NMSU  
Department of Astronomy  
Department Handbook  
DRAFT 2013-2014

1 INTRODUCTION

Welcome to the NMSU Department of Astronomy. We strive to provide a vigorous, exciting program of research and education in Astronomy and Astrophysics, covering a broad range of interests, from planetary science and extrasolar 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 at APO and our 24" at Tortugas Mountain, 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.

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 2013-2014 entering class. More senior students may choose to follow these guidelines or those given to them upon entrance into the program.

2 COMPONENTS OF THE ACADEMIC PROGRAM

There are many different facets of participating in our graduate program, and one issue you should think about is time management, i.e., how much time you spend overall on the program and how much time you choose to spend on the different aspects. While the faculty and staff are here to help and advise you, ultimately you are responsible for what you will get out of the program. The choices that you make are likely to affect your ability to get jobs when you graduate, so this is not something to take lightly.

2.1 Research

Most students enroll with the goal of becoming an academic researcher as a career, and we have developed our program primarily with this goal in mind. However, it is becoming increasingly challenging to obtain long-term employment in an academic position, so you should be aware that achieving this goal is likely to require significant time and effort. Over the past 15 years, less than half of our students have ended up going on into academic positions. In many cases where they have not, it is because they have recognized that, in fact, this was not what they really wanted to do, so this statement is not meant to scare students away, just to recognize the issue.

While research is often the primary goal of students, it is often the hardest to allocate time towards, especially in the first several years of the program, because of competing demands of classes, teaching, and outreach. If research is a high priority for you, we urge you to set aside time specifically for it.

Note that research involves not only studying a topic to achieve new knowledge, but also to disseminate this knowledge. The primary dissemination tool in academics is via scientific publications, and in most cases, the primary judgement of people (e.g., in job searches) is their publication record. As you proceed with research, we strongly recommend that you work on writing up your results as you are developing them, so that the process of writing becomes integral to the research process.

Some key ways to get up to speed on active research areas are to

• read papers: you should be aware of the main journals and, in particular, the astronomy preprint archieve, astro-ph. Get in the habit of looking at this regularly, and downloading and reading papers. Keep track of the
papers that you have read: if, after some time, you find the list is short, recognize that you need to put aside more time for this

- talk about research: you can talk with other students, with faculty, or with visitors. Discussions are a way to develop your ideas and get new ones. If you don’t like talking about research, you probably won’t end up doing it

- go to meetings where you can hear about and present research results. While there are several large general meetings in astronomy (the American Astronomical Society twice annual meetings plus the Division of Planetary Sciences annual meeting), these general meetings often do not provide the best opportunity to recognize the level of research that is being done (often by graduate students) by people who will succeed in the field. Look for topical meetings on subjects that you are working in, and try to find ways to go to these.

Plan to talk with your advisor (or any faculty member) regularly about research and about their opinions on what it will take for you to succeed. Discussions about research should take place frequently; it usually does not work to save up a lot of issues to discuss. A guideline of talking to your advisor once per week is probably reasonable!

2.2 Classes

Classes are a very significant component of the program during the first two years. While the academic requirements for the program are outline in detail in a subsequent section, a few key points may be of interest:

- astronomy, like other fields, is constantly advancing and, in many cases, becoming increasingly specialized. While our classes aim to provide you the fundamentals, as well as making you aware of the latest advances, it is impossible to cover “everything”, even everything that you will probably need to know if you go on in the field. Classes provide an introduction and a framework for you to understand new material, but you will almost certainly need to learn, and continue to learn, through your own initiative, outside of classes. Do not be fooled into thinking that, if you know everything that is taught in class (but no more), that you will be sufficiently prepared! We urge you to think about what you want to know, and then go try to learn it, through asking questions, reading books, or reading research articles.

- Grades in graduate school are generally nowhere near as important as they are for undergraduates. If you want to go on in the field, people will most likely scrutinize your research record far more than your grades. Of course, understanding the material is critical, and related to the grade you get, but the understanding and ability to apply it is much more important than the grade itself.

2.3 Teaching

Teaching is an important component of the program, as many career paths after the program may involve it. Obviously, if your primary goal is an academic position, teaching will be involved. Universities are increasingly interested in the quality and innovations in teaching in addition to research accomplishments, so this is not to be taken lightly. Furthermore, many of our graduates end up in predominantly teaching positions, where it is clear that teaching experience is critical.

Another important role of teaching is that it generally provides financial support for students, especially in their first several years, but sometimes for more advanced students as well.

Most of our teaching assistants are for our introductory undergraduate classes, ASTR 105 (The Planets) and ASTR 110 (Introduction to Astronomy). If you are a TA for one of these, your primary duty will be to teach the lab sections of the class and grade the lab reports. It is critical that you are familiar with the labs beforehand for them to go smoothly! There are several resources available to help you with this: generally, the TAs schedule weekly meetings to go over upcoming labs, and previous TAs have put together notes and teaching materials for most of the labs. In addition to labs, you will also likely be called upon to help grade exams, and possibly homeworks, from the main class section.

We also teach several 300 level undergraduate classes, which generally have more writing assignments. TAs in these classes generally spend more of their time grading papers.

