CHAPTER TWO

Sketching Comets

Comets add a sense of surprise and freshness to the predictability and seeming timelessness of the visible cosmos. Some of these mists of dust and fluorescing gas sail through the inner solar system at regular intervals, such as the famous comet 1P/Halley. Many other comets are discovered yearly as they make their first observed descent to our vicinity. Depending on their distance, composition, and intrinsic brightness, comets can present a variety of appearances—from almost stellar objects, to soft round patches, to majestic, tailed plumes that are sometimes visible to the naked eye. Because these are fleeting, transitory objects, time spent observing and sketching them is all the more precious.

Since comets travel very quickly as they approach the neighborhood of the Sun, it is often possible to note the gradual motion of the comet across the star field while observing telescopically. Although this can make locating a particularly faint comet difficult, this motion is something you may wish to record in your sketch. In the tutorials that follow, we will take a look at techniques used to capture the details that each comet possesses. Not only will it serve as a record of your experience, but it will also improve your observing skills and provide you with a great resource if you wish to discuss your observation with other comet enthusiasts.

The tools you will need to sketch a comet can be as simple as a sheet of paper, a pencil, a clipboard, and a red light. However, to give you more control over the appearance of your sketch, there are a few other items you may want to have ready. Following is a list of suggested sketching materials for a graphite comet sketch:

- Clipboard
- Dimmable red observing light
- Paper prepared in any of the following ways:
  - Blank
  - Prepared with predrawn sketching circles
  - Copied or preprinted log sheets
  - Copied, printed, or traced star fields (as discussed in the tutorials on pages 32 and 145)
- HB and 2H pencils
- Pen (for notes)
- Blending stump or tortillon
- Choice of erasers (Art Gum, eraser pencil, kneaded)
- Eraser shield (used to constrain erasures to a small area)
- Pencil sharpener or lead pointer
- Sandpaper block (used to hone the point of a pencil, blending stump, or tortillon)
- Small paint brush (used to brush away loose graphite or eraser debris)

2.1 Sketching a Comet and Its Motion

I will use a telescopic sketch of comet 73P-C/Schwassmann-Wachmann 3 as an example in this tutorial. This comet was relatively bright at the time of the observation at about 6th magnitude. Its beautiful, soft glow swept across the field of stars like the expanding wake of a speed boat on glassy water. The pseudonucleus was stellar in appearance with an elongated bright spike extending to the southwest. The flowing tail was striated with varying levels of luminosity and consisted of a bright, narrow, inner portion enveloped by a shorter, fainter, outer fan.

When observing comets, use averted vision, different eyepieces, and even slight movements of the telescope to discern as many details as possible. Take nothing for granted. Fascinating unexpected structures may reveal themselves, if you are diligent with your observation and sketch. Not all comets display bright tails, and all you may see at first is a round coma. As you observe this feature, try to discern how strongly defined its core is. At higher magnification, see if you can you discern any subtle irregularities in brightness.

If the comet is faint, a tail (if present) may be very difficult to detect. This is where movement of the telescope—perhaps letting the comet drift through the field—can be helpful in spotting this feature. If one or more tails are evident, how long and wide do they appear? Which portions of the tails are brightest, and can you spot any irregularity in that brightness? The comet in this tutorial exhibits a pronounced tail. If the comet you are sketching does not have one, simply disregard those steps.

Choose a magnification that you feel provides a good view of the comet. You may decide to render more than one sketch to cover details seen at low and high magnifications. Or you may combine multiple views into one sketch. For this sample sketch, I chose a low-power view that nicely highlighted the comet's bright

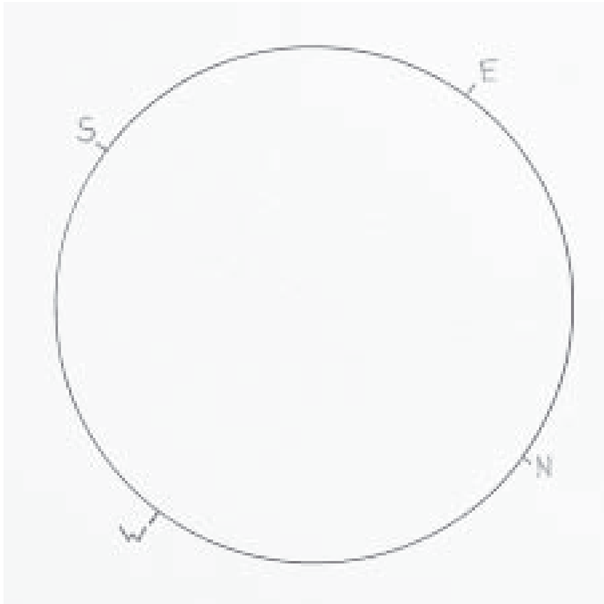

Figure 2.1.1

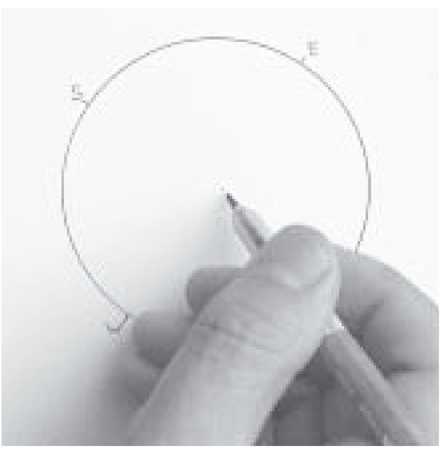

Figure 2.1.2

tail. I made the observation using my 15-cm f/8 Newtonian with a 32-mm Plössl eyepiece. This offered a magnification of 37.5× and true field of view of 88 arc minutes.

Step 1: Framing and preparing the sketch area Line up your telescope so that you get the best view of the comet and its surroundings. If you have some room for adjustment, try to place a conspicuous star in the center. This is not absolutely necessary, but it can make the placement of stars and comet features more convenient. Mark the cardinal directions around your sketch circle. (**Figure 2.1.1**) Use one of the techniques discussed in *Assessing Cardinal Directions* on page 39.

