# REFLECTIONS AND REFRACTIONS

OF THE UNIVERSITY LOWBROW ASTRONOMERS

DECEMBER 2004


**Upcoming Events**

**December 2004**

- **Saturday, December 4, 2004.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset.) Open House at Peach Mountain.
- **Saturday, December 11, 2004.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset.) Open House at Peach Mountain.
- **Friday, December 17, 2004.** (7:30PM). Monthly Club Meeting.
- **Saturday, January 8, 2004.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset.) Open House at Peach Mountain.
- **Saturday, January 15, 2004.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset.) Open House at Peach Mountain.
- **Friday, January 21, 2004.** (7:30PM). Monthly Club Meeting.

# Capturing Auroras The Lowbrow Way

*by Doug Scobel*

Few celestial phenomena are as spectacular and captivating as the Aurora Borealis, otherwise known as the northern lights. On the evening of Sunday, November 7, 2004, much of the northeastern United States and eastern Canada was treated to just such a display. I took some photos from my back yard, and many of you have seen them. Now you may think that capturing an aurora's delicate features and awe-inspiring beauty on film can be a little daunting. The good news is that you can do the same thing. All it takes is some modest equipment, and the application of some simple techniques. It can definitely be done the Lowbrow way!

**Equipment**

Before I start, I want to mention that I have direct experience only with film cameras when photographing auroras, so I may be a little off on my advice with digital cameras. But what I've outlined here should give you a good starting point, regardless of what kind of camera you use. Still, you may have to experiment some to get the best results.

First, you need a camera capable of long exposures, at least up to 30 seconds. Most 35mm single lens reflex (SLR) cameras will work. Auroras are generally not that bright, and you need to keep the shutter open long enough for the image to register. If you are using a digital camera, then you'll need a similar capability.

As far as film goes, ISO 200 or 400 film ought to work well. In the "old" days, anything faster would tend to yield images that were too grainy. But today's modern films, at ISO ratings of 800 or even faster, may provide good results too, although I have not tried them and cannot say for certain. As I said earlier, feel free to experiment!

The other prerequisite is a way to steady the camera. You simply cannot hold it by hand and expect a sharp image. This is where a tripod is essential. If you do not have a tripod, then find a way to prop and aim the camera on a table or something solid so that you don't have to touch it while the shutter is open. Regardless of how you support the camera, you also need a way of tripping the shutter without touching the camera. Use a cable release, or use the camera's self timer.

**Taking the Photos**

To take the photos, use the widest-angle lens you have, open the aperture as fast as it will go (50mm lenses are usually around f/2, 28mm's around f/2.8), put the camera on the tripod, aim it roughly north, and shoot away. You need to take a long enough exposure to capture the aurora, but you don't want to go too long, because auroras move around and they may be "smeared" on the image. Between 15 and 30 seconds is ideal. You're also limited to similar exposure times if you don't want stars to trail noticeably. This places a limit of about 15-20 seconds for a 50mm lens, and 30-40 seconds for a 28mm wide-angle lens (when using a 35mm film SLR). Of course, if your camera is mounted on some kind of drive, then star trailing is irrelevant. For the rest of this article, though, I will assume that you are not using a drive.

As I said earlier, to avoid shaking the camera when opening and closing the shutter, use a cable release or the self timer. If you can use neither, then you can use the old "hat-trick" method. Put a hat or large piece of dark material in front of the lens, open the shutter, remove the hat, and after the prescribed exposure time replace the hat and close the shutter.

When using ISO 200 film, you'll need a good 30 seconds to get a decent image, and at least half that when using ISO 400. I would recommend you use the longest exposure you can get away with without having the stars trail or the aurora smear. In other words, use the fastest film you are comfortable using, and expose for say 15 seconds with a 50mm lens or 30 seconds with a 28mm. If you're unsure, then bracket your exposures by one stop either way. To bracket, besides exposing for the "ideal" time, expose also for maybe one half that time and also double that time. That way you can "cover your bases", and the best image will likely be one of the three. Be sure to write down what you do for each exposure, so that when you see the final pictures you know what combination worked the best.

