given in the form of cumulative exams (see below). To satisfy the requirements for the written portion of the comprehensive exam, the student must pass six of the cumulative examinations. This must be done prior to the oral portion of the exam.

Written Comprehensive "CUME" Exams

The Department will typically administer nine (9) written "CUME" examinations during each academic year. The exams will be two hours in duration and will usually be based upon one or more papers selected from the Astronomical literature. Copies of scientific papers will be provided when appropriate and, usually, no other source material may be consulted. These exams are designed to test the student's knowledge of the literature, the student's academic and research background, and the student's ability to understand and deal with what may be unfamiliar material.

Each "CUME" exam will be written and graded by a single member of the faculty, and after the exam is administered and graded it will be circulated to other members of the faculty (together with the graded papers of students) for their comments. The degree of difficulty will be variable but is intended to test the student at the comprehensive examination level. The exams will be graded on a pass/fail basis. No penalty is imposed for failure to pass a given exam

and students are not required to take any given exam. However, all students are encouraged to take the exams if only to familiarize themselves with the type of questions, etc., and a purposefully skipped exam does count toward the 22 exam opportunities.

It is expected that a student with a B.S. or B.A. will have passed six such CUME exams by the end of her/his fifth semester (during which time 22 CUME exams will have been administered), whereas a student entering with an M.S. in Astronomy should have passed six CUME exams by the end of her/his third semester. If the student does not pass the six CUMES on this time scale, then the student's committee will meet and decide between the following two options:

1. The student will be given a one semester extension to pass the remaining exam(s).
2. The student will be considered to have failed the comprehensive exam.

Under very exceptional circumstances (e.g., illness), the student may petition for a second one-semester extension to complete the six CUME exams if approved by the student's committee.

The CUME exams constitute the written portion of the comprehensive exam. A student will **not** be permitted to take the oral part of the comprehensive exam until six CUME exams have been passed.

Oral Comprehensive Examination

Once the student has satisfied the requirements for the written portion of the comprehensive exam (by passing six CUME exams), it becomes the student's responsibility to form a Dissertation Committee. Once a Dissertation Committee is formed, the student's Committee on Studies is dissolved and the Dissertation Committee will thereafter oversee the student's progress toward a degree. In selecting a Dissertation committee, it is expected that the student will first select an advising professor who will act as committee chairperson for the subsequent oral comprehensive and final examinations, as well as being the principal advisor in the dissertation research. The Dissertation Committee chair must be a member of the NMSU Graduate Faculty. **The dissertation committee must consist of at least three members of the Astronomy faculty (including the Chair) plus one Graduate Faculty member from another NMSU department**. Selection of a faculty member as a member of the dissertation committee requires careful thought on the part of the student, and approval by that faculty member. Also, Ph.D. Astronomers from outside NMSU can be nominated by the candidate for membership on the dissertation committee; the chairperson of the dissertation committee has the responsibility of approving such individuals following the guidelines established by the Graduate School. Such outside (non-NMSU) dissertation committee members do not replace NMSU dissertation committee members. An NMSU Graduate Dean's Representative will be appointed to the dissertation committee by the Dean of the Graduate School. In almost all cases the out-of-department NMSU faculty member on the dissertation committee will serve in this Dean's Representative role. The Dean's Representative must be a member of the NMSU Graduate Faculty. The student is encouraged to consider a Dissertation Committee membership greater in number than the minimum requirement described above.

The student's Dissertation Committee will make a judgment as to when the student is ready to take the oral portion of the comprehensive exam. *Normally, this oral exam will be given within one or two semesters of the completion of the written portion of the comprehensive*.

The comprehensive oral exam will be taken at the convenience of the student and the dissertation committee. *It is the student's obligation to set a date and time satisfactory to all concerned*. The examination consists of two parts described below. The student and her/his committee will determine the order in which these two parts will be administered.

Part 1- ***Dissertation Proposal Colloquium:*** The student will present a colloquium to the entire Astronomy Department of the topic of her/his dissertation. The colloquium will include a discussion of previous research in this field, planned observations and/or theoretical calculations, scientific goals, and the impact of this research on the field. In addition, the student will prepare a written outline (typically 5-10 single-spaced pages long) of the proposed dissertation research for the committee at least one week prior to the colloquium. The student will describe the proposed research in enough detail so that the committee members will be able to judge the appropriateness of the proposed research. Following the colloquium, the student will be questioned by members of the committee concerning detailed background knowledge of the dissertation subject, and observational/theoretical techniques. If the committee views the dissertation proposal as satisfactory, then the student will continue with part 2 of the exam. If two or more committee members believe the proposal is inadequate, the student will be asked to revise the proposal and present the revised version at another meeting of his/her committee.