There has been a lot of recognition recently that traditional modes of teaching may not always be especially effective, and that we often call upon people to teach without giving them any instruction in how to do so! We urge
you to think about your teaching, and discuss how you do it with faculty and other students. Many people have lots of opinions about good ways to do things.

A key component of effective teaching is getting students to be excited and enthusiastic about learning. Much of student behavior can be generated by teacher behavior. If you are excited and interested by what you are talking about, it becomes more likely that the students will be. While we can’t guarantee that this will be true for all students, the converse is almost always true: if you aren’t excited and interested, the students almost certainly won’t be either! We recognize that it’s not always easy to project a positive attitude; a little bit of acting is sometimes called for!

Another aspect of a TA position may be that you will be called on to help out at the campus observatory. Generally, we require all students in the ASTR110 classes to go to the campus observatory twice in a semester; this means a total of roughly 500 visits to the observatory in a semester. We usually have the campus observatory open two nights a week, staffed by different TAs on different nights. It is important that you are comfortable with knowing what is in the sky and knowing how to operate the telescopes before you are involved in one of these sessions! Note that campus observatory knowledge is also required when you will be helping out with one of the department’s monthly open houses. Tom Harrison usually holds a campus observatory training session at the beginning of each year.

2.4 Public Outreach

Most of the money which support the department (and astronomy in general) 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. Fortunately, in astronomy, many people are genuinely interested in what we do, and talking with them about it can be a lot of fun!

The department has a good reputation in the local community for outreach efforts, and we wish to continue this. Our graduate students provide critical role in these outreach activities, which include presentations to schools in Las Cruces and the surrounding southern New Mexico communities, local civic groups, local astronomical interest groups, etc. Some of the outreach events are nighttime events that involve looking at the sky, while others are daytime events.

We strongly encourage students and faculty members to participate in several events each year. Usually, local groups approach the department with a request for someone to do an event with them. These requests are channeled to the Astronomy Graduate Student Organization (AGSO) officers, who are responsible for finding volunteers to do the event, and for keeping records of what events are provided, and who volunteers for them. Note that there are some perks for participating in these events: they count as public service events for the NMSU Graduate Student Organization, and, if an individual has sufficient hours of public service, you can apply to the NMSU GSO for funding assistance, e.g. with travel to conferences, etc. In addition, a few of the outreach events provide a small amount of financial compensation.

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 the telescopes here on campus at the Tombaugh observatory. A schedule of participation will be distributed at the start of the Fall semester. At these events, graduate students are generally expected to run the telescopes, so it is important to be well trained on operating them before the open house.

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 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.

2.5 Suggested Milestones in the Graduate PhD Program

As you think about the graduate program, you might consider some typical time scales toward completion of a Ph.D. Later sections in this guide describe some of these things in more detail.
<table>
<thead>
<tr>
<th>Year</th>
<th>Category</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Classes</td>
<td>Usually 3 standard classes + seminar each semester</td>
</tr>
<tr>
<td></td>
<td>Other learning</td>
<td>based on material in classes, with other students, and your interests, read supplementary material</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>Learn and teach undergraduate labs recognize different teaching styles and develop yours</td>
</tr>
<tr>
<td></td>
<td>Research</td>
<td>Identify a topic you’re interested in, perhaps with your initial advisor, work on during year as time allows, but significantly in summer</td>
</tr>
<tr>
<td></td>
<td>Exams</td>
<td>Take cume exams monthly</td>
</tr>
<tr>
<td></td>
<td>Outreach</td>
<td>Several events</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>Establish NM residency</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>Consider lower standard class load with some research credit (ASTR 598)</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>Continue to develop teaching style and skills</td>
</tr>
<tr>
<td></td>
<td>Research</td>
<td>Ramp up time spent on research. Think about advisor, thesis and funding possibilities</td>
</tr>
<tr>
<td></td>
<td>Exams</td>
<td>Continue monthly cumes; take “comprehensive” exam (just a committee meeting!) to certify program advancement (slight pay raise!)</td>
</tr>
<tr>
<td></td>
<td>Outreach</td>
<td>Several events</td>
</tr>
<tr>
<td>3</td>
<td>Classes</td>
<td>Take remaining classes per your interest; research credits (ASTR 598/600, ASTR599 for Masters thesis)</td>
</tr>
<tr>
<td></td>
<td>Research</td>
<td>Identify thesis topic, prepare thesis proposal, consider funding possibilities</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>As necessary</td>
</tr>
<tr>
<td></td>
<td>Exams</td>
<td>Finish remaining cumes if necessary; take oral classwork exam (fall); thesis proposal (spring)</td>
</tr>
<tr>
<td></td>
<td>Outreach</td>
<td>Several events</td>
</tr>
<tr>
<td>4</td>
<td>Research</td>
<td>Work on thesis! Remember to be writing as you work!</td>
</tr>
<tr>
<td></td>
<td>Classes</td>
<td>Research credits (ASTR 700)</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>As necessary</td>
</tr>
<tr>
<td></td>
<td>Outreach</td>
<td>Several events</td>
</tr>
<tr>
<td>5</td>
<td>Research</td>
<td>Finish thesis!</td>
</tr>
<tr>
<td></td>
<td>Classes</td>
<td>Research credits (ASTR 700)</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>As necessary</td>
</tr>
<tr>
<td></td>
<td>Exams</td>
<td>Dissertation defense</td>
</tr>
<tr>
<td></td>
<td>Outreach</td>
<td>Several events</td>
</tr>
</tbody>
</table>

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.