If you are using a digital camera, then exposure times and lens settings should work similarly. But in terms of how long you can expose before stars start to trail, note that you'll have to compensate for digital camera lens' shorter focal lengths. The smaller image plane in digital cameras means that shorter lens focal lengths cover the same area of sky as longer 35mm SLR lenses. You may wish to experiment with non-aurora shots, to see how long an exposure you can take before star trailing becomes objectionable.

Another thing to watch for when using a digital camera is to use the highest quality setting your memory card will let you use. Each picture will consume more storage than with a lower quality setting, but it will be sharper and have more detail in it. Despite what you see in movies and TV shows, if the detail is not present in the original image, then no amount of digital post-processing can re-create it.

**Developing Your Film**

If you use a film camera, then it's time to have your film developed. Now I have had occasions where the developer decided that my photos of the night sky were out of focus and/or underexposed, and they decided not to print them! So I always provide special instructions, directing them to print all exposures, regardless of how they look. Also, you may wish to tell them not to cut the negatives. If the pictures are way under-exposed, then the developer may not be able to detect the frame edges, and could cut the negative right in the middle of an image! I've also seen this happen.

If you don't have access to a computer with image processing software, then you're done. But if you do, then you'll want digital copies of your pictures too. I always send my film to Kodak for processing and printing, and also have them add the images to a CD at the same time. It's relatively cheap and they make very high quality, high resolution scans right off the negatives. These scans are far superior to what you would get by scanning the prints using a flatbed scanner.

**Digital Post-Processing**

Now that you have your photos, you may be perfectly happy with them. But, they might look a little dull and lackluster. This is where the so-called digital darkroom comes in. A little bit of digital "magic" can make the difference between an ordinary-looking photo and a real stunner.

In a raw digital image, there are all kinds of information that might not be apparent. Colors may be subdued, or there might not be much contrast. Plus there might be some defects that you wish were not there, like dust, scratches, or airplane trails. All of these shortcomings are easily corrected with image processing software, like Photoshop, or Paint Shop Pro (which I use). Generally, I'll first remove any defects I don't want, such as airplane trails or dust. Then I'll adjust the contrast so that there's a good balance between the dark and bright areas of the image. Finally I'll adjust the color saturation to make the colors really pop out, being careful not to over-do it. Sometimes it's hard to believe that the finished product actually came from the original.

Here's a before-and-after example. The original picture below looks flat and lifeless. An airplane left a straight trail right of center near the bottom, plus there was a small hair in the camera which exposed itself in silhouette in the upper left corner of the negative.

Here's the same photo after processing. There's much more "pop" in the image, plus the unwanted defects are gone. The picture has really "come to life".

There you have it. With simple equipment and a little practice now you too can produce your own stunning aurora photos. All we need now is to be blessed with another display of the northern lights!

# Two Days in Manhattan

*by Dave Snyder*

This summer I visited Manhattan. Manhattan is not a dark sky area, but it has something almost as good; the Hayden Planetarium. It is located inside the Frederick Phineas & Sandra Priest Rose Center for Earth and Space, and both are on the north end of the American Museum of Natural History.

You can enter from West 81st Street, or through the Museum at West 79th Street.

Above is the Rose Center as seen from West 81st street. The circular shape is the Hayden Sphere; the planetarium is inside the sphere.

There is a spiral walkway that winds around the sphere. The second photo was taken from the walkway. The Hayden Sphere is to the left and Manhattan buildings are visible in the background.

The Hayden sphere is used to help visitors visualize astronomical scale. Models of the planets (including Saturn, Jupiter, Neptune and Uranus) are suspended from the ceiling. If you think of the Hayden sphere as the Sun, then the models have the appropriate size. (The analogy isn't perfect; they are all too close to each other).

There are stainless steel displays along the walkway. As you walk down the spiral, these displays ask you to make further comparisons of this type. The Hayden sphere is the large reference object which you then compare to a smaller object. In steps like this, you can work your way down from the entire universe to single atoms.