Part 2- ***General Questioning on Astronomy Course Work***: The members of the dissertation committee together with a representative of the Graduate Dean's office will quiz the student to ascertain her/his knowledge of and familiarity with factual material, techniques, theory, and methods in Astronomy. The exam will cover most of the areas represented by the core Astronomy courses. The level of difficulty and the nature of the subject material are up to the individual questioner.

Final Dissertation Examination

The Ph.D. candidate has up to five (5) years to successfully defend her/his dissertation after passage of the oral comprehensive exam (although two to three years is more typical). Upon completion of the dissertation, the candidate will schedule a final oral examination by his/her committee. Once again, it is the responsibility of the student to schedule this exam on a day and time that is satisfactory to all members of the committee. ***The student will provide copies of the dissertation to all members of his/her committee at least three (3) weeks prior to the scheduled final examination.*** If the content is acceptable to the Committee, the Ph.D. candidate will then submit the appropriate forms to the Graduate School at least two weeks prior to the Final Exam (PhD dissertation defense) date. The dissertation defense will generally consist of an hour long colloquium presented to the entire department followed by a second hour or

more of examination by the committee. The committee will then vote to pass, fail or adjourn as described above for the comprehensive oral.

Suggested Milestones in the Graduate PhD Program

For an ideal, uninterrupted program of study, the following are suggested milestones and time scales toward completion of a Ph.D. in Astronomy:

1.	Years 1 & 2	Complete most classes & Qualifying Exam and most if not all CUME Exam passes; financial support will usually be a state-funded Teaching Assistant position
2.	Year 3	Complete course work & CUME exams if requirements remain; establish a Ph.D. Dissertation Committee & formulate a Ph.D. research plan; undergo comprehensive orals; financial support will often transition to a Research Assistantship with the dissertation supervisor.
3.	Year 4	Dissertation research
4.	Year 5	Complete dissertation research; write dissertation; defend the dissertation

Please note that the above are only rough guidelines. Each student will take a somewhat unique path -- some will finish sooner and some will complete the Ph.D. later.

MASTER'S DEGREE PROGRAM

Upon successful completion of the written and oral portions of the PhD comprehensive exam, it is the intention of the department that a student be awarded an M.S. degree in Astronomy. Other students may elect to pursue a Terminal Master's degree rather than a Ph.D. upon the advice of their committee. The rules for a Terminal M.S. are outlined below.

For the Terminal M.S. degree in Astronomy, the student must satisfy the requirements of the Department as well as those established by the Graduate School. The Department requires a minimum of 33 credits of which six are generally for Master's Thesis research.

A thesis is nearly always required for a Terminal M.S. degree. However, under some exceptional circumstances, the thesis requirement may be waived, in which case the credit requirements must be satisfied in formal course work. Such a waiver requires agreement by both the student's committee and the Department Head. In all cases, the student seeking a Terminal M.S. degree must pass a final oral examination covering course and any relevant research work. Any regular Terminal M.S. degree program will require a thesis.

Course Requirements

The minimum course requirements for a Thesis MS will include:

ASTR 500		3 credits (3 semesters)
ASTR >500 & >600*		15
PHYS >500	(or equivalent)	6
ASTR 598		3
ASTR 599		6
	TOTAL	33

For a student who has decided and been approved to pursue a Course-work only MS Astronomy degree, the minimum course requirements are:

ASTR 500		3 credits (3 semesters)
ASTR >500 & >600*		21
PHYS >500	(or equivalent)	6
ASTR 598		3
	TOTAL	33

*These requirements exclude ASTR 598, 600, and 698

If a student enters the Astronomy program with a M.S. degree in Physics, the Physics requirement may be waived and graduate courses in Astronomy, Mathematics, Computer Science, Engineering or chemistry may be substituted. In other cases, with the permission of the student's committee, graduate courses in Mathematics, Computer Sciences, Engineering, or Chemistry may be substituted for part of the Physics requirement.

Upon making a decision to pursue only a Terminal M.S. degree, the student will form a Master's committee. In selecting a Master's committee, it is expected that the student will first select an advising professor who will act as Master's committee chairperson for the final oral examination, as well as being the principal advisor in the thesis research. **The Master's degree committee must consist of at least two members of the Astronomy Department faculty plus one Graduate Faculty member from another NMSU department.** Selection of a faculty member as a member of the Master's committee requires careful thought on the part of the student, and approval by that faculty member. A Graduate Dean's Representative will be appointed to the Master's committee by the Dean of the Graduate School. In almost all cases the out-of-department NMSU faculty member on the Master's committee will serve in this Dean's Representative role. The Dean's Representative must be a member of the NMSU Graduate Faculty. The student is encouraged to consider a committee greater in number than the minimum requirement described above.

