June 2009

Inside this Issue

S*T*A*R
P.O. Box 863
Red Bank, NJ 07701
On the web at:
http://www.starastronomy.org

Edited by: Ahmad & Hanna Jrad

June's Meeting

The next meeting of S*T*A*R will be on Thursday, June 4. This will be our annual business meeting. All are welcome. The meeting will begin promptly at 8:00 p.m. at the Monmouth Museum on the Brookdale Community College campus.

Editor's Corner

Many thanks to Gavin Warnes, Barlow Bob, Allen Malsbury and Randy Walton for contributing to this month's Spectrogram.

Reminder to pay membership dues $25/individual, $35/family. Donations are appreciated. Make payments to our treasurer Rob Nunn at the June meeting or mail a check payable to S*T*A*R Astronomy Society Inc to:

S*T*A*R Astronomy Society
P.O. Box 863
Red Bank, NJ 07701

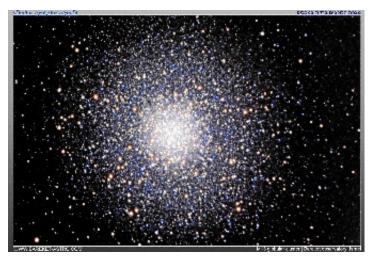
August Issue

Please submit articles and contributions for the next *Spectrogram* by July 25.
Please email to stargaze07@verizon.net.

M15, Imaged on Dec 30th, 2008 from E Riverside Co. - SBIGST-2000XM w/ KAI-2020M CCD
Credit: Behyar Bakhshandeh

Calendar

- Sep 4, 2008 – "***Past Saturn and 7 More Years to Pluto:***" New Horizons Mission, Michael Lewis, NASA Solar System Ambassador
- Oct 2, 2008 – ***" An Idea That Would Not Die"*** by Robert Zimmerman
- Nov 6, 2008 – ***"Tour of Monmouth Museum & Demonstration of Planetarium"*** by S*T*A*R's own Dennis O'Leary
- Dec 4, 2008 – ***"Why does the sun shine for billions of years?"*** by S*T*A*R's own Arturo Cisneros
- Jan 8, 2009 - ***"Celestial Navigation"*** by Justin Dimmell, Island School, Eleuthera, Bahamas
- Feb 5, 2009 - ***" ATM Night"*** S*T*A*R Members will bring and talk about their home made telescopes
- Mar 5, 2009 - ***"Solar Telescopes"*** by Alan Traino of Lunt Solar Systems
- Apr 2, 2009 – "***The Origin of Star Names***" S*T*A*R's own Ahmad Jrad will talk about how the stars got their names
- May 7, 2009 – ***"Mars Science Laboratory"*** by DJ Byrne of JPL
- Jun 4, 2009 – AGM



M13 – The Great Hercules Cluster
By: Jacob Bareket, C14 at f/8.7+ST8 CCD

President's Corner

By Gavin Warnes

Welcome to the last Spectrogram of this season! Although our club doesn't meet until September there will still be astronomy activities over the summer. If you haven't done so already, check out the discussion board at www.starastronomy.org to see what people are up to.

Well, I'm sad to say that this is my last letter as President of S*T*A*R. I've really enjoyed doing the job for the past two years and am very pleased to announce that two great candidates, Nancy McGuire and Rich Gaynor, are standing for President and Vice President respectively. Thanks go to my fellow board members – Dennis O'Leary, Steve Fedor, Rob Nunn and Dan Pontone who have been great colleagues. Steve, Rob and Dan have been kind enough to stand for another year. I wish them the best of luck. Special thanks go to Frank Loso for lining up such a great list of candidates!