If you continue down the spiral walkway, you end up at the lower level. The bottom of the Hayden Sphere is visible at the top of the third photo. Two circular courses of the spiral staircase are also visible.

In the center of the picture is a large meteorite. Around the walls are stainless steel displays. The display to the right of the meteorite is about the planets. To the left of

the meteorite is a display of astronomical images. The images change while you watch them, as you can see in the fourth picture.

The fifth picture is a close up of the meteorite. My niece Michelle is on the right, next to her aunt, two uncles and her cousin.

There are many more displays. The picture below shows different types of stars. For example, Sirius is an Intermediate Mass Star, Antares is a High-Mass Star and Rigel is a Very High-Mass Star.

The circle at bottom left is a scale. There are several similar scales at different places in the room. They do not display your Earth weight, rather they display what your weight would be on the Sun or Mars or some other object.


There were a number of hands-on displays. In the foreground of the seventh picture is a cone filled with a yellow liquid. You can't see it in the photograph, but when you rotate the cone, you can create patterns similar to the convection currents in stars. The woman in the foreground is Michelle's cousin.

To the left of her in the picture, a girl is standing on one of the scales I mentioned earlier.

The displays to the right show how different types of electromagnetic radiation are used in astronomy.

Behind her is the display of stars shown previously. Even though you can't read the text, you should recognize the H-R diagram in the center.


Other displays show the different types of Galaxies: Spiral, Elliptical and Irregular.

Central Park is a short walk from the Rose Center. Walk across Central Park, and you will find the Metropolitan Museum of Art (the Met for short).

You might not expect to find anything related to astronomy in the Metropolitan Museum of Art, however....

There was a display of old timepieces. The object on the front right is an astrolabe, a mechanical computer used to calculate astronomical events. (I couldn't use flash -they don't permit it- and I didn't have a tripod, so this photograph is darker than I would like).

The card seen to the right of the astrolabe went into more detail. It reads as follows:

> Monstrance Clock
> Case of gilt bronze; dial of gilt brass
> Movement of iron
> German (probably Augsburg), ca. 1570
>
> In addition to showing the hours, the astrolabe dial of this clock (parts of which are missing) was made to indicate the apparent motions of twenty-three stars in the northern hemisphere, the position of the sun and the moon in the zodiac, and the age and phase of the moon in its monthly cycle. The recessed ring encircling the chapter of hours gives the day of the year, saint's days, and other calendrical information for the period beginning in 1570 and ending in 1610. The dial on the top is for setting the alarm, the finial is a nineteenth-century addition.
>
> Gift of J. Pierpont Morgan, 1917
> 17.190.639

The Met is not the only place to see astrolabes. As I understand it, the best place to see astrolabes is Chicago where you can find a large collection.

# Adventures with Used and Cheap Equipment Part II

*By Tex Ritter*

When we last left our hero, he was hanging up the phone after promising to give a demonstration of "How to See Stars in the Daytime using Off-the-Shelf Equipment" to his customer on the following day. The problem was, he thought, he hadn't actually seen any stars with the used equipment he had assembled. Nevertheless, he felt certain that whatever problems he might encounter would be few and easily overcome. Admittedly, in the distant past, a lack of preparation and a willingness to "wing it" had occasionally resulted in some minor disaster or two, but it had just as often brought him opportunities which he wouldn't have had, had he waited until things were perfect. Yin and Yang, he thought. Perfect, or just good enough to get the job done before the planet freezes over?