Upon completion of the thesis, the student will schedule a final oral examination by his/her committee. The exam will consist in part of a public presentation of the research conducted for the Thesis. It is the responsibility of the student to schedule this exam on a day and time that is satisfactory to all members of the committee. ***The student will provide copies of the thesis to all members of his/her committee at least three (3) weeks prior to the scheduled final examination***. If the thesis content is acceptable to the Master's committee, the student will then submit the appropriate exam scheduling forms to the Graduate School for the Final Oral Examination at least two weeks prior to the scheduled exam date. The final oral examination for the M.S. will include questions related to the thesis research, and can also address basic principles addressed in the student's coursework . The Master's committee will then vote to pass, fail, or adjourn. If the committee votes to adjourn, the exam must reconvene within three (3) weeks of final decision.

NOTE: For students who decide to pursue a Terminal M.S. degree, but are thinking about possibly continuing for a Ph.D. degree once they complete the Terminal M.S. degree, it is important to:

a) continue to taking CUME exams if recommended by the student's Committee

b) continue taking courses so that they will not suffer unnecessary delays in meeting the Ph.D. course and exam requirements.

OTHER ITEMS OF INTEREST

Graduate Assistantships

Most students will be admitted into the program with financial aid in the form of a state-supported teaching graduate assistantship (GA). This will require the student to perform 20 hours of work per week. You will be assigned to a faculty member(s) for these teaching duties.

You can generally expect to receive continued support in the form of a 20-hour per week Graduate Assistantship (Teaching and/or Research). Your Assistantship might be state-funded and/or research grant funded. **Continued funding requires that your progress is satisfactory in coursework, teaching and research, and that you are performing your supported efforts at a sufficiently satisfactory level. Continued support is not guaranteed.** ***A decision on continuation of your support will be made at the end of each academic term.*** Summer support generally comes from faculty research grants, and you are encouraged to discuss your options with faculty members well in advance of the summer.

After passage of the Comprehensive Exam and the commencement of your dissertation research, your source of financial aid will generally shift to a grant-supported Research Assistantship and/or externally funded fellowship (e.g., NASA, NSF, Air Force, etc.). ***It is your responsibility to plan, in collaboration with your research supervisor, how your dissertation research will be funded.*** The best approach is to identify, within your first few years at NMSU, a faculty member with grant support performing research in an area of interest to you. Begin working on a project with this faculty member (via ASTR 598 or 600) and demonstrate your abilities to him/her. Under the best circumstances, a dissertation proposal will emerge from this research and the faculty member will offer you an RA. Thus, it is important to identify a project which is of common interest to you and a professor, and that project should be supported by a grant. Alternatively, you may choose to work on a dissertation topic which has no funding in the department. This places an extra burden upon the student to financially support this research. Depending upon your topic, there are both local (e.g., NASA Space Grant Consortium) and national (e.g., NSF; NASA) student awards available to compete for. In summary, you should plan carefully on what topic you chose to work on for a dissertation, and how this research will be supported. Your advisor will be happy to work with you on this.

Complaint Procedures

It is inevitable that you will run into problems at some point with either equipment or personalities. Here are a few individuals to contact for help in resolving these problems:

Building Problems -	Ofelia Ruiz or Lorenza Sanchez
Computer Problems -	
IRAF -	Joni Johnson
Disk problems -	Jon Holtzman/Anatoly Klypin
Hardware problems -	Jon Holtzman
Backups -	Jon Holtzman
Library Problems -	
Dept. Reading Room-	Anatoly Klypin/Kurt Anderson
University library -	Anatoly Klypin/Kurt Anderson
Laboratory/Observatory problems -	
Campus -	Tom Harrison
APO 3.5-m problems -	Kurt Anderson, Jon Holtzman
APO 1-m problems -	Jon Holtzman
Issues about-	
Other students -	Jim Murphy
Faculty (any Dept.) -	Jim Murphy

In conclusion, we hope that this guide will provide answers to many of your questions about getting started in graduate school. Clearly, each student will develop individual concerns and questions. We urge you to communicate with your advisor, the Department Head, and other members of the faculty to address any of these questions and concerns. Good luck!

****The policies and procedures outlined in this guide are subject to change****