

## Care and Feeding of Your Observing Notebook

### Part 1: Overview and Visual Observing<sup>1</sup>

The observing notebook we asked each of you to get for use in this class will be used mostly for **recording observations**, and sometimes also for **writing calculations** (and whatever other fun things we can think up for doing on cloudy class nights).

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The two primary reasons for keeping such a log are

- to remind yourself of what you did, and to allow you to analyze and interpret your recorded information more carefully at a later time.
- to remind you of things you might want to try or retry in the future.
- (besides, in this class, it gets inspected by the instructor.) OOPS, who said that?

Sometimes the log finds use as additional data for some future project, yet unplanned when the observations were initially recorded, or is used by others as confirmation of something someone else saw or even possibly as additional data for one of *their* future projects. As your work gets more oriented toward obtaining useful data for quantitative scientific or engineering work (e.g., 12.410J "Observational Techniques of Optical Astronomy", or physics "Junior Lab", or the electronics lab portion of 6.002, 12.009 "Weather Control on Terrestrial Planets" and others), maintaining a quality lab notebook becomes *crucial*, and you'll probably hear this spiel again with even more verve and passion in those other classes.

It makes sense, then, that Your Observing Notebook be maintained with particular attention paid to *clarity*, *neatness*, and *completeness*. These aspects are all related and are all equally important (think for a moment about the limited value of orderly sketches without any indication of what the seeing<sup>2</sup> or other atmospheric conditions are like, or a neat log whose contents otherwise make no apparent sense whatsoever). A good observing log includes all the information necessary to reproduce your observations. The idea is to record **all** facts that may contribute in any way possible to your later interpretation and understanding of the observation.

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<sup>1</sup>Part 2 comes in another handout later in the term.

<sup>2</sup>**Seeing** refers to the smearing and defocusing of images by temperature-caused and other variations in the Earth's atmosphere.

# 1 "What am I expected to write in it?"

As you become more practiced at making astronomical observations, you will find it easier to know what might be most useful to record. Here's the list of basics to get you started:

## 1.1 Before you go out

Experience has shown that spending a little time planning a set of suitable targets for an evening's observing will, in the long run, allow you to make better use of available observing time. Choose objects you know will be well up in the sky during the time you plan to be at the telescope (altitude  $20^\circ$  or greater is a good rule-of-thumb) because the seeing gets really really bad at lower altitudes. (You'll get a head-start on this for use during the term, in the form of a forthcoming handout with visibility information already computed for you.) Even if you're doing "easy" objects which don't require that you make detailed finder charts, use your notebook to sketch out a plan for the "star hopping" you'll use to locate the object with the telescope (more about this later). It's better to do as much of this preliminary paperwork as possible indoors beforehand, since trying to browse without direction through handouts and reference books out at the telescope in the (cold) wind with a red flashlight makes observing seem much more complex than it really is, and sops up valuable observing time.

### ▪ **When you get outside**

At the beginning of the observing session you can record

- **Date and Location** of observing session, **Observer(s)**, and **Instrument Used** (In our class situation it's particularly useful to record the number of the telescope kit you're using, so that if you find an equipment problem that should be looked at by seminar staff outside of class you can definitively identify the offending kit.)
- **Sky Conditions** - general description.

*Date: 1991 July 11*

*Location: Keauhou Beach Hotel, 5 miles south of Kona, Hawaii.*

*3:00 am HST: Mostly clear to the east where Sun will be during eclipse; a few scattered clouds visible overhead. What a relief! Go back to bed.*

*4:35 am: ACK! OVERCAST! Panic! Should we try to go north? Indecision: stick it out here a while and see what happens.*

*5:45 am: appears to be clearing, from the SOUTH, contrary to usual weather patterns.*

*6:00 am: definite breaks in clouds now down here, but still looks solid to north (where all the TV crews are...). Looks like we may actually win!*

- To quantify sky conditions, include an estimate of *limiting magnitude*, the magnitude beyond which you cannot see with your dark-adapted but otherwise unaided eye; the chart in Figure 1 is provided for this purpose.<sup>3</sup>

*Date: 1984 Jan 21*

*Location: Pine Glen, PA*

*9:20 pm EST: Very dark sky (only 2 nights past New Moon), limiting mag. about 5.5*

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<sup>3</sup> If you REALLY want to do this RIGHT, include also an estimate of the size of the seeing disc in arcseconds, and grade the sky *transparency* on a 1-10 scale.

Then, for *each* individual object you observe or photograph, include

- a clear statement of *what* you are doing and *why*. This needn't be anything particularly earth-shattering exciting or philosophical: something like

*Finding M13 to observe and sketch a globular cluster*

is fine.

- **Name** of object observed: common name if it has one, otherwise you're stuck with the catalog designation (e.g. "Rosette Nebula" vs. "NGC-2237").
- *If* you obtained the **celestial coordinates** of the object from a reference source, it'll be convenient to have them in your notebook as you proceed to find the object with the telescope.