Step 2: Plotting the star framework If you placed a star in the center of your view, mark it now with your pencil. (**Figure 2.1.2**) For tips on plotting stars in your sketch, see *Marking Stars* on page 126. If you have placed the core

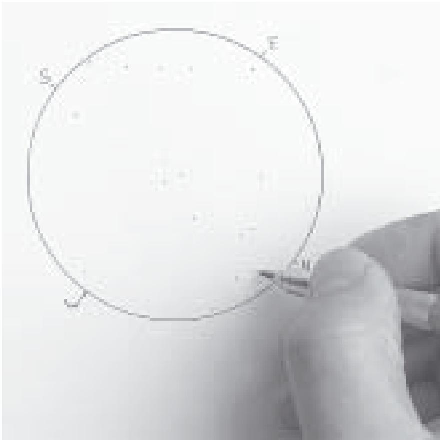

Figure 2.1.3

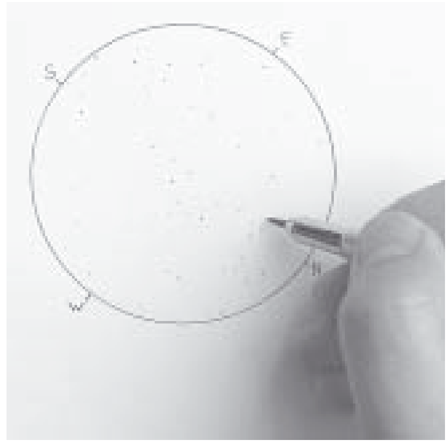

Figure 2.1.4

of the comet at the center of your sketch, refer momentarily to Step 3 to lightly mark its position there and then return to this step.

With the center point marked, you will now plot the remaining stars that are visible through the eyepiece. (**Figure 2.1.3**) These stars will serve as measuring points when you add dimension and note the motion for the comet. They will also allow you to describe the position of the comet in relation to known star positions using a star atlas or planetarium software. I recommend going through the *Sketching a Simple Open Cluster* tutorial on page 99 for tips on how to accurately place these stars. Simply put, plot the brightest stars first by imagining their positions on a clock face, noting how far they are from the center. Then proceed to mark the fainter stars by either using the same method or by noting where they reside in relation to the stars you have already plotted. Mark these stars lightly, so there is a notable difference between the bright and faint stars. Try to visualize the geometric shapes they make with each other as you do this. Finish this stage by comparing the boldness of the stars in your sketch with the eyepiece, making progressively brighter stars bolder if necessary. (**Figure 2.1.4**)

Step 3: Marking the comet's position With the framework of stars in place, you can now sketch the comet. To begin, I suggest using a blending stump to lightly mark the center of the coma. Refer to the techniques described in *Using a Blending Stump* on page 153 to lightly load your blending stump with graphite. With the blending stump prepared, lightly swirl a very small mark at the comet's position (**Figure 2.1.5**). As soon as you do this, check the time and mark it in your notes.

NOTE: In this tutorial, I render the tail first, since it was so prominent. However, if the coma of the comet is more pronounced, you may wish to sketch it first (see Step 6). The order in which these features are sketched should not be set in stone. In fact, you will likely switch back and forth between them as more details reveal themselves over the course of the observation. For simplicity's sake though, we will tackle them one at a time.

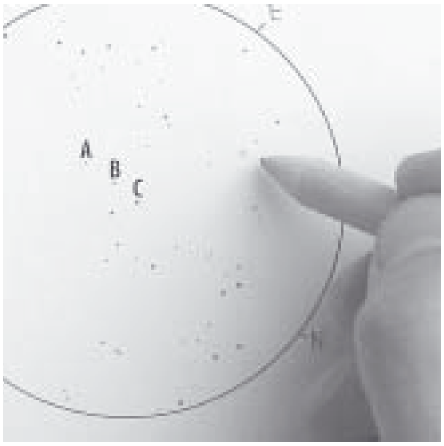

Figure 2.1.5

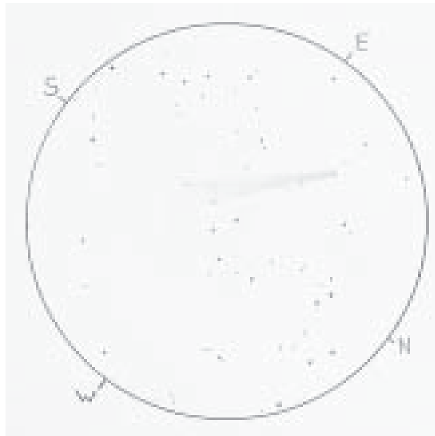

Figure 2.1.6

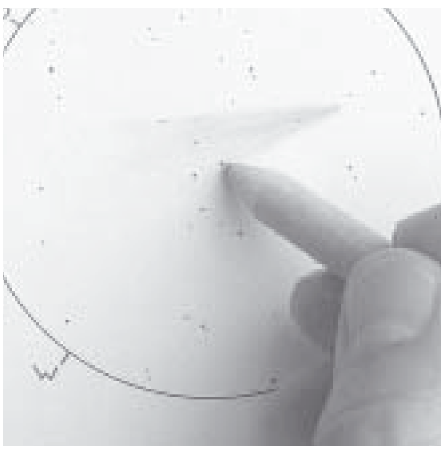

Figure 2.1.7

Step 4: Shading the core of the tail If the comet has two or more widely separated tails, concentrate on rendering one at a time. Rendering the bright core of the tail first will give you a spine on which to build the rest of the tail. Using the stars in your sketch as a guide, note which direction the tail points. Use averted vision to determine how long it appears and how wide it is. Load your blending stump and begin with the portion of the tail that is the most obvious. For this sketch, the bright, inner core of the tail was spread between two stars marked A and C in **Figure 2.1.5.** There was also a brighter spike within: that pointed to the star marked B in the same image. The tail as a whole extended past the field stop of the view, but was rather faint by that point.