## 3 PERSONNEL

For the 2013-2014 academic year, there are thirteen faculty (10 tenure track), two emeritus professors, several research associates and postdoctoral assistants, two professional office staff, nearly thirty Apache Point Observatory staff, and several dozen graduate students in the Astronomy Department. In addition, there are many 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.

### 3.1 Faculty

Reta Beebe - Planetary atmospheres; HST, Voyager, and Galileo space-based observations; Director of the Planetary Data System Atmospheres node
Nancy Chanover (Associate Prof.) - Planetary Atmospheres, Instruments, PDS Atmospheres Node
Chris Churchill (Associate Prof.) - Quasar Absorption Lines, Intergalactic Medium
Tom Harrison - High Energy Astrophysics; Optical Counterparts of Gamma-Ray Sources; Novae; Cataclysmic Variables
Jon Holtzman (Prof.) - Stellar Population in Galaxies; Star Formation Histories in Galaxies; Globular Clusters; Instrumentation.
Jason Jackiewicz (Associate Prof.) - Helioseismology, Solar Physics, Space Weather, Condensed matter physics
Anatoly Klypin (Prof.) - Cosmology and Numerical Simulations of Structures in the Universe; Galaxy Formation.
James McAtteer (Assistant Prof.) - Solar physics, space weather
Bernard McNamara (Prof.) - Stellar Astrometry; Stellar Variability; Ground-Based Observations of High Energy Objects; Binary Stars.
Jim Murphy (Associate Prof.) - Atmospheric Science, Martian Atmosphere, Mars Exploration Missions
Nicole Vogt (Associate Prof., retiring) - High Redshift Galaxies, Galaxy Evolution
Rene Walterbos (Prof.) - The Interstellar Medium of External Galaxies, Galaxy Evolution, Massive Stellar Populations, Galactic Structure
William Webber - Cosmic Ray Astrophysics

3.2 Emeritus Professors
Kurt Anderson - Apache Point Observatory Site Director; Galaxy Morphology, Active Galactic Nuclei, Stellar Evolution.
Herbert Beebe - Solar and Stellar Atmospheres; Solar Astrophysics, History of the NMSU Astronomy Department, Clyde Tombaugh Archive.

3.3 Research Associates
Paul Higbie - Space and Cosmic Ray Astrophysics
Lyle Huber - Planetary Data System Atmospheres Node
Joni Johnson - PDS Atmospheres Node
Lynn Neakrase - PDS Atmospheres Node
Irma Trejo - PDS Atmospheres Node
Drew Chjonowski - SDSS APOGEE project

3.4 Postdoctoral Assistants
Patrick Gaulme - solar group
Chunming Zhu - solar group
Jim Norwood - planetary group

3.5 Department Staff
Lorenza Sanchez - Accountant
Ofelia Ruiz - Administrative Secretary

3.6 Apache Point Observatory
Dmitry Bizyaev - 2.5m observer
Howard Brewington - 2.5m observer
Jon Brinkmann - computing
Frances Cope - plugger
Jack Dembicky - 3.5m observing specialist
Garrett Elbke - telescope technician, 2.5m
Ben Harris - site supervisor
Diana Holder - plugger  
Cathy Jordan - buyer  
Bill Ketzeback - chief telescope engineer, 3.5m  
Karen Kinemuchi - 2.5m observer  
Mark Klaene - Site Director  
Ed Leon - electronics engineer  
Dan Long - chief telescope technician, 2.5m  
Elena Malanushenko - 2.5m observer  
Viktor Malanushenko - 2.5m observer  
Russet McMillan - lead support astronomer, 3.5m  
Tracy Naugle - lab tech  
Dan Oravetz - 2.5m observer  
Audrey Oravetz - 2.5m observer  
Kaike Pan - 2.5m head observer  
James Parker - electronics  
Robert Pfaffenberger - engineer  
Alaina Sheldon - 3.5m observing specialist  
Alysha Shugart - 3.5m observing specialist  
Fritz Stauffer - computing  
Gretchen Van Doren - program manager  

3.7 Adjunct (Affiliate) Professors  
Krzysztof Belczynski (Los Alamos National Lab)  
Jon Brinkmann (Apache Point Observatory)  
Tim Dowling (University of Louisville)  
Stefan Gottlober (Astrophysical Institute, Potsdam)  
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)  
Mark Marley (Ames NASA Research Center)  
Donald F. Neidig (National Solar Observatory, Sunspot)  
Sally Oey (University of Michigan)  
Frazer Owen (National Radio Astronomy Observatory, Socorro)  
Davor Palle (Institute Rudor 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 Ulvestad (NRAO, Socorro)  
Tom Vestrand (Los Alamos National Laboratory)
4 FACILITIES

4.1 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.

The mailing address for regular mail is:
Department of Astronomy
Box 30001
MSC 4500
New Mexico State University
Las Cruces NM 88003

The shipping address is:
Department of Astronomy
1320 Frenger Mall
New Mexico State University
Las Cruces NM 88003

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, astronomy class/lab copies and research copies. Please note personal copies are $0.06 each, you will be billed monthly. If you are making copies for a professor with a research grant, use the code 12345. If you are making copies for teaching purposes use the code 37723. Across from the mailboxes is the coffee and snacks room. Please keep it clean!

