How the Pictures were Taken

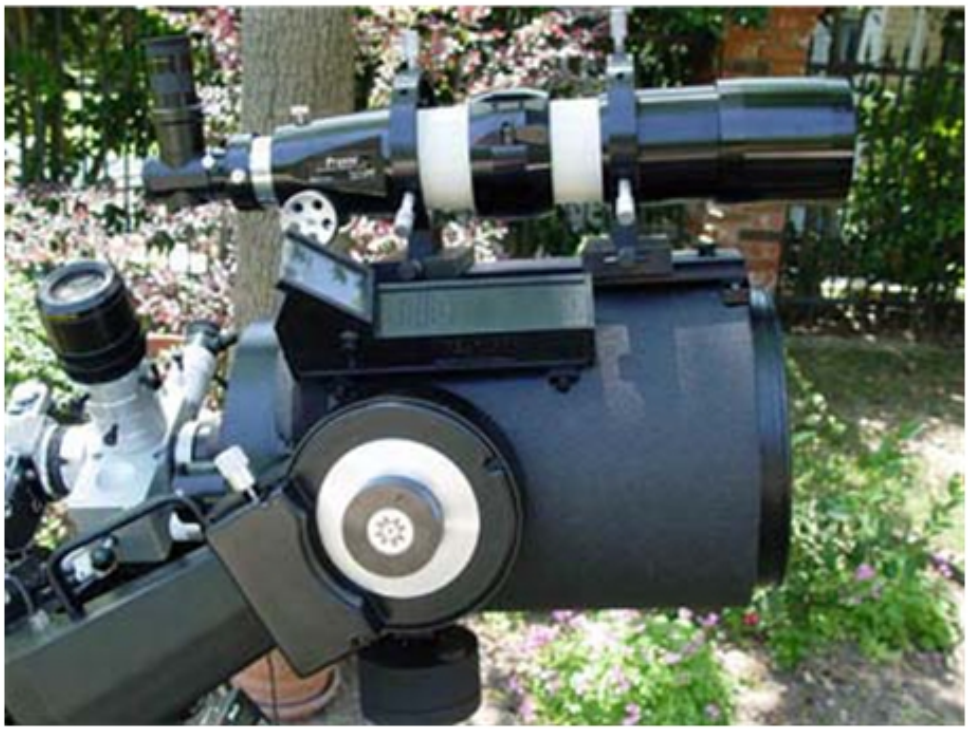
All of the pictures presented in this site were taken with an 8-inch aperture Schmidt-Cassegrain telescope (LX200). I bought this scope because of its versatility. The aperture is adequate for both visual and photographic work and it has an electronic program for locating objects in space. The cost of the basic scope was also relatively cheap (about $2,000). I spent much more than that, however, buying the right equipment for use in the field. Astrophotography is an expensive (and time consuming) hobby. The following discussion gives a brief overview of what was involved in taking the pictures shown on this site.

Picture1: Basic Setup

The picture above shows the basic setup of the scope for astrophotography. It appears to be awkward and ungainly and it is. However, the stability of the setup is more than adequate for all but the most critical photographers. The awkward appearance in Picture 1 has to do with the use of a polar wedge on which the scope is placed. Polar alignment (alignment of the scope with the north celestial pole) is necessary for long exposure astrophotography. In the picture, the silver polar wedge placed on top of a tripod is a custom built "Milburn wedge". The polar wedge provided by Meade (the manufacturer of the scope) is inadequate. It is simply not crafted well and is difficult to use for making fine adjustments in declination (north-south in space) and right ascension (east-west in space) when attempting to polar align.

Picture 2: Milburn Polar Alignment Wedge

The Milburn wedge is more clearly shown in the picture above. It is made from aluminum, easily handles the weight of the scope and accessories, and also is easy to use for making fine adjustments when polar aligning. The head of the telescope fits onto the wedge.