To render the tail, lightly load your blending stump with graphite. Beginning at the head of the comet, use circular, elliptical, and even linear strokes to define the core of the tail. (**Figure 2.1.6**) Lighten pressure on the blending stump as you render fainter areas. Keep your eyes open for clumps or streamers of brightness so that you can render these faithfully in your sketch. (**Figure 2.1.7**)

Step 5: Refining the tail In order to see the fainter portions of the tail, you will need to give your eyes a rest from your red sketching light. Spend plenty of time at the eyepiece, using averted vision and slight motions of the telescope to bring out as many faint details as possible. With the image sufficiently burned in your mind, load your blending stump with a small amount of graphite. Then

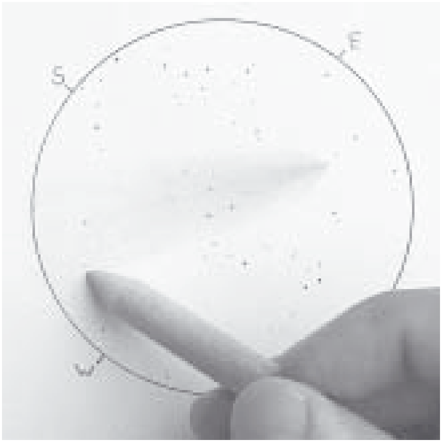

Figure 2.1.8

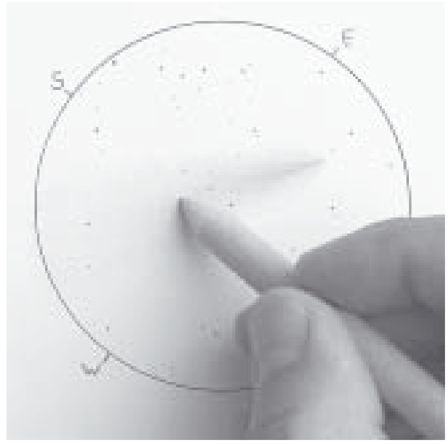

Figure 2.1.9

use soft, smooth strokes to render these fainter portions of the tail. (**Figures 2.1.8**) To produce a gradual transition at the outermost edges of the tail, reduce the pressure on the blending stump to almost nothing in those areas. Return to any brighter portions of the tail and darken them up if necessary. (**Figure 2.1.9**) If you find that you have shaded an area too heavily or produced a transition that is too sharp, you can use a kneaded eraser to carefully lift graphite away from these areas (see *Using a Kneaded Eraser* on page 157).

Step 6: Adding the coma Using other stars in the view for comparison, determine how wide the coma appears. With some comets, the coma will appear circular and distinct from the tail. Other comets may not offer such a simple distinction. For example, in this sketch of 73P-C/Schwassmann-Wachmann 3, the coma did not present itself as a distinctly circular feature. There was, however, a faint outer shell to the tail near the comet's head that will serve to illustrate the point.

To render this feature, load your blending stump very lightly with more graphite. Using a very soft, circular, or elliptical motion, begin at the center of the coma and swirl outward, lightly defining its boundaries. (**Figure 2.1.10**) If the outer edges of the coma are soft, reduce pressure on the stump to almost nothing as you shade these areas. (**Figure 2.1.11**) Observe how bright the coma gets as you approach its core and add more layers of graphite with your blending stump to represent this.

Be sure to capture any luminous structure noted in the coma, such as jets, hoods, and fountains, with increased pressure on your blending stump. Dark areas in the coma can be captured by gently removing graphite with your kneaded eraser. Pay close attention to how the scale and position of these features relate to the overall size of the nucleus. Using clock face and concentric circle imagery can help here as well.

Step 7: Adding a pseudonucleus or central condensation If the comet presents a bright, stellar, or almost-stellar point at its heart, determine

Figure 2.1.10

Figure 2.1.11

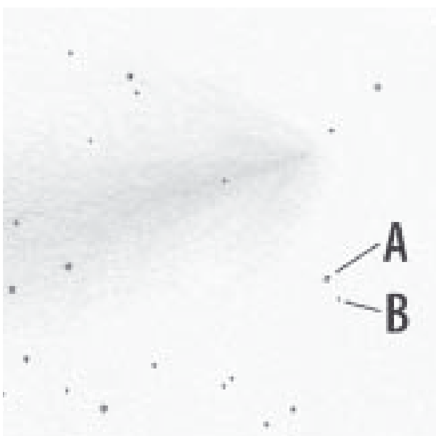

Figure 2.1.12

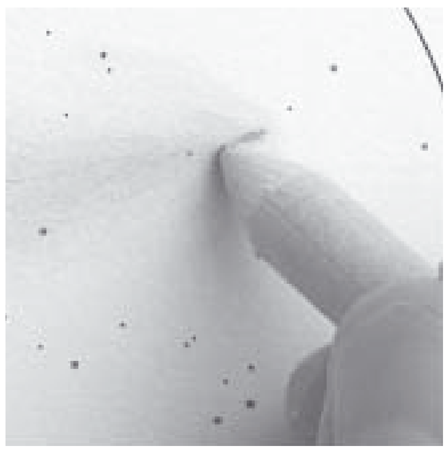

Figure 2.1.13

how sharp it is. If it is a thick, bold spot or streak, you may want to use your blending stump to mark it. Pick up more graphite on the stump if necessary and then carefully press it at the position of the central condensation. Apply controlled pressure with a very tight circular motion until the correct brightness is achieved. If there is a stellar pseudonucleus at the core, use your pencil to carefully mark it. Compare it to any other stars in the field that are similar in brightness and mark it with a similar boldness.