However, working in the other direction by recording coordinates that you read off of the paddle readings on your LX200 may be somewhat less useful and less accurate (though they shouldn't be *toooooo* bad).

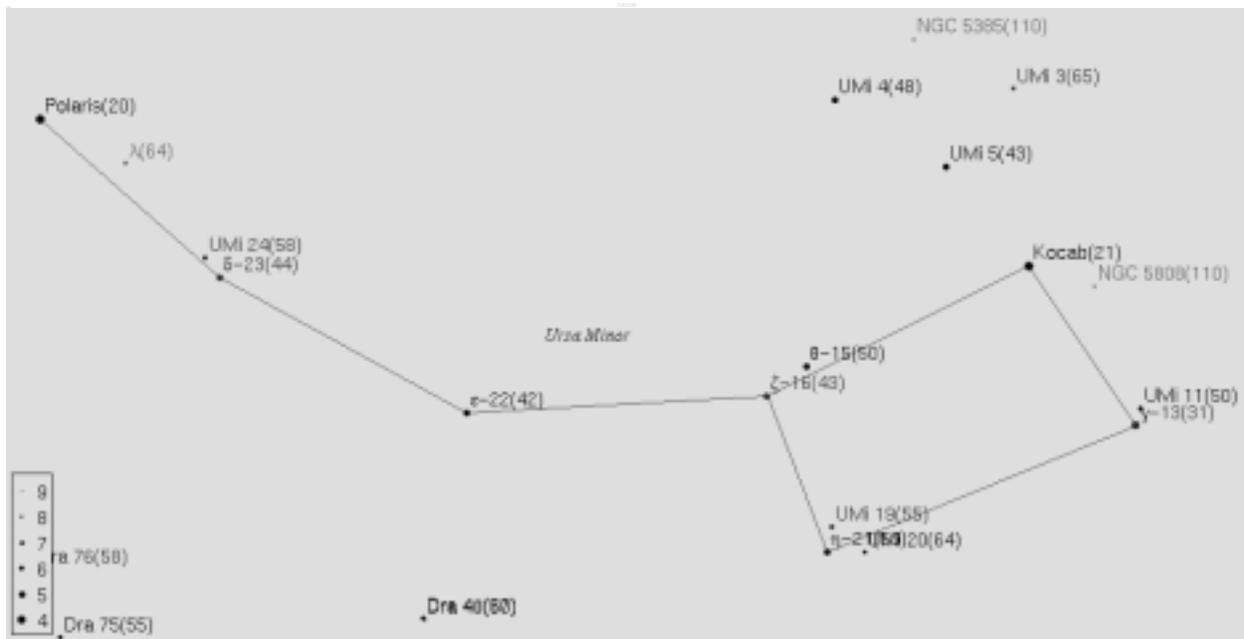


Figure 1: Reference Magnitudes in Ursa Minor

[www.starastronomy.org/Library/umical.html](http://www.starastronomy.org/Library/umical.html) copyright 1999 S\*T\*A\*R Astronomy

- **Description and Comments** - especially points which may not be clear in the pencil sketch you're about to make. Don't worry about being overly structured with these; just keep them clear in meaning and clear in handwriting:

*Located Pleiades with naked eye; looks like a small faint cloud. Pointed telescope at it by sight. Many stars spread over a fairly large field; decide to sketch the finder field (mag. 6 times) as suggested in Handout 5 to be able to cover its area.*

*The longer we stared at M42, the more we saw --- by moving my eye around in the field, averted vision picks up details in different areas. Faint wisps of nebula appear to extend over the entire field.*

*M35 in Gemini just a big, dim glow.*

*M74 face-on galaxy not found, though we verified that we had the correct star field visible at 50?. The instructor agrees we have the right field.*

Impressions and other qualitative comments give your records some character and make your observations more personally interesting to review later on:

*M13 is spectacular viewed through the LX200!*

*For a moment I had a weird feeling of seeing depth, as of a flat object held up in front of the Trapezium. The Orion Nebula feels "cold" (although this may be mostly because I'M COLD!!)*

- **Time** observations were made. "The time" of an observation which isn't instantaneous, such as a sketch or long photographic exposure, should be recorded as separate start and end times (best), or as a start time and a duration (adequate). Traditionally, astronomers use "UT": Universal Time, the time at Greenwich, England, but local time is fine for us provided you explicitly record which time zone you're using (e.g. EST or EDT). If no UT clock is handy I'll normally just write down the clock time (zone time) and time zone while at the telescope and figure out the UT later on, the idea being that I'm less likely to misread my watch than goof an on-the-fly UT computation.
- **Sketches** - through finder scope and/or through the various eyepieces you have available, **as appropriate**: you'll want to use low powers or the finder scope to sketch the field of spread-out objects like open star clusters; use high powers for small bright objects with detail like planets or for seeing details on the Moon. (Remember also to note if you're using the diagonal mirror attachment, since this yields a non-inverted but *left/right-reversed* image in the eyepiece.)
  - Σ Pencil works better than ballpoint pen does for showing objects of varying intensity (e.g. nebulae or planet atmospheric features), and you can also try representing wispy effects by intentionally smearing pencil marks with your finger. Ballpoints also freeze.