Picture 3: Head of the LX200

The telescope head has several pieces of equipment attached to it. The black rectangular object is called a "Telrad" and is used to help find things in space. It does that by projecting a red bulls-eye into space which provides a general map of where the telescope is pointed. Directly on top of the scope is a small 2.8 inch refractor (made by Televue). This is used for wider field astrophotography. Pictures taken through the LX200 can cover, at maximum, about 0.65 X 0.45 degrees of sky with a 35mm frame. The refractor in the picture above can cover about 3 X 4 degrees of sky. For example, the picture of the Lagoon (M8) and Trifid (M20) nebulas in the same field of view (see Astrophotography page 1), and the Andromeda Galaxy (M31) (see Astrophotography page 8) were taken with a camera attached to the back of that refractor mounted on top of the LX200. On the bottom of the head are weights needed to counter balance the weight of other equipment attached to the scope (particularly the Televue refractor). On the back of the scope is a variety of other equipment (discussed below) also used for astrophotography.

Picture 4: Top view of the wedge and front view of the control panel for the LX200

Long exposure astrophotography requires owning a telescope with good motors for tracking objects that you're imaging in declination and right ascension. Counterbalancing with weights helps the drive motors operate smoothly when tracking objects in space. The LX200 has decent motors on both axes and an easy to use computerized program for finding objects in space, once the telescope is aligned. That package includes a user-friendly hand controller for operating the scope.

Picture 5: Off-axis guider and equipment

The picture above shows a critical set astrophotography equipment attached to the back of the scope. The silver device extending out the back of the telescope is called an off-axis guider, in this case a custom built "Van Slyke Slider". This piece of equipment serves multiple functions. It holds the camera (a Canon 20da, a digital camera specialized for astrophotography), a 40mm eyepiece coming out the top that allows one to see what is being shot through the camera, and an illuminated reticle eyepiece sticking out the side. Reticle eyepieces have illuminated crosshairs that are used for tracking stars in long exposure astrophotography. The off axis guider has a pickoff mirror on the inside and cannot be seen in the picture. This mirror "picks off" a piece of space that is close to the field of view of the picture you are taking. The reticle then finds a star in this area of space and you place it on the crosshairs to help correct for what are called "tracking errors". Astrophotography of "deep space" objects (objects outside of the solar system) typically required a one-hour (or longer) exposure when using film. With the 20da , the same shots can be taken in as little as 5 minutes. But even with a 5 minute exposure, it is necessary to have a telescope that moves in sync with the rotation of the Earth. Failure to precisely "track" the movement of objects across the sky generally results in stars appearing elongated instead of as pinpoints. The problem is that few amateur telescopes have motors refined enough to follow the rotation of the Earth for more than a couple of minutes without periodic correction. This necessitates manually (or electronically) adjusting the movement of the telescope to compensate for such "tracking" errors. With manual guiding, an illuminated reticle eye-piece is used to keep track of these errors. Once you find and place a star in the cross hairs and start your shot, the goal is to keep the star exactly on the cross hairs for the duration of the exposure. Fine adjustments in tracking in either right ascension or declination are made with the electronic program provided with most reasonably sophisticated telescopes.

Personally, I have found the task of finding and holding a star on the cross hairs of a reticle for an extended period of time to be an unpleasant task. A close examination of a couple of the pictures on this site (e.g., M42 and M31) show clear tracking errors. Another popular option is to use "autoguiders". Autoguiders are electronic devices that find and automatically track stars across the sky and send commands to a telescope telling it how to adjust tracking. The benefit is that you get to sit in your chair enjoying the night sky during the shot instead of agonizing over first finding a star (which is more difficult than it sounds) and then keeping it in the cross hairs. I have purchases two different autoguiders over the years, both from the Santa Barbara Instrument Group (SBIG): the ST-4 and the STV. I was unable to get either one to work reliabily with my scope. I found that other astrophotographers have had similar problems when using Schmidt-Cassegrain telescopes with F 6.3 focal reducers (which is the first piece of equipment on the back of the scope to which the Van Slyke Slider is attached). Anyway, I haven't given up hope. One of these days I'll buy a different scope and try electronic guiding once again. I look forward to sitting in a chair while a machine does all of the work.