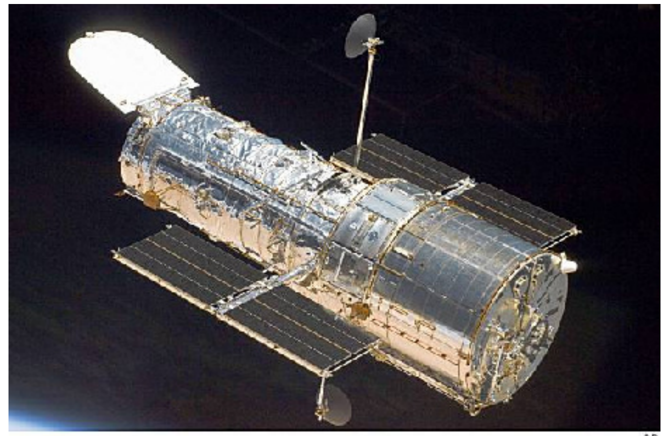
Please make sure you attend the annual business meeting on Thursday so we can elect the new officers. In addition to the AGM, we'll also have presentations from Allen Malsbury, Dennis O'Leary and Nancy McGuire. I'll bring along a Lunt solar telescope in case people were not able to get a close look during Alan Traino's presentation earlier in the year. The sun has been very quiet so far this year, but when I set up this morning there were some great prominences visible.

Hopefully everybody was able to take a look at the 13" Coulter telescope at the last meeting. This instrument is available for use by S*T*A*R members free of charge! It has some accompanying eyepieces plus a Telrad and has plenty of aperture but still fits into Dennis' Honda Civic sedan. It's great for looking at DSOs – please try it out! Just contact the Vice President to take it for a spin.

I suspect that most of our members have a general interest in science. Next week the World Science Festival will be held in New York City. There are many public events planned including talks on cosmology. See www.worldsciencefestival.com for details.

Keep looking up!

Gavin



AP

Hubble's Final Triumph

Saturday, May 23, 2009

Picture the universe as a star-salted blue-black expanse. Chances are that image came from the Hubble Space Telescope, which has churned out space vistas for nearly 20 years from its orbit above Earth.

This past week the Hubble got the handy-man treatment from astronauts who made a floating house call from the space shuttle Atlantis. New gyroscopes, fresh batteries, a camera and a computer data unit were installed.

Matching the marvel of Hubble was the treatment it got. The space crews made repairs never before done in space. The altitude of 350 miles put the team in a anger zone created by whizzing space junk. There was no safety net if the shuttle was damaged or a repair mishandled.

It all went smoothly, though with a trace of regret. The Hubble can now back to work peering into deep space, but there won't be another house call. After a long life and $10 billion, the telescope will wind down, its job done in another five to 10 years.

What did the Hubble achieve, besides sending back screen-saver art and magazine cover pictures? It was a rigorous scientific tool, measuring the universe's expansion, the nature of black holes, and the formation of our planetary system.

The telescope encapsulated the challenge of space. Amid dangers and uncertainties, the Hubble and its human attendants persevered. Science and human spirit are infinitely better for it.

This article appeared on page A - 11 of the San Francisco Chronicle

Scoring More Energy from Less Sunlight

For spacecraft, power is everything. Without electrical power, satellites and robotic probes might as well be chunks of cold rock tumbling through space. Hundreds to millions of miles from the nearest power outlet, these spacecraft must somehow eke enough power from ambient sunlight to stay alive. That's no problem for large satellites that can carry immense solar panels and heavy batteries. But in recent years, NASA has been developing technologies for much smaller microsatellites, which are lighter and far less expensive to launch. Often less than 10 feet across, these small spacecraft have little room to spare for solar panels or batteries, yet must still somehow power their onboard computers, scientific instruments, and navigation and communication systems. Space Technology 5 was a mission that proved, among other technologies, new concepts of power generation and storage for spacecraft.

Helen Johnson, a spacecraft technician at NASA's Goddard Space Flight Center, works on one of the three tiny Space Technology 5 spacecraft in preparation for its technology validation mission.

"We tested high efficiency solar cells on ST-5 that produce almost 60 percent more power than typical solar cells. We also tested batteries that hold three times the energy of standard spacecraft batteries of the same size," says Christopher Stevens, manager of NASA's New Millennium Program. This program flight tests cutting-edge spacecraft technologies so that they can be used safely on mission-critical satellites and probes. "This more efficient power supply allows you to build a science-grade spacecraft on a miniature scale," Stevens says.