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.

Building security is an issue that we should all be aware of. 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 can help to 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.

There are several other buildings in proximity to Astronomy with which you should also become familiar. The first is the science 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 undergraduate classroom and colloquium room is Biology Annex 102 (BX102). The Biology Annex is located immediately opposite the Astronomy building, to the south. Most of the ASTR 105G and 110G lab equipment is located in the auxiliary room in the back of BX 102. If you are employed as a TA, you should get a key to BX102 from Ofelia Ruiz. BX102 has a projector that can be used to display images from a computer or a video player. There is a computer in the room, and also a video cable for a laptop. The computer is connected to the network, and an Ethernet cable is available for a laptop to do the same. Familiarize yourself with usage of the equipment before planning to run a lab or make a presentation! A key to the projection cabinet is usually kept inside the auxiliary storage room in BX102, hanging on the light switch.

4.1.1 Department Library/Visitors office

The Astronomy Department maintains a small library in Room 207. This room also doubles as a visitors office and study space, so please respect the multiple uses of the space.

Many recent Astronomical journals plus recent preprints of papers from institutions around the world can be found in the reading room. 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. 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 Anatoly Klypin and/or Bernie McNamara.

4.2 Observatories

4.2.1 Apache Point Observatory

NMSU operates the Apache Point Observatory, which is located in the Sacramento Mountains east of Las Cruces, about a two hour drive away. APO is home to four telescope:

• the ARC 3.5m telescope
• the Sloan Digital Sky Survey (SDSS) 2.5m telescope
• the NMSU 1m telescope
• the ARCSAT 0.5m telescope

You should definitely consider these facilities for possible research projects; they provide resources that are not available in all graduate programs! Take some time to learn about their capabilities via information on the web and/or by talking with faculty and other students.

The 3.5m is scheduled on a quarterly basis, and you will receive emails soliciting proposals. Graduate students are welcome to propose projects, either with or without faculty involvement; proposals are reviewed by an internal faculty committee.

The SDSS project conducts several survey projects, and all department members have access to the survey products and to collaborations with the large SDSS community.

The NMSU 1m and the ARCSAT provide additional opportunities for research projects.

4.2.2 Campus Observatory

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 need to be trained and checked-out on the equipment: a training session is generally scheduled by Tom Harrison at the beginning of the fall semester. Some online instructions can be found at http://astronomy.nmsu.edu/astro/observatory/telescopeguide.html

There is a separate key for the observatory domes. Inside the dome, you can find another key hanging up that can be used to open the gate.

4.2.3 Tortugas Mt. Observatory

The Department has a 24” telescope in a dome on the north peak of Tortugas Mt (A Mt.), that is readily visible from town. This observatory was used significantly, especially for planet monitoring purposes, for several decades since its construction in the 1960s, but has been used little recently. We started an effort in 2010, in collaboration with the American Association of Variable Star Observers, to bring it back into service as a remote/robotic telescope. If you are interested in working on this project and/or using the telescope, contact Jon Holtzman.

Eventually, we have some hope to take advantage of this visible facility to help to disseminate information about research at NMSU, but details of how to do this are still somewhat murky!
4.3 Computers

All students should have a basic computer workstation on their desk. These computers run the Linux operating system (specifically, the RedHat/CentOS flavor of Linux). All computers are networked and there is are central servers that host accounts and disks. As a result, if you have a department account, you can log onto any of the department computers; there are not individual accounts for individual machines.

Your desktop is meant to provide basic computer services like editing of files, web access, email access, image display, plotting, and the capability to compile and run basic programs. Many basic programs are installed either on each individual system, or centrally on the server disks, and thus accessible to all machines. However, the desktop computers are probably not optimal for significant computing.

If significant computing resources are needed for your work (e.g., more powerful/faster processing, more memory, etc.), there are several centrally located computers that are available via remote login:

<table>
<thead>
<tr>
<th>machine</th>
<th>CPUs</th>
<th>Memory (Gby)</th>
<th>Dedicated usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>praesepe</td>
<td>48</td>
<td>132</td>
<td>Large jobs</td>
</tr>
<tr>
<td>liyades</td>
<td>48</td>
<td>32</td>
<td>Large jobs, better for parallel code?</td>
</tr>
<tr>
<td>virgo</td>
<td>64</td>
<td>64</td>
<td>Large jobs</td>
</tr>
<tr>
<td>antigona</td>
<td>16</td>
<td>16</td>
<td>Klypin group</td>
</tr>
<tr>
<td>seismo</td>
<td>32</td>
<td>64</td>
<td>Jackiewicz group</td>
</tr>
<tr>
<td>solarstorm</td>
<td>48</td>
<td>132</td>
<td>McAteer group</td>
</tr>
<tr>
<td>milkyway</td>
<td>64</td>
<td>64</td>
<td>Holtzman group</td>
</tr>
</tbody>
</table>

If you feel that your work is being limited in any way by the computer setup, you should definitely discuss the issue, either with your advisor, Jon Holtzman, or Anatoly Klypin.