In this example, the pseudonucleus was stellar in appearance, but had a bright streak extending away from it in the direction of the tail. This streak was about as long as the distance between the stars marked A and B in **Figure 2.1.12. Figures 2.1.13**

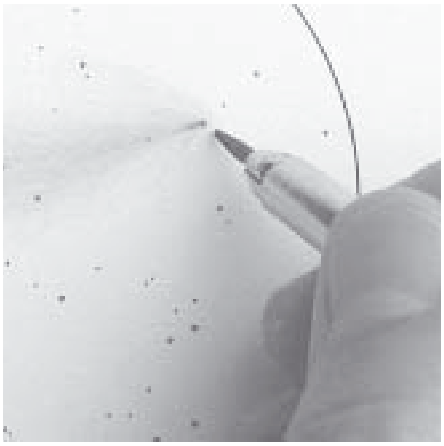

Figure 2.1.14

Figure 2.1.15

and **14** demonstrate the addition of this streak and the plotting of the stellar pseudonucleus. If this point appears to be too sharply defined, further blending may be needed. To do this, lighten the load of graphite on your blending stump, return to the core of the coma, and lightly swirl outward to soften the transition. (**Figure 2.1.15**) If this lightens the pseudonucleus too much, you will need to reapply more graphite. Repeat these steps until you are satisfied with its appearance.

Step 8: Finishing the sketch Take an overall look at the comet now and compare it to your sketch. Rework any inconsistencies with your blending stump and kneaded eraser. After shading the comet features, replot any stars that were blurred in the process. Take a few moments to reexamine the view through the eyepiece and compare the star brightness to what you see on your sketch. Adjust the boldness of any stars necessary to match what you see. (**Figure 2.1.16**) This is also a good time to finish writing any notes about the observation.

Step 9: Marking motion I find that part of the enjoyment of comet observing is noting the motion of the comet over the course of the observation. You may notice motion over the course of making your sketch or you may go off to other observations and return to the comet an hour or two later to note its new position. In either case, if you make a point to mark its position carefully and note the time, you will have a rough estimate of its direction and rate of travel. For this sketch, I returned 2.5 hours later to find that the comet had moved about 14 arc minutes to the east-northeast. When you check the new position, carefully compare it to the star framework, and then mark it with a precise "X," "+," or other mark that you will recognize. (**Figure 2.1.17**) Do not forget to note the time. With this step complete, you have a full record of time well spent with the comet. (**Figure 2.1.18**)

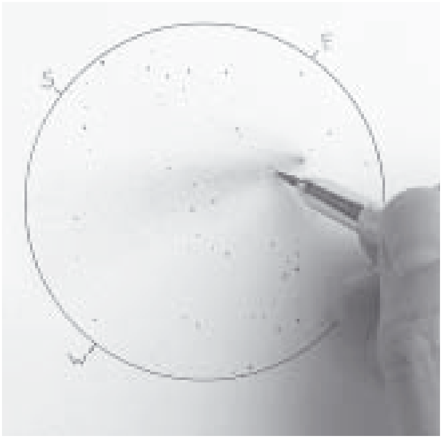

Figure 2.1.16

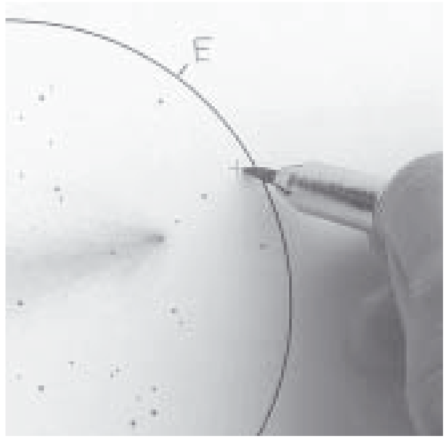

Figure 2.1.17

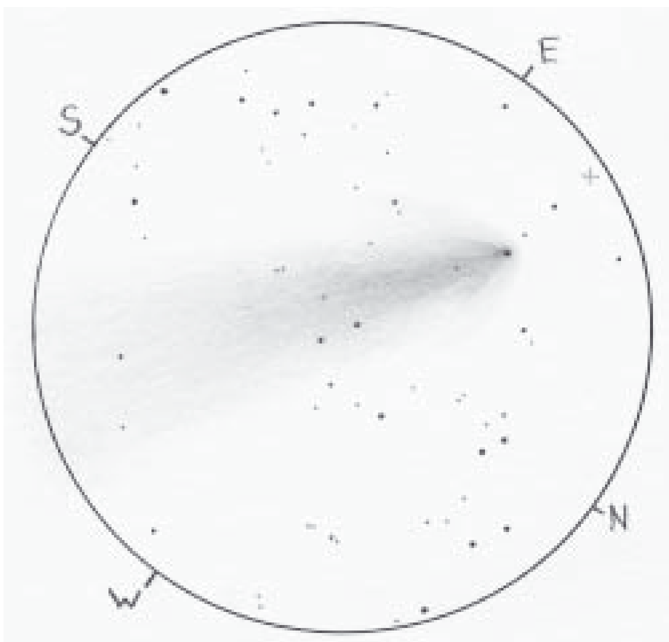

Figure 2.1.18

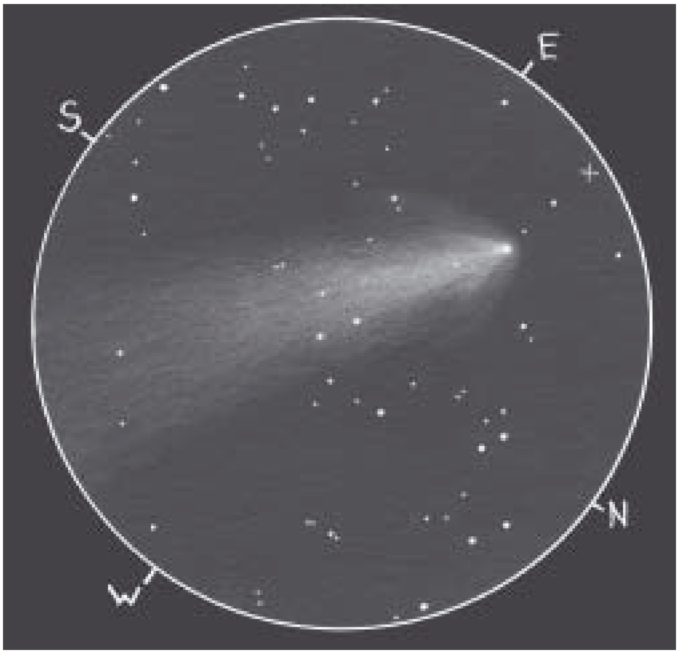

Figure 2.1.19

A positive white-on-black version of the sketch can be seen in **Figure 2.1.19**.