- The circular outline of the visible field should be drawn, so that sizes of and distances between objects can be estimated later. With fifty pages of notebook for the term, there's no reason to struggle with micro-sized field circles less than about 3 inches (8 cm for the metric lovers) in diameter or to try to cram multiple sketches in with the written notes on any given page. In fact, for objects with significant detail (like the Moon), one 4 to 5 inch (10 to 13 cm, 0.3 to 0.4 light-nanoseconds) sketch per page works best, giving you room to draw as well as room on the page for the written portion of your log; see figure 2 for a full-size sample of a boffo, high-class sketch drawn by an experienced visual observer. Some students have found it helpful to prepare empty circles on notebook pages indoors while planning the evening's work, to be filled in outdoors with sketches.
- Record what **visual magnification** you were using for the sketch. A common point of confusion here is to read the focal length of the eyepiece off its barrel and record that as the magnification. While the two values *are* related, they're not the same!

The magnification is more generally useful information than merely the focal length of the eyepiece because the latter by itself doesn't tell the whole story: the focal length of the telescope optics also figures in to what you see.

For an LX200 the magnification equals  $2000/f_e$ , so with a standard selection of eyepieces:

- 50x when using 40mm eyepiece
- 77x when using 26mm eyepiece
- 161x when using 12.4mm eyepiece

(For now you get these numbers free, along with a promise that you'll be shown the "why and how" derivation later on when we do some theory and practice of optics.)

- One easy but *crucial* bit of information to record with your sketch is to **mark with arrows the directions of north and east**. Don't let us forget to demonstrate this individually for you:

To identify north in your field, set the paddle speed to "CNTR" and move the telescope to the north (push the N button) while at the same time observing the field in the eyepiece; and *stars will move south*. East and west can be determined similarly by moving the telescope toward the east (direction from which objects are rising); and the stars will move west.

A most common observation enhanced with this information is a sketch of Jupiter and the relative positions of its four Galilean satellites: armed with north and east, you'll be able to use a reference (such as the *Astronomical Almanac 2002*, or the *Voyager III* software application) and definitively label which moon is which.

- As best you can, identify the objects in your sketched visual field with labels, before you forget what it is that you drew! AT THE TELESCOPE, put in enough information so that you can do the detailed labelling on your next trip inside. Include at least enough "field stars" near the object in your sketch to provide definitive information about orientation and scale. (This is where even the best of intentions can start to slip on particularly cold nights...)

- Any **Weather Conditions** specifically affecting this observation, especially if the conditions have changed since the overall sky condition was noted when you started the session.

*Trying to view M31, but it's right in the path of the exhaust from the steam plant smokestack across the street.*

- **Anything Unusual** about sky or equipment, e.g.

*Images have been dimmer and increasing in blurredness though sky conditions seem unchanged. (?)*

*(...more observing notes in here...)*

*Aha! Noticed that a significant covering of dew has formed on the corrector plate. Probably affects at least my preceding six photographs of the Moon.*

or

*Exposure #4: twelve minutes into a fifteen-minute exposure, and JO SEEMS TO HAVE GOTTEN HER TONGUE STUCK TO THE FREEZING COLD TRIPOD! What was she thinking? Closed shutter immediately. Takes 20 min. to polar align again.*

When in doubt, *write it down*. Record anything interesting about the object, even if it seems trivial or irrelevant at the time. Your first observations in this class won't be as good as the last ones you'll do towards the end of the term (or at least, they *shouldn't* be, if we get a reasonable number of clear nights); you'll be training your eyes to see details you'd have missed at the beginning of the term and training your hands to write nice neat notes and amazing beautiful sketches in a wind-whipped notebook, in the dark, while wearing your thick winter gloves, even as your fingers are getting cold and numb ~~and I'm sipping a mocha and catching up on the latest professional lacrosse scores.~~ (Sounds great, doesn't it?)

## **2 A note about working in pairs**

We work in pairs in this class for a number of reasons: it makes planning and set-up more efficient, you can help each other while observing, and it's usually a lot more fun than working alone, particularly if neither of you are quite sure of what you're doing (this is unquestionably the usual state of life in this seminar, so don't feel inadequate).

Of course, the point of running the seminar is to individually afford you the opportunity, including equipment and knowledgeable staff resources, to *do* some observational astronomy yourself, at a specific, fairly relaxed level. Thus, we feel it inappropriate to have students merely hand-duplicating others' at-the-telescope observing records rather than recording their own observations; such copying would, quite frankly, be a complete waste of time and effort (yours, and ours too) and misses the whole point of this class. Please feel free to chat with your instructor if you've any questions or concerns along these lines.