Solar cells typically used on satellites can convert only about 18 percent of the available energy in sunlight into electrical current. ST-5 tested experimental cells that capture up to 29 percent of this solar energy. These new solar cells, developed in collaboration with the Air Force Research Laboratory in Ohio, performed flawlessly on ST-5, and they've already been swooped up and used on NASA's svelte MESSENGER probe, which will make a flyby of Mercury later this year. Like modern laptop batteries, the high-capacity batteries on ST-5 use lithium-ion technology. As a string of exploding laptop batteries in recent years shows, fire safety can be an issue with this battery type.

"The challenge was to take these batteries and put in a power management circuit that protects against internal overcharge," Stevens explains. So NASA contracted with ABSL Power Solutions to develop spacecraft batteries with design control circuits to prevent power spikes that can lead to fires. "It worked like a charm." Now that ST-5 has demonstrated the safety of this battery design, it is flying on NASA's THEMIS mission (for Time History of Events and Macroscale Interactions during Substorms) and is slated to fly aboard the Lunar Reconnaissance Orbiter and the Solar Dynamics Observatory, both of which are scheduled to launch later this year. Thanks to ST-5, a little sunlight can go a really long way.

Find out about other advanced technologies validated in space and now being used on new missions of exploration at nmp.nasa.gov/TECHNOLOGY/scorecard. Kids can calculate out how old they would be before having to replace lithium-ion batteries in a handheld game at spaceplace.nasa.gov/en/kids/st5_bats.shtml.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Spectroscopy History – Part 3

Compiled and Edited By Barlow Bob

Meanwhile, at Harvard College Observatory (HCO) in Cambridge, MA, a gathering of money, memorial and motivation was poised to reshape astronomy forever. Observatory director Edward C. Pickering shared much in common with Draper, including a dream to construct an all-sky spectral catalog. Pickering was frustrated by the slow progress that his young male assistant was making on the analysis of photographic plates. In fact, legend has it that in 1880, Pickering became so fed up with his assistant that he claimed that his maid could do a better job. It turns out that Pickering was right.

Fortunately for Pickering, his maid was Williamina Fleming. Fleming had no formal science education. As she had just been abandoned by her husband and was raising her infant son alone, she needed to be gainfully employed. Going out on a limb, Pickering hired her as a full-time member of the observatory staff in 1881. Fleming soon found herself knee deep in astronomical data and tackled her newly assigned duties with zeal. She studied photographs of stellar spectra and discovered that a certain type of spectra indicated long-period variable stars. She also discovered ten novae by studying stellar spectra.

Finally in 1886, under the financial support of the newly-founded Henry Draper Memorial Fund managed by Anna Draper and the leadership of Pickering, Henry Draper's dream project commenced at HCO. Pickering, a proponent of women's rights, soon found himself in desperate need of data analyzers. At the time, women were thought to be naturally suited to repetitive tasks like calculating, tabulating, measuring, and scrutinizing. They were also paid less than half the cost of their male counterparts.

After 1886, the workrooms at the observatory never held fewer than a dozen "computers." For more than thirty years, 45 women were employed at HCO. The women computers of HCO were expected to work six days a week, seven hours a day. Fleming later said in her journal that Pickering's seven-hour day went from 9 a.m. to 6 p.m. The starting wage was 25 cents an hour. For these women, the opportunity to be involved with the science they loved was far more important than salary considerations.

The original appeal of stellar spectra lay in their mystery. The first observations of stellar spectra in the early 1800's hinted to astronomers that there was something significant about the pattern and intensities of the dark lines that chopped the rainbow into slivers, yet they simply did not know the origin of that significance.

Fleming soon found herself in 1881 supervising a platoon of assistants. After four years of tireless, tedious scrutiny, Fleming and her team had managed to classify 10,498 stars with a scheme that the astronomical community coined the "Pickering-Fleming system." This label indicated the first general recognition of a female astronomer. This system consisted of 15 spectral classes, each of which had specific identifying features such as the strength of the dark lines corresponding to hydrogen. The classes were given simple letter designations, A through Q (I, J, and P were omitted; all oddities were lumped into Q).