2.2 Creating a Wide Field Comet Sketch

Every so often, a notably bright comet will grace the night sky, offering an exciting opportunity for detailed binocular observations. Some may even stand up to naked-eye scrutiny. Making an effort to sketch one of these remarkable comets will provide you with a fine record of an event that you will remember for years to come. For a naked-eye or binocular sketch, you may want to print or copy a sky chart of the area so that you can concentrate on the comet rather than the daunting multitude of stars you are bound to see.

This tutorial will feature a binocular sketch of comet C/2004 Q2 Machholz. At the time of the observation, the comet was observable to the naked eye at 4th magnitude. By using 10 × 50 binoculars, I was able to see a thin ion tail and a wide dust tail. This tutorial will demonstrate the use of a preprinted star chart that will serve as a stellar framework for the sketch.

Step 1: Framing and preparing the sketch area If you are preparing your preprinted star background using planetarium software, there are a couple things to consider. First, if you are not sure how large the comet will

Figure 2.2.1

appear or where the tail will be pointed, you may want to print a few sheets of the region at different scales and positions and bring them all with you. This will allow you to use the one that is most appropriate for the observation. Another thing to consider is how large your software plots brighter stars. If a test print reveals bright stars that are exceedingly large and you find that distracting, see if your software allows you to change the scaling of star weights. If not, you may want to lay a second sheet of paper over the print and redraw the stars to a more reasonable size. If you find it difficult to see through well enough to trace, try holding the sheets together with a small piece of tape and placing them against a sunlit window, a bright computer screen, or a television. (**Figure 2.2.1**) You can use the same technique with a printed star atlas that you are photocopying or tracing by hand.

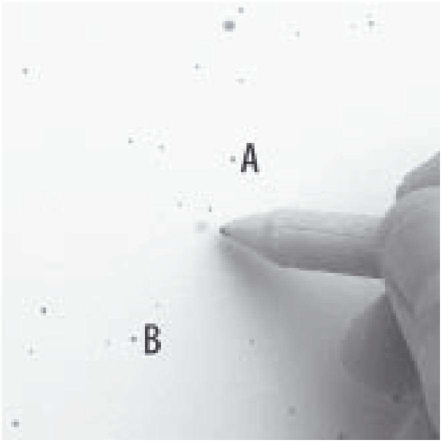

Figure 2.2.2

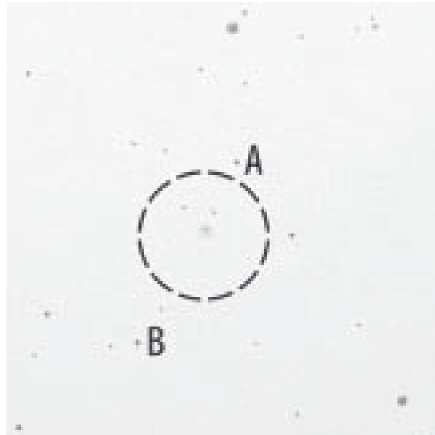

Figure 2.2.3

Step 2: Marking the comet's position Carefully compare the position of the comet's coma to the surrounding star field. Using a blending stump that is lightly loaded with graphite, mark the position of the center of the coma on your preprinted chart. Jot down the time you plotted this point in your notes. For this sketch, I noted that the center of the comet's coma appeared a little more than a third of the way along an imaginary line from a star marked A to another marked B in **Figure 2.2.2**.

Step 3: Determining the disposition of the coma With this position marked, take time to determine the full extent of the coma. Also note what its brightness profile looks like. Is it very diffuse or is it highly condensed at the center? If it possesses a distinct central condensation or pseudonucleus, is this feature centered or off-centered compared to the entire coma? Use the stars that are visible in the sky and plotted on your chart as a scale to estimate the coma's diameter. For example, in this sample sketch, the coma's diameter appeared to be about two-thirds the distance between the stars marked A and B in **Figure 2.2.3**. The dashed circle represents how I visualized this diameter on the sketch.

Step 4: Sketching the first layer of the coma With the size and profile of the coma in mind, lightly load your blending stump with graphite (see *Using a Blending Stump* on page 153). Take the blending stump and begin swirling it lightly, starting at the point you marked in Step 2. Using a delicate circular motion, proceed outward from the center to define the coma's visible diameter. (**Figure 2.2.4**) As you approach the outer edge of the coma, decrease the pressure on the blending stump to the lightest possible touch. You will usually want these outer edges to fade softly to nothing.

Figure 2.2.4

Figure 2.2.5

Step 5: Sketching the brighter portions of the coma Now that you have applied a base layer that defines the maximum visible extent of the coma, you can fill in any brighter portions you see. Although this brightening will typically manifest itself in the vicinity of the nucleus, you may observe luminous patches in other areas, so keep yourself open to this possibility. Load your blending stump with more graphite if necessary and softly define these brighter portions. (**Figure 2.2.5**) Add them gradually and in layers. Take care not to bring the edges of these layers up to the edge of the base layer if you do not want to give the coma a hard-edged appearance.

Step 6: Analyzing the tail or tails Any visible tails on the comet may be much harder to discern. So take your time, using averted vision, to search for any evidence of them. If you finally get a glimpse of one, pay attention first to which direction it appears to point. Compare this to the stars on your sketch and make a mental note of this. Next, take time to see how far away from the coma you can see the tail stretching. Consider also how wide the tail appears both in the vicinity of the coma and at its trailing end, and whether you can make out any variations in brightness.