If you are having issues with your computer, ask someone about them! We can only attempt to solve long term problems if we know about them! It is OK to shutdown or reboot your computer using the menus on the login screen, but please let Jon Holtzman know if and why you are doing this, so we can attempt to rectify any known issues.

Additional information on department computing can be found at http://astronomy.nmsu.edu/computing

4.3.1 External access

In an effort to decrease the possibility of computer security issues (hacking), we restrict login access from outside of NMSU to a single gateway machine, astronomy.nmsu.edu. You can connect to this machine from anywhere using the SSH login protocol. Once logged into astronomy.nmsu.edu, you can login to any of the individual nodes if you need to.

4.3.2 Laptops and internet access

Many students now have their own laptops, which you can certainly make use of. To get connected to the network, you will need to first register your machine in the NMSU system. This is easily accomplished by pointing your browser to netreg.nmsu.edu (often, it will automatically be redirected there), and filling out the requested information (you’ll need to know your my.nmsu.edu access information).

You can connect to the network with an Ethernet cable if there is a spare port in your office (if there isn’t and you need one, talk with Jon Holtzman about possibilities) or via a wireless connection in much of the building. There is a wireless access point in downstairs in AY119, astro-wireless-g, and one upstairs in AY201, astro-wireless-g2. Both require a password, NMSUAstronomy, to access.

4.3.3 Email

Your NMSU email address will be username@nmsu.edu, where your username is chosen by you when you first access the NMSU my.nmsu.edu system; we set astronomy usernames to match the NMSU username. Email coming into username@nmsu.edu can be accessed via the my.nmsu.edu webmail system. However, many department members choose to forward mail from my.nmsu.edu either to a personal, external email address (e.g., gmail or whatever), or to a local address in the astronomy department (username@astronomy.nmsu.edu). You can set up automatic forwarding in the my.nmsu.edu email system.

If you use the my.nmsu.edu access or set up forwarding to an external email address, you should make sure than any email that might be sent to you internally from another astronomy machine will get to where you will see it. You
can accomplish this by creating a file called .forward in your Linux home directory, and putting the email address to which you wish to forward your email into this file. **Don't** do this if you forward email from my.nmsu.edu to username@astronomy.nmsu.edu, or else all email will just keep bouncing back and forth!

### 4.3.4 Web pages

The department hosts a set of web pages at http://astronomy.nmsu.edu with a uniform “look-and feel”. Instructions for how to establish and keep the contents of your department web pages can be found at http://astronomy.nmsu.edu/computing/notes.

You can also make personal web pages by placing files in /home/httpd/html/username, which will be seen at http://astronomy.nmsu.edu/username

### 4.3.5 Backups

Computers and computer disks do occasionally fail, so it is important to consider backing up important data and files. Within the department, we have implemented several disk-to-disk backup systems:

- **on a daily basis**, small files are backed up to a disk on a central server. Copies of small files are stored for a week, so these backups also serve as a short-term record if you inadvertently mess up one of your files.

- **on a weekly basis**, the primary disk on many of the workstations are backed up to a central server. Here, all files are backed up, but the backup from the previous week is not kept.

- **No backups** are done for secondary disks on workstations, nor of the large disk RAID arrays on several of the compute nodes. This is because we simply don’t have the capacity to do so

See http://astronomy.nmsu.edu/computing/notes for some additional information.

It is important to recognize that disk-to-disk backups, especially within the department, are not foolproof. In an extreme example, if a fire or a hacker takes down the entire building, the backups will go along with the originals. As a result, it is always a good idea to consider whether you want to keep an off-site backup of your critical files. It is inexpensive to buy a USB disk that you can bring in occasionally, sync your files to, and bring you. If you’re interested in this, consult Jon Holtzman for easy ways to do this.

## 5 DEPARTMENT TALKS AND EVENTS

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. 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 should be well advertised with web page postings and email reminders.

### 5.1 Colloquium

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 afternoons at 3:15 PM in BX102. Coffee, tea, and cookies are usually provided at 3:00 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.

### 5.2 Pizza lunch

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. 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 TBD per slice.

We strongly encourage students to do pizza-lunch presentations, even one every year. If you are taking research credits via ASTR 598 (see below), you will be expected to make a presentation as part of the class.

5.3 Seminar class
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.

Different faculty have different philosophies of what style of seminar is most beneficial.

5.4 Research group meetings
Some of the research groups have regular meetings to discuss a variety of topics within their research area:

- Planetary Group is a meeting where all department members interested in learning more about planetary science get together to discuss recent science results and mission highlights. You do not need to be doing research in planetary science in order to come and participate! This is a great opportunity to learn about recent science results that you can share with your undergraduate students, and discuss current planetary exploration efforts and policy issues with our local experts. It’s also a great opportunity to learn about results presented at recent planetary science conferences, and support department members preparing practice talks for such conferences. The Planetary Group meets twice per month; the meetings will be scheduled the week after classes begin.

- The solar group has also been having regular meetings

- Several people have expressed interest in a galaxies group meeting. This has been started in the past but the effort was not sustained. Interested parties should get together to organize something!

5.5 Tea time
We traditionally have held a tea time once per week, where different department members rotate bringing in some sort of treat for everybody to share. Please sign up when the announcement goes out.