He walked outside to where the Celestron was set up. It was just after 1:00 PM, and the moon was visible in the clear blue sky. The first thing to do to find a bright star in the daytime was to reference its

position to something he could actually see, like the moon, and for that he needed to align the Astromaster. He had seen this done several times before by others, so he figured he could probably do it, too. First, level the tripod. He looked at the circular bubble level on top of the Celestron's wedge, and it was over to the side as far as it could go. Fortunately, the tripod had adjustable legs for just this purpose. He loosened a leg clamp, leaned the tripod back, and the first leg extension slid smoothly out until it hit the ground about a foot away. Tightening the clamp, he thought; One down. He repeated this with the second leg, which slid out about six inches and stopped. He examined the extension tube and found that the previous owner of this used and inexpensive piece of equipment had flattened the tube into a D shape by overtightening the clamp. He pulled on the extension and nothing happened. He twisted it. Still nothing. He took the wedge and the C-8 off the tripod, laid the tripod down on the ground, and applied serious leverage with his foot. Several times. The leg slid out a foot. Now for the third leg. Simultaneous twisting, pulling, and an assist from a pipe wrench got the leg out eight inches, where it refused to move an inch further. Furthermore, it now refused to move by any amount in any direction. Well, the other legs could still be shortened to level the scope.

Replacing the wedge and the C-8 onto the tripod, he pointed one of the legs of the now off-balance tripod toward where he thought North would be. He then loosened the clamps on the remaining two semi-functional legs and pushed the tripod down until the bubble level moved off the wall. It didn't actually get inside the central circle, but it did get closer. A minor adjustment should take care of this, he thought. However, he had to lift the tripod's errant leg off the ground to extend it, and when he set it back on the ground, it ended up in a different spot in the grass. A higher or lower spot. A spot slightly to the side, perhaps, since the legs were a bit wobbly at this point. But certainly, a different spot. The bubble in the level now angled off in a completely new direction. The direction, in fact, of the jammed leg. Adjusting both of the opposite legs moved the bubble around quite a bit, but brought it no closer to the center of the circle. After several iterations of this sort, he was beginning to reflect on the advantages of paving over the planet, when he decided to just shim under the legs with cardboard until a more satisfying solution could be found.

The moon was now an hour further toward the west, and it was time to plug in the clock drive. He assumed that the Astromaster would work better if the clock drive was running, but he had to admit, he really didn't know that for certain. This particular fork mount was equipped with dual synchronous motors, both of which engaged and drove the main spur gear simultaneously, presumably on the assumption that their errors would average out. He hoped that was true. He found an extension cord, plugged the drive in, and sighted on the moon. Strangely, the moon didn't seem to be staying in the field of view. What, Oh What, was the problem? He snugged up the RA locking lever. He listened to the motors, and indeed, they seemed to be making a loud buzzing noise. Maybe they were jammed. After all, you never really knew what you might get when you bought used equipment.

He unplugged the drive, took the fork assembly off the equatorial wedge, and went to find some hex wrenches to remove the drive motors. Of course, the wrench he needed was missing from the set, but a quick trip to the hardware store got him a new set, and the wrench he needed quickly removed both motors. He reconnected electrical power to the drive and was able to see that both gears on the end of their motor shafts turned as they should. He tried to stop them with his fingers, but they kept on turning. This was a good sign. What was not such a good sign was the fact that the motors were preloaded against the spur gear by tightening the two motor fastening screws, and tightening them tended to move the motors around a bit. His previous experience with gear preloading taught him that a remarkable amount of force could be accidentally generated by setting the gears too close. Could that be happening here? He deliberately set the motors back from the gear somewhat, and reassembled the C-8 onto the tripod. Now, the drive still didn't drive the scope, but there was a distinct clunking sound when he moved the scope back and forth.

He disassembled the drive again and reset the motors hard up against the spur gear. Overtightening the preload may damage the gears, he thought, but this only has to work for a few hours. He plugged the drive back in, and the motors made their usual buzzing sound. Peering up into the base of the fork mount, he could dimly see the little paddles in the motor windows flicker as their armatures spun around. It must be working, he reasoned, but it still wasn't driving the scope. In frustration, he gave the little lock lever on the RA base an unreasonably forceful twist. The scope started tracking.