Step 7: Sketching the tails In the case of 2004/Q2 Machholz, two tails presented themselves. The first to reveal itself was the slender ion tail that extended like a thin ray from the coma. To sketch this delicate feature, load your blending stump lightly with graphite. Begin by laying down a base layer for the tail. For a long, slender tail, use light, linear strokes to drag the shading for its

Figure 2.2.6

Figure 2.2.7

Figure 2.2.8

Figure 2.2.9

core away from the coma. (**Figure 2.2.6**) As this core grows fainter, lighten the pressure on your blending stump. (**Figure 2.2.7**)

With this core in place, move back in and add light shading to show the faint outer reaches the tail. (**Figure 2.2.8**) Refine the tail until it matches the relative variations in brightness that you see in the comet itself. (**Figure 2.2.9**)

The second tail appeared as a short, broad fan that was centered about 120 degrees counterclockwise from the ion tail. Begin by sketching from the brighter central region and work outward. Lightly load your blending stump again if

Figure 2.2.10

Figure 2.2.11

Figure 2.2.12

necessary. Using delicate circular strokes, start a layer of shading beginning with the brighter portion of the tail. Ease up on the pressure so that the shading fades out softly along the outer reaches. (**Figure 2.2.10**) Continue to refine it by reloading the blending stump and darkening the brighter portions. (**Figure 2.2.11**)

Step 8: Finishing the sketch Reexamine the comet and brighten or softly erase any areas that need to be refined to match what you see. (**Figure 2.2.12**) If you drew the stars on your sketch by hand, you may need to redraw any

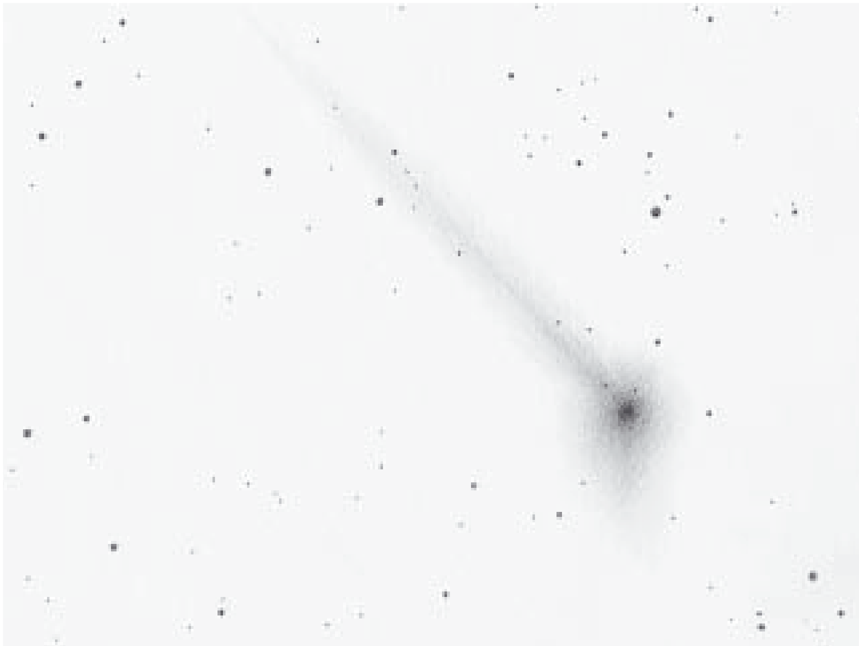

Figure 2.2.13

Figure 2.2.14

that were blurred when you shaded the comet. Complete any notes about your observation; the sketch is finished. (**Figure 2.2.13**) An inverted version of the sketch can be seen in **Figure 2.2.14**.

Tips and Techniques

2.3 Assessing Cardinal Directions

One way to check for cardinal directions is to place a conspicuous star at the center of your field of view and turn off the clock drive if you are using one. Then observe which direction this star drifts. The point where it exits the view is west. (**Figure 2.3.1**) If you have an equatorially mounted scope that is polar-aligned, you can nudge the telescope back and forth in declination to indicate north-south. A quick glance at the subtle motion of the top of the scope will tell you whether you are moving the scope toward the north or south celestial pole. If the scope is moving north, stars will enter the view from the north and exit from the south. The opposite will be true when the scope is moving south. I like to use this method since it is faster than watching for drift, especially in low-power views. Once one direction has been indicated, you can automatically fill in the others if you know how your telescope handles an image. Telescopes with an even number of mirrors or no mirrors at all, such as Newtonians and refractors without mirror diagonals, will present "right-reading" views. A right-reading view may be rotated in any direction, but is otherwise normal. Telescopes with an odd number of mirrors, such as Schmidt Cassegrain Telescopes (SCTs) or refractors with mirror diagonals, will present a mirror image. For a right-reading view, working clockwise, the cardinal directions will proceed as follows: north, west,