Tea time is an informal opportunity for people to get together and discuss any variety of topics.

6 ACADEMIC REQUIREMENTS AND POLICIES
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. You are also 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 have the option of taking some 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.

If deficiencies exist in your physics or mathematics background upon entry into 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.
6.1 Course Offerings and Requirements

6.1.1 Astronomy Department Courses

The Department of Astronomy offers courses at the 500 and 600 level. Historically, the 500 level classes covered more basic areas and the 600 level classes more specialized, but this distinction has become quite blurred. All of the classes are 3 credit classes except as noted below. The course numbers and titles are as follows:

ASTR 500 Seminar (1 credit)
ASTR 505 Astronomy & Astrophysics I (retired 2013/14)
ASTR 506 Astronomy & Astrophysics II: (shift to Stellar Dynamics 2013/14)
ASTR 515 Stellar Atmospheres (not taught for a long time, see 545)
ASTR 535 Observational Techniques I
ASTR 536 Observational Techniques II
ASTR 545 Stellar Spectroscopy
ASTR 565 Stellar Interiors (revised 2013-14)
ASTR 575 Computational Astrophysics
ASTR 598 Special Research Programs (flexible number of credits)
ASTR 600 Predissertation Research (flexible number of credits)
ASTR 605 Interstellar Medium
ASTR 610 Radio Astronomy (also see 536)
ASTR 615 Galactic Structure
ASTR 616 Galaxies
ASTR 620 Planetary Science I
ASTR 621 Planetary Science II
ASTR 625 Cosmology
ASTR 630 Astrostatistics (new 2013-14)
ASTR 670 Heliophysics (new 2013-14)
ASTR 675 Star Formation & Stellar Evolution
ASTR 698 Special Topics

As of 2013/14, we have shifted to a core set of courses being offered every other year in the fall: ASTR 535, ASTR 565, ASTR 605 in odd years, and ASTR 506, ASTR 545, and ASTR 615 in even years. Certainly, first year students should plan on taking the fall courses that are offered, and most second year students will take them as well, although some second year students might consider a ASTR 598 during the fall semester.

During spring semesters, more specialized courses will be offered on an every other year basis, with an intention of offering 4 choices each spring semester. However, since NMSU policy requires that graduate classes have a minimum of 5 students per class, there is a possibility that a spring class will not be able to be offered unless students distribute themselves roughly evenly between the courses that are being offered.

ASTR 610, 616, 620, 621, 625, 630, 625, and 670 are typically offered every other year in the spring The remaining 600 level classes are offered on an occasional (as per demand) basis.

6.1.2 Out-of Department Courses

Astronomy graduate students can (but are not required to) take up to two graduate level classes from departments other than Astronomy and have them count towards the degree requirement (of course, more can always be taken!). 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 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:

- EE528 Radiometry and Infrared Detectors (solid course on detectors and S/N considerations, taught from an engineering standpoint)
- EE577 Fourier Methods in Electro-Optics
- CS579 Introduction to Computational Science May be an excellent course for students wishing to learn more advanced programming techniques, including algorithm designs, numerical methods, database, use of parallel computers.

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.

### 6.2 Astronomy PhD Degree Program

#### 6.2.1 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:

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 500 (Seminar)</td>
<td>4 credits (4 semesters)</td>
</tr>
<tr>
<td>ASTR “regular” graduate classes (501-597, 601-699)</td>
<td>27 credits (9 courses)</td>
</tr>
<tr>
<td>Out of dept graduate classes OR ASTR graduate classes</td>
<td>6 credits (2 courses)</td>
</tr>
<tr>
<td>ASTR 598 (Special Research Programs)</td>
<td>3 credits</td>
</tr>
<tr>
<td>ASTR 600 (Pre-dissertation Research)</td>
<td>6 credits</td>
</tr>
<tr>
<td>ASTR 700 (Doctoral Dissertation)</td>
<td>18 credits</td>
</tr>
<tr>
<td>Minimum Total Credits</td>
<td>64 credits</td>
</tr>
</tbody>
</table>

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

Students may take two out-of-department classes to fulfill the overall credit requirements if these classes are 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 out-of-department course/credit-hour requirement, but only with the approval of the student’s Committee. Otherwise, out of department classes must be at the 500 or greater level.

If more than 6 credits of out-of-department classes are taken, they may potentially count toward the required total courses/credit hours, but only with the approval of the student’s Committee.

#### 6.2.2 Research credits

Several different course numbers involve research credits: ASTR 598, ASTR 599, ASTR 600, and ASTR 700.

ASTR 598 is generally taken sometime in the first five semesters (we recommend trying to schedule one during your second year) and is intended to provide a semi-formal introduction to doing a research project. It may or may not involve research that subsequently develops into a thesis project. As the first research credits, it is important to try to carefully consider goals and expectations for ASTR 598, in particular, to make sure that it does not fall secondary to the (perhaps) more immediate demands of formal classwork, teaching etc. You get a grade in ASTR 598 just like in any other class. To assist in making ASTR 598 productive, we have instituted some formal guidelines that you should discuss with your ASTR 598 advisor. These include:

- setting up, within the first two weeks of the semester, a schedule with milestones
- making sure that the research project involves background research on the topic, and not just analysis of some new data, techniques, etc.; trying to “do research” without a background of why it is interesting and important often leads to problems later!
• requiring a written report and an oral presentation of what has been accomplished at the end of the semester. It’s certainly fine if a project has not been completed, or yields no result; with the background research and the efforts made, it should be straightforward to provide a written and oral summary. Written reports may end up being very useful towards the development of a publication!

