First Light

Newsletter of the Cape Cod Astronomical Society

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Mooncusser's 21st Century Almanac

By Jim Carlson

First Quarter – Fri. May 05 at 01:15 EDT
Full Moon – Sat. May 13 at 02:53 EDT
Last Quarter – Sat. May 20 at 05:22 EDT
New Moon – Sat. May 27 at 01:27EDT

Object	May 01 (EDT)	May 16 (EDT)	May 30 (EDT)
Sun	R: 05 37 S: 19 39	R: 05 20 S: 19 54	R: 05 09 S: 20 08
Mercury	R: 05 04 S: 18 02	R: 05 13 S: 19 41	R: 05 57 S:21 27
Venus	R: 04 02 S: 15 54	R: 03 44 S: 16 20	R: 03 28 S: 16 50
Moon	R: 08 00 S: 23 23	R: 23 58 S: 07 30	R: 08 54 S: 23 17
Mars	R: 09 08 S: 00 27	R: 08 52 S: 00 01	R: 08 39 S: 23 33
Jupiter	R: 19 42 S: 06 01	R: 18 33 S: 04 57	R: 17 26 S: 03 53
Saturn	R: 11 15 S: 01 52	R: 10 20 S: 00 52	R: 09 28 S: 23 57
Uranus	R: 03 28 S: 14 41	R: 2 30 S: 13 45	R: 01 32 S: 12 47
Neptune	R: 02 25 S: 12 39	R: 01 27 S: 11 40	R: 00 24 S: 10 41
Pluto	R: 22 41 S: 08 53	R: 21 41 S: 07 53	R: 20 40 S: 06 53

May 2006 Events (UT)

02 – Mars 4° south of the Moon.

04 – CCAS meeting. Club President Mike Hunter, having recently returned from Australia, will talk about "Observing Down Under."

04 – Saturn 4° south of the Moon. Jupiter at opposition.

05 – Eta Aquarid meteor shower peaks at approximately 00:00 EDT.

07 – Moon at apogee (251,389 miles).

11 – Spica occulted by the Moon at 00:00 UT (19:00 EDT on the previous day, the 10th).

12 – Jupiter 5° north of the Moon.

17 – Mercury at ascending node. Venus at aphelion.

18 – Mercury at superior conjunction.

19 – Mars at greatest northern heliocentric latitude. Neptune 4° north of the Moon.

21 – Mercury at perihelion. Uranus 1° north of the Moon near sunrise.

22 – Moon at perigee (229,042 miles). Neptune stationary.

24 – Venus 4° south of the Moon.

25 – Mars 5° south of Pollux.

31 – Mars 3° south of the Moon. Vesta occulted by the Moon at approximately 07:00 EDT. Saturn 4° south of the Moon.

Sources: TheSky6, Software Bisque; Observer's Handbook 2006, Royal Astronomical Society of Canada

CCDs

Jim Carlson

Few innovations have had as much impact on astronomy as CCDs. A typical charge-coupled device is capable of detecting 40 to 50% of the incoming light, an efficiency, which at its peak, is 25 times greater than film. The most expensive CCDs are supercooled to record 98% of the incident light. The benefit is shorter exposures and the ability to process and manipulate images with software, thus revealing more about the nature of the object being observed.

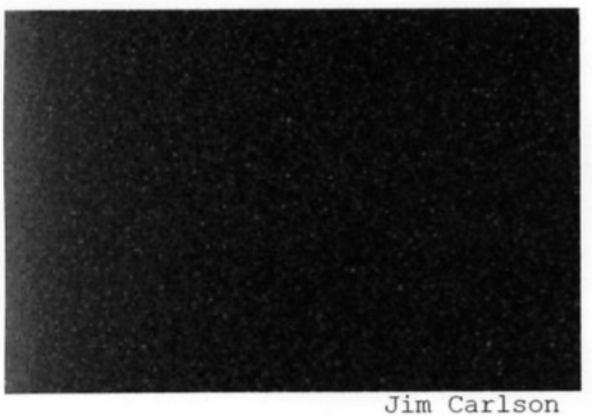
A CCD is a silicon chip, similar to the chip in a computer. It contains an array of picture elements, or pixels, each of which is composed of a device called a capacitor (more technically, a metal-oxide semiconductor capacitor). At the beginning of an exposure the capacitors are initialized with a standard charge. When the shutter is opened a photon hits the silicon, dislodging an electron and altering the initial charge on the capacitor. After the exposure is completed, the modified charge is read out and a photograph produced. No dark rooms are involved and no chemical emulsions that require careful monitoring; it is all done electronically with circuits and digitization.

The CCD camera at the observatory is called an SBIG ST-8XE, manufactured by the Santa Barbara Instrument Group in California. Kodak makes the chip. It has an array of 1530 x 1020 capacitors (or pixels), which can be reduced to 765 x 510 or 510 x 340. Each capacitor in the array is capable of storing 100,000 photons, allowing for photographs of

very dim objects. Exposures can be added together to produce pictures of any length.