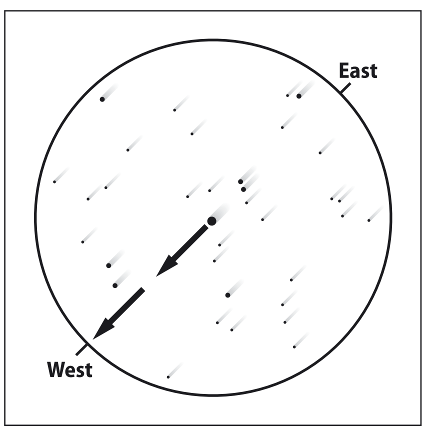

Figure 2.3.1 Star motion proceeds east to west

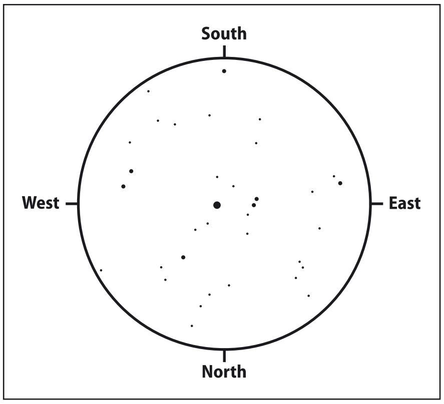

Figure 2.3.2 Cardinal directions in a right-reading view

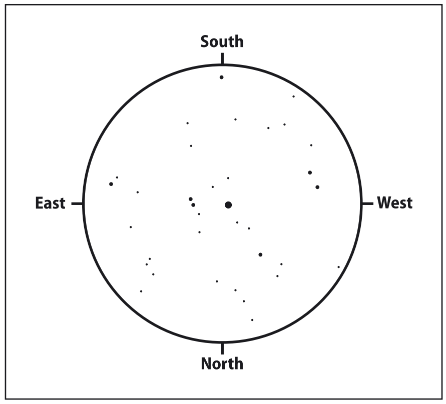

Figure 2.3.3 Cardinal directions in a mirrored view

south, and east. (**Figure 2.3.2**) For a mirror-imaged view, working clockwise, the cardinal directions will proceed as follows: north, east, south, and west. (**Figure 2.3.3**)

2.4 Sketch and Observation Log Sheets

There are a wide variety of methods for recording your sketches and observing notes. No single observing record system will fit the style of every amateur astronomer, so the way you choose to do this will be unique to you. Some observers like to record their sketches and observing notes on preprinted observing record sheets. Others prefer the freedom of sketching and jotting notes on blank sheets of paper, using sketch circles or none at all, as the situation demands. Others combine these two methods in various ways. If you are new to sketching, try a few methods and find what suits you best. On page 181, you will find a condensed deep sky observing form with space for a sketch. A variety of other observing forms can also be found online.

If you want to add a sketching circle to a blank sheet of paper, there are a few things you can do. You can find a cup, can, or bottle with a suitable diameter and trace around this to create a circle. A compass is another obvious and handy instrument for making sketching circles. However, the most useful tool I have found so far is a plastic circle template with circle diameters ranging from 1.25″ to 3.5″ (32 mm to 89 mm). (**Figure 2.4.1**) Such a template will allow you to quickly trace circles without using the awkward arm positions necessary to sketch around a cup, can, or bottle. It also avoids the pinprick that some compasses can leave at the center of their circles.

Whichever method you use, do try to capture at least the following information: object observed, date and time, instrument used, eyepiece and filter used, magnification, and atmospheric conditions. Not only will this information assist

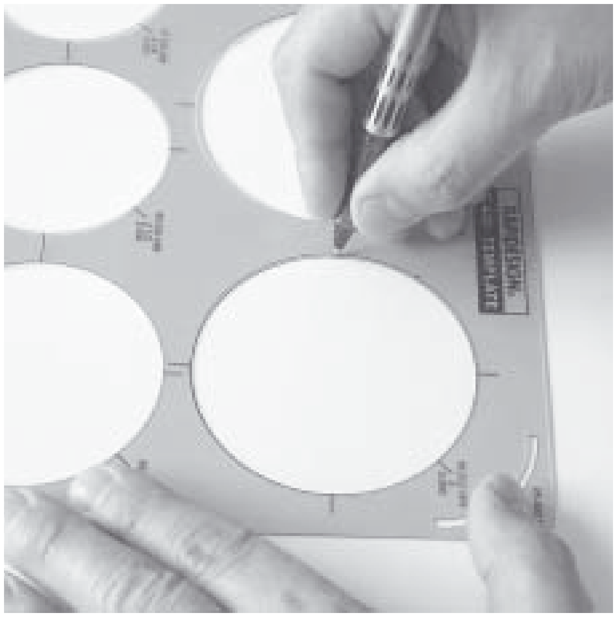

Figure 2.4.1

you in recalling the details of your observing sessions, it will also help you prepare for future observations as you consider what combinations of equipment and conditions led up to the view you were able to sketch. This information is also valuable to other amateur astronomers if you decide to share and compare your observations.

There are a wide range of papers to choose from for your sketches and observation records. A few important things to consider are the weight, texture, and acid content of the paper. Heavier papers are more likely to handle better and be less likely to wrinkle under humid conditions. Papers are also offered in a wide range of textures, from smooth to rough. Smooth papers are well suited for detailed work, but may not always accept multiple layers of shading because the "tooth" of the paper fills in more quickly. Rougher papers tend to accept more layers of shading, but will also display heavier texture to any shading you add. Finally, if possible, try to use an acid-free paper to increase the longevity of your sketches. Papers with acid content will yellow and deteriorate over time. There are no definitive answers on what type of paper you should use, and you should experiment to see which you prefer.

Finally, you will want to consider how you want to store and protect your finished sketches. Some astronomical sketchers keep their work indexed and stored in vertical file folders, flat files, or plastic sleeves. Others keep their sketches in 3-ring binders or in pre-bound sketch books. The archival possibilities are numerous. Whatever method you use, you may wish to apply a spray fixative to your sketches to help protect them from smudging and scuffing. If your sketches

Figure 2.5.1 Distracting flashlight patterns

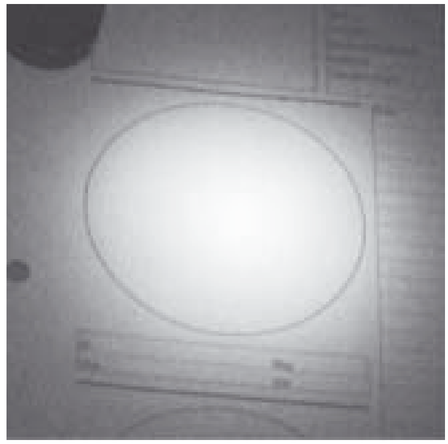

Figure 2.5.2 The same flashlight beam with a piece of wax paper behind the lens

are stored securely and seldom disturbed, a fixative may not be as crucial. However, if you regularly browse, rearrange, or show your work, applying fixative can be important insurance for your hard-earned memories. The need for a fixative becomes even more critical if you use charcoal or pastels in your sketches, since these are much more susceptible to wear and tear than graphite.