ASTR 600 and ASTR 700 credits are designed towards dissertation research. You may take anywhere from 1-9 credits of these in a semester. Generally, ASTR 600 credits can be taken before the thesis proposal is done, and ASTR 700 credits can be taken afterward. Specific milestones/requirements for ASTR 600 and ASTR 700 should be discussed with your research advisor.

If students end up working towards a Masters thesis, rather than towards a PhD dissertation, then they should enroll in ASTR 599 credits when working on the Masters thesis.

6.2.3 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.

6.2.4 Committee on Studies

Each entering student is assigned a departmental graduate Committee on Studies (usually consisting of two 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.

6.2.5 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:

1. The first is the Qualifying ”examination” which is an evaluation of the student’s progress. This generally just involves a meeting with the initial faculty committee to discuss progress in the areas of cumes (see next point), classes, research, teaching, and outreach. Generally, if the student is making, good progress, he/she is advanced to Ph.D. candidacy, which means a slight increase in assistantship salary. The qualifying exam meeting is generally completed at the beginning of the fourth semester, or earlier if good progress on the cumes is being made.

2. Next is the Comprehensive Examination which involves three portions: written cumulative exams (cumes), an oral classwork exam, and an oral and written thesis proposal. In place of a single written comprehensive exam, the Astronomy Department offers a series of monthly written “cume” exams. Students are required to pass six of these exams within five semesters. After passing the cumes and completing classes, students take an oral classwork exam: a good goal would be to complete this by the end of the fifth semester. Finally, students present a written and oral thesis proposal to the whole department, which is followed by a discussion with the thesis committee: a good goal would be to complete a thesis proposal by the end of the sixth semester.

3. Finally, upon completion of the dissertation work, the student undergoes a Final Examination, which consists of a presentation of the thesis work to the Department, followed by a meeting with the thesis committee.
More details on these three evaluations are provided in the following sections.

**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 Ph.D 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 administered 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; typically, the coursework exam is taken first (shortly after courses have been completed).

Part 1- 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 is expected to predominantly cover classes that the student has taken in the program, but can include any core Astronomy material. The level of difficulty and the nature of the subject material are up to the individual questioner.

Part 2- 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.

The formal completion of the oral comprehensive exam occurs when the second portion of the exam is taken (regardless of which order they are taken in). It is this final completion that is registered with the Graduate School. In order for this to be accomplished, the Graduate School must be notified about the date of the exam at least 10 days before it occurs. Forms must be completed in advance so that the necessary paperwork can be generated; see Ofelia for assistance.

Upon successful completion of all portions of the Comprehensive Exam, a student is eligible to receive a Masters of Science degree in Astronomy. To be awarded the degree, the student must complete an "Application for Degree"
document, and an MS "Program of Study" document which WILL NOT include any ASTR 600 credits the student might have previously earned. The completed documents should be delivered to the Department Head who, with the assistance of the Department office staff, will oversee the delivery of the documents to the Graduate Student Services Office.

**Final Dissertation Examination**

The Ph.D. candidate has up to five (5) years to successfully defend her/his dissertation after successful completion of all portions of the 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.

### 6.3 Masters 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:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 500</td>
<td>3 credits (3 semesters)</td>
</tr>
<tr>
<td>ASTR “regular” graduate classes (501-597, 601-699)</td>
<td>15 credits (5 courses)</td>
</tr>
<tr>
<td>Out of dept graduate classes OR ASTR graduate classes</td>
<td>6 credits (2 courses)</td>
</tr>
<tr>
<td>ASTR 598</td>
<td>3</td>
</tr>
<tr>
<td>ASTR 599</td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>33</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 500</td>
<td>3 credits (3 semesters)</td>
</tr>
<tr>
<td>ASTR “regular” graduate classes (501-597, 601-699)</td>
<td>21 credits (7 courses)</td>
</tr>
<tr>
<td>Out of dept graduate classes OR ASTR graduate classes</td>
<td>6 credits (2 courses)</td>
</tr>
<tr>
<td>ASTR 598</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>33</td>
</tr>
</tbody>
</table>

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:

1. continue to taking CUME exams if recommended by the student’s Committee
2. continue taking courses so that they will not suffer unnecessary delays in meeting the Ph.D. course and exam requirements.

6.4 Academic ethics

You should be careful to be ethical about the work you do and how you do it. At a high level, science depends on people being ethical about research: you need to faithfully report what you do and what you find, taking care not to overemphasize facts that might support a view that you hold while underemphasizing facts that do not.

On a lower level, e.g., vis a vis classes, we expect that you will behave honestly. On tests, we expect that you will not consult any material that you have not been explicitly told that you can, or attempt to look at the work of other students. Homework is perhaps a bit of a greyer area, as we encourage discussion of issues among students, while at the same time, expect that each individual student puts in sufficient effort to develop an understanding independently.