He couldn't believe it. He now realized that the drive was set up so that the motor gears turned a floating RA spur gear, and the locking lever connected the floating gear to the stationary polar axis. He had wrongly assumed that the RA gear was fixed to the polar axis, that the telescope fork rested on the turning RA gear (and would turn with it as long as the drive was on), and the telescope could normally slip against the RA gear's face when manually turned, but could be locked firmly to the gear by the lever when desired. In this particular mount, it was clear that the RA lock was worn enough (a flaw in this kind of arrangement) so that it wouldn't drive the scope unless it was tightened near its breaking point. There was not nearly enough time left to remachine the mechanism. It was worn, and worked in some spots and not in others. He just hoped it would be in a spot where it would work for the demonstration tomorrow morning.

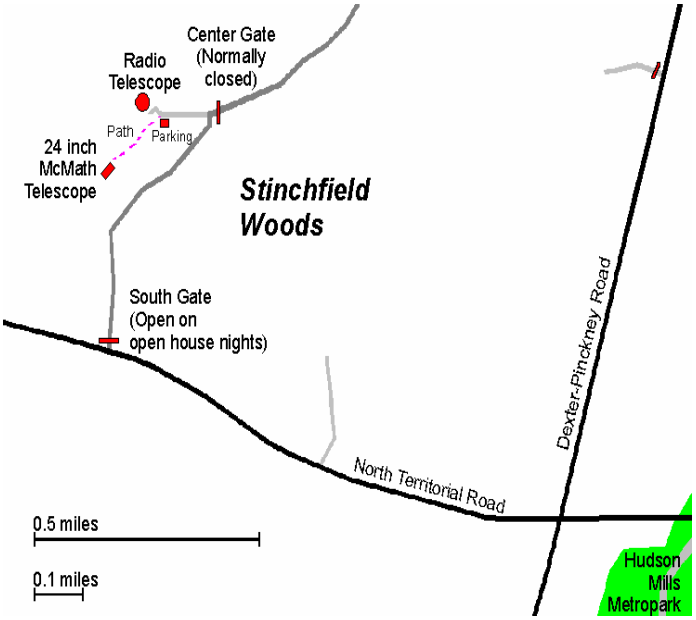
Inexplicably, this design flaw made him think of the time, many years ago, when he was alone in a foreign country's aircraft plant, and he had to explain to a roomful of suits just why the device he had designed, and they had purchased, didn't actually work in the field (It had worked just fine in the lab). There are good designs and bad designs, he reflected, luck and preparation, and when covering new territory, it's best to stay on the sunny side of every street you're on.

As the sun plunged toward the horizon and the sky darkened, he switched on the Astromaster.

*To be continued.*

# Places and Times

Dennison Hall, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of South University Avenue. The meeting is held in room 130. Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.




Peach Mountain Observatory is the home of The University of Michigan's 25 meter radio telescope as well as the University's McMath 24 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of Dexter-Pinckney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.

# Public Star Parties

Public Open House/Star Parties are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties are canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 4332-9132 for a recorded message on the afternoon of a scheduled Star Party to check on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitoes - bring insect repellent, and it does get cold at night so dress warmly !

Amateur Telescope Making Group meets monthly, with the location rotating among member's houses. See the calendar on the front cover page for the time and location of next meeting.

# Membership

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students and seniors (age 55/+). This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training).

Dues can be paid at the monthly meeting or by mail to this address:

Kathy Hillig
7654 W. Ellsworth Road
Ann Arbor, MI 48103

# Magazines

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:

Sky and Telescope: $32.95 / year
Astronomy: $29.00 / year

For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer. Make the check payable to "University Lowbrow Astronomers".

# Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call or Email to Newsletter Editor at: **John Ryan (734) 662-4188 allegheny@mac.com** to discuss length and format. Announcements and articles are due by the first Friday of each month.

# Telephone Numbers

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# Lowbrow's Home Page

**http://www.umich.edu/~lowbrows/**

Doug Scobel took these two pictures on consecutive evenings in November. They show the conjunction of the moon with two planets.

They also graphically show how much the moon moves in one day, and in which direction.

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ASTRONOMERS

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