Spray fixative can be purchased from most local or online art supply stores. When applying the fixative, be sure to do so in a well-ventilated area—outdoors if possible—and to spray one to two feet away from your sketch, using smooth even strokes. It is better to apply two or three light coats of fixative than to apply a single soaking coat. Allow the fixative time to dry between coats, and before touching the sketch area or sandwiching it between other sheets of paper. With a little planning and care, your astronomical sketches will be preserved for you to enjoy for a long time to come.

2.5 Sketching Faint Objects in Low Light

When you decide to sketch faint, delicate objects that hover on the threshold of vision, you will face a dilemma. To see these objects well, your eyes need to be adjusted to the dark. However, in order to sketch these elusive cosmic quarries, you need some form of light to see what you are doing. How can you reconcile these two competing needs?

The first thing to do is invest in a red flashlight with a dimmer switch, available from most amateur astronomy suppliers. Red lights can sometimes project irregularly lit patterns onto your sketch. (**Figure 2.5.1**) This can be very distracting when you are trying to sketch a faint object. One way to help diffuse this pool of light (**Figure 2.5.2**) is to place a strip of masking tape over the lens of the flashlight. I have found that opening the flashlight up and placing a piece of wax paper behind the lens also works very well. Having a dimmer switch on your red flashlight is very important. When sketching, you must endeavor to keep the light turned down as much as possible. As your eyes adjust to the dark, that faint light will gradually become useful enough to accurately render your sketch—at least when it comes to stars.

The situation becomes a little trickier when rendering faint nebulosity. The faintest settings on your sketch light can make it very difficult to discern the feeblest smudges of blended graphite on paper. With the light at such a low level, you may end up overdoing the darkness of the shading simply because you cannot see it on the sketch. This can be especially true when you are taking your first steps in the realm of astronomical sketching. This struggle will become more manageable with practice sketching in the field.

Turn the light up a little as you work toward this comfort level. As you get better acclimated to your sketching tools and techniques, the brightness of the light can be dropped back down again. No matter how dim you keep your light, it is still an artificial light source and will affect your dark adaptation to one degree or another.

To compensate for this, the most important technique is to keep your eye glued to the dark recesses of your eyepiece as long as it takes to maximize your dark adaptation. For particularly elusive subjects, you may want to turn your sketch light off completely while you are absorbed in the view. Pull a hood or towel over your head and eyepiece to block stray light. Concentrate carefully and at length on the view in the eyepiece, burning the image into your mind as strongly as possible. Once you have the image firmly in mind, drop down to the sketch, turn the light back on, and add the shading quickly while the image is still in your mind's eye. Try to spend as little time as possible with your eyes exposed to the red light. Once you have applied as much as you can remember, return to the eyepiece, letting your eyes adapt again before going back to the sketch and starting the process over again.

This may seem frustrating if you are uncomfortable putting pencil to paper to begin with. You may feel the need to spend as much time as possible at the sketch, with the light turned up brightly, working your way through the mechanics of the whole process. And you know what? That is perfectly fine. Work under the conditions you need until you are comfortable with the process. However, keep these points in mind as you gain confidence. Try to apply them with every sketch and you will find that it becomes easier with time.

Figure 2.5.3

One final issue is how to hold your red flashlight. If you are able to sit while observing, you can keep the clipboard in your lap and hold the flashlight in one hand while you sketch with the other. (**Figure 2.5.3**) However, if you must stand to observe, the solution requires a bit more creativity since you must now hold the clipboard with your free hand. A simple solution is to lay the flashlight on its side on the clipboard and aim it at your sketch. (**Figure 2.5.4**) This can be a frustrating solution though, because the ray of light will fade from light to dark across the length of your sketch. The flashlight will also tend to shift position if you do not keep the clipboard still and level. Another option, if the flashlight has a lanyard, is to hang it from a convenient structure such as your telescope's eyepiece. (**Figure 2.5.5**) You can also try rubber banding it to the head or arm of a camera tripod and aiming where you need it. (**Figure 2.5.6**)

One solution that I found particularly useful was to purchase a spring clamp, a hose clamp, and a gooseneck lamp with a clip. I removed the lamp head and wiring from the gooseneck lamp. I then used the hose clamp to attach the spring clamp to the loose end of the gooseneck. (**Figure 2.5.7**) The red flashlight is then held in the

Figure 2.5.4

Figure 2.5.5

Figure 2.5.6

Figure 2.5.7

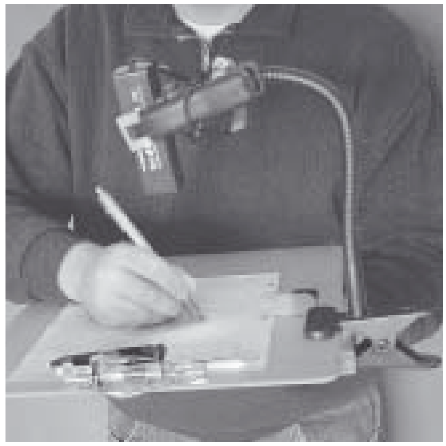

Figure 2.5.8

spring clamp, and the gooseneck is clipped to the clipboard. (**Figure 2.5.8**) You may need to slip a narrow item such as an empty cassette tape holder beneath the clipboard so that the gooseneck clip has a thicker surface on which to attach itself.

Another lighting solution that some amateur astronomers find useful and convenient is a red LED headlamp. A headlamp can keep your hands free, and point the light right where you need it. However, keep in mind that even a headlamp with adjustable brightness settings may still be too bright at its dimmest setting. If you find this to be the case, judicious application of masking tape, or electrical tape with small holes in it may help dim the light down to a manageable level. Other lighting solutions can also be found online in most amateur astronomy forums.

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