For some classes, solution sets may have been distributed to students in previous years for homeworks or for exams, and it is possible that some professors may use similar or identical questions. As a result, we expect that you will not make any effort to get previous answers.

When in doubt about ethical behavior, ask an appropriate person, whether that be the professor of the class, your advisor, or the Department Head!

7 FINANCIAL ISSUES AND SUPPORT

Essentially all of our students are financially supported at some level. Most of our students are NMSU graduate assistants, where the assistantships can either be teaching assistantships (funded by the state) or research assistantships (funded by grants). In addition, some students obtain external fellowships that provide financial support.

7.1 Graduate Assistantships

NMSU graduate assistantships can be either for teaching (TA) or research (RA). The NMSU graduate assistantships formally cover 20 hours of work per week during the academic year. During the summer, when students are supported as RAs, there is some flexibility in the amount of pay that can be offered (20-40 hours per week). Note, however, that the primary requirement is getting work done, not counting hours. In fact, the summer hiring level more often varies because of grant funding availability than because of variations in the expected amount of work. If you want to succeed in the field, you will need to be working full-time, and likely more!

It is more common for first and second year students to be supported as TAs, with more senior students supported as RAs, but exceptions to this certainly occur frequently depending on a number of different circumstances, including
faculty funding levels, admissions offers, etc. While it may not seem fair to have different students at the same level with different types of support, funding issues are a very real part of academic life, and, as you will subsequently learn, we all have to work within the framework of available resources, and this leads to different conditions for different people.

7.1.1 Teaching assistantships

If you are working as a teaching assistant, the department head will assign TAs to different faculty/class sections based on peoples’ schedules, and when possible, faculty and student preferences. Feel free to make these known. Because of different teaching styles and course requirements, there is no guarantee that workload will be equal for all TAs, which is too bad, but will occasionally occur.

7.1.2 Research assistantships

RA support generally comes from faculty research grants. These are written by faculty to funding agencies and, in general, are awarded with specific expectations of work that will be accomplished with the funding. It is extremely important for students to take their responsibilities as grant-funded RAs seriously. Not only are you being supported by public funds to accomplish research, but the ability of faculty to continue to be successful in obtaining future grants likely depends strongly on their ability to demonstrate success, as measured by concrete deliverables like papers, on previous grants.

You are encouraged to discuss research support with various faculty members at any time. Since research support is the only option during the summer, you will want to make sure to line up a source of support for summer well before summer comes around, i.e., you should consider and discuss this early in the spring semester.

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.

7.1.3 Other funding opportunities

Aside from faculty research grants, there are opportunities for students to apply for independent funding, as well as some funding fellowship opportunities that the Department can apply for. Students are strongly encouraged to be aware of, and apply for, independent funding opportunities. Some of these include NSF graduate research fellowships, NASA student fellowships (e.g., NESSF), NM Space Grant Consortium opportunities, as well as others.

Independent funding frees you from working on a subject that is covered by a faculty research grant, and helps out the entire department by making TA and RA funds available for other students.

The Department attempts to take advantage of all award opportunities it is aware of for eligible students. Some of these awards require that a FAFSA financial aid document be completed and available to the award-providing office. Thus, the Department encourages all students to complete and submit a FAFSA document at the start of each calendar year.

7.1.4 Residency

So long as you are employed as a graduate assistant, you are eligible for NMSU in-state tuition. However, there have been some issues in the past with getting in-state tuition if you are on an external fellowship. Because of this, you should establish and apply for NM residency during your first year here. Instructions for how to do so can be found at http://nmsu.edu/~registra/residency.html

7.1.5 Benefits and policy

As an NMSU employee, you may need to be aware of official NMSU policy on a variety of subjects. Information on current NMSU policy can be found at http://www.nmsu.edu/manual/current-nmsu-policies.html.
7.2 Purchases and travel

There may be circumstances where you will want to be reimbursed for expenses, either for work-related purchases or work-related travel. You should definitely check with whoever will be funding these purchases (your advisor or the Department Head) before making the expenditure. Assuming the expenses has been approved, you need to submit receipts to Ofelia so that she can process a reimbursement.

If you work with Ofelia in advance, it is possible to purchase plane tickets directly without having to lay out your own money in advance. Note that, for reimbursement, receipts are required for meeting registration, plane tickets, hotel, etc.

When possible, expenses should be charged to the department credit card from which they can then be covered by charging an appropriate internal account, i.e. without requiring reimbursement at all. Ofelia and Lorenza can help with credit card purchases. The department credit card cannot be used to purchase airline tickets.

Note that international travel requires pre-approval, see http://international.nmsu.edu/travel-forms.html

8 INFORMATION AND COMPLAINTS

It is possible 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 Issues/Problems: Ofelia Ruiz or Lorenza Sanchez
- Computer Issues/Problems: Jon Holtzman
- Library Issues/Problems: Bernie McNamara
- Laboratory/Observatory Issues/Problems: Tom Harrison
- APO 3.5m Issues/Problems: Jon Holtzman
- APO 1m Issues/Problems: Jon Holtzman
- Issues about:
  - Other students: Jon Holtzman, Department Head
  - Faculty (any Dept.): Jon Holtzman, Department Head

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*