However, there are certain processes at work that reduce a CCD's efficiency. All of these involve noise. Noise is an undesirable effect that masks the light from the object under study. In it's most intrusive sense, noise is actually light, but the kind of light produced by the thermal jiggling of atoms in the circuits and electronics of the CCD itself. Under normal operating conditions, the CCD is cooled to suppress the jiggling, but cooling can't suppress all of it. The light thus created, called dark current, dislodges electrons from the silicon structure of the chip, altering the energy in the capacitor in the same manner as the desired signal.

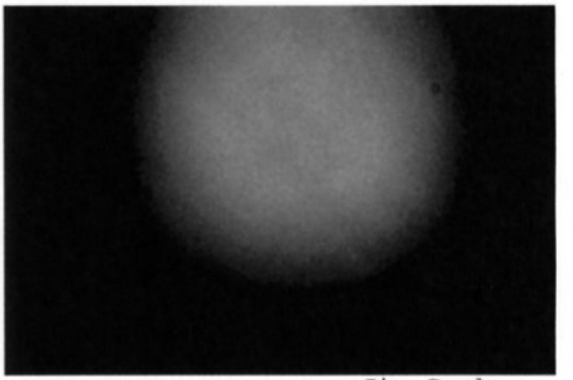
The standard method to correct for this involves a series of separate photographs taken while the shutter is closed to record only the noise and not the signal. Later, when all the exposures are completed the noise can be subtracted from the signal, thereby cleaning the image.



Jim Carlson
Dark Frame showing "hot pixels" on the SBIG ST-8XE

Another source of noise comes from the optical surfaces of the CCD or the telescope. Tiny bits of dust can settle on the CCD's window or the telescope's mirrors. They form donut shaped shadows that alter the amount of incoming light. Many times these are visible in the image. These can be eliminated by a technique called flat fielding, which distributes light evenly across the entire field of view.

Flat fields can also correct for a phenomenon called vignetting, a commo occurrence with film as well as CCDs. vignetted photograph is brightes towards the center and darker at th edges. Since the flat field distribute light evenly, it can remove or reduc that source of noise.



Jim Carlson
Flat Field showing the affect of focal reducer on CCD image

A typical sequence at the observator might involve ten 30-second exposures fifty 30-second dark frames and fifty 5 second flat fields. The raw exposure are then calibrated with the darks an flats to eliminate as much noise a possible.

Finally the ten processed photos ar combined to produce a single photo. T ensure a good quality measurement whe doing variable stars, a series of nin other sequences involving another te 30-second exposures might be needed.

Jim Carlson
Raw CCD image (one of ten) prior to being calibrated with darks and flats and being stacked

Jim Carlson

Final CCD Image of NGC7331 after calibration of ten raw images with darks and flats and stacking

That's it in a nutshell. It's not always easy to do, and can in fact be challenging, but the results are well worth the hours of effort you put into learning how to use a CCD.

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GETTING HELP/HELPING OUT

Have you ever wondered about where to get that special accessory for your scope? Or, which size gizmo works with your f7.32 Gregorian reflector? Or, how about, is that $200 8 inch refractor you saw on the web really any good? There is a place where you can usually get an answer that you can trust. Although, it should be noted that you may not want to trust all of the answers received!

That place is yahoo.com. And, just like the yahoo email, it's free. There are literally thousands of user groups called Yahoo Groups on the site. There are 1,225 groups under the subject of astronomy as of April 21. The subarea of astronomy>amateur has 822 groups. If one of those 822 groups does not match your special interests in amateur astronomy, start one of you own and you will be the Owner.

This editor belongs to six such groups, one of which is all but defunct. The other five produce approximately forty emails each day of which about ten are usually on topics of immediate interest. If that's too many for you, you can turn off the direct delivery of email to your mail box and read the messages that you may be interested in by going to the group's site.

Each group also has a section where members can post photos of their scopes, astro images, observing site, etc. FAQ's, training materials, ideas for equipment modifications, etc. are also found on most sites. It can be a gold mine.

Members can ask questions, seek advice or direction, search for vendors, etc just by sending an email to the group as long as it pertains to general purpose of the group. The Owner and Moderators (one or two very active members) keep the chatter polite, honest, ethical, etc. It's kind of refreshing. They also keep the members OT (on topic).

Here is an example of what occurred on one group during the past year. A member of the group stated that the Meade LXD55 10" telescope was too heavy for its mount and was not fit for serious imaging. After several days of messages and opinions flying back and forth, a member suggested that they all should take a look at an image (shown below) taken with such a scope. End of discussion; everyone agreed that good work could be done with the scope.

Tony Hitchcock
NSW, Australia

Large Magellanic Cloud

Give them a try. They're Yahoo Groups at yahoo.com. MH