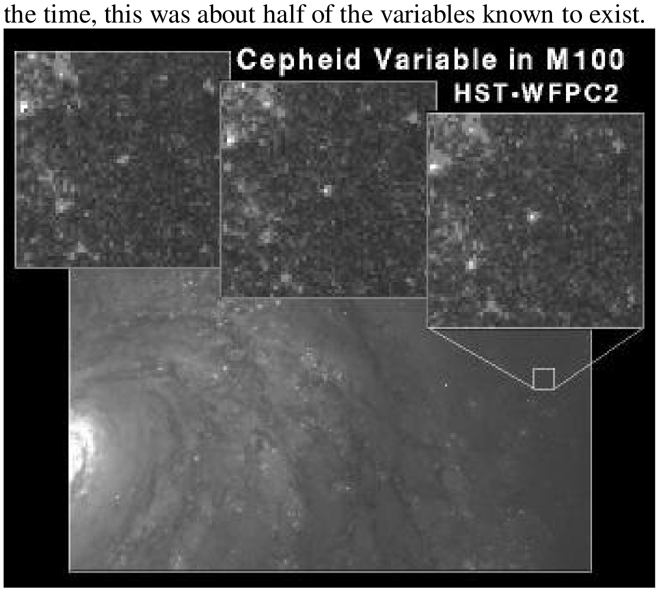
Fleming's work with spectra was so marvelous that Pickering later trusted her with virtually every aspect of the astronomical work at the observatory. She would ultimately become the first woman to earn an official Harvard "corporate" appointment. Her accomplishments paved the way for subsequent achievements by her colleagues and successors.

One of Fleming's successors was Annie Jump Cannon. She was one of the few computers who had training in physics and astronomy, having graduated from Wellesley in 1884. A decade later, after returning home to Delaware, the partially deaf Cannon realized that her heart lay in the stars. She became one of Pickering's assistants in 1896.

The study of improved spectra was assigned in 1888 to Draper's niece Antonia C. Maury. By noting that some spectra showed double sets of lines, she discovered a spectroscopic binary. These are stars that appear single but are actually two stars orbiting each other. She was the first person to realize that the sharpness of spectral lines tells important information about a star. Maury eventually left HCO after disagreements with Pickering.

Cannon took over Maury's work. Cannon's classification scheme retained Fleming's original letter designation, but followed the overall sequence of Maury's. By using Maury's sequence, Cannon saw the need to categorize stars according to some unknown physical property. Cannon created the familiar O, B, A, F, G, K, M, seven major classes, each with ten subclasses: 0 through 9. These subclasses are based on the presence, absence, or intensity of particular spectral features. O stars are hot stars and M stars are relatively cool. The Sun is a G2 star. The spectral class immediately provides information about a star's physical properties, including temperature. She classified the spectra of more than 350,000 stars during her years at Harvard, while her work in many other areas continued until her death in 1941.

Henrietta Swan Leavitt had a college degree and began working at Harvard in 1895. Leavitt's forte was photographic photometry. Photometry is the determination of the absolute brightness of the stars from photographic plates. She could get an accurate photometric magnitude scale with the aide of photography and also perform night-to-night comparisons of stars to locate new variable stars. She studied photographs of variable stars and discovered that the periods of variable stars called Cepheids are related to their actual luminosity, or brightness. This period-luminosity relationship helps astronomers measure distances in the universe. A star's distance can be calculated by comparing its actual brightness to its apparent brightness. She also discovered over 2,400 variable stars this way. At the time, this was about half of the variables known to exist.



Cepheid variable in M100 from the Hubble Space Telescope.

Using photographs of nebulae, Edwin Hubble found Cepheid variable stars. These are yellow supergiant pulsating stars that are very important in establishing distances to groups of stars beyond our own Milky Way galaxy. He analyzed the light of Cepheid stars in three nebulae. Hubble was able to determine the distance to these galaxies in the 1920's using Henrietta Leavitt's period-luminosity relationship. His results showed that the farther away a galaxy is from us, the faster it is moving away from us. This shocking evidence that the universe is expanding changed the centuries-old opinion that the universe was static.

From 1859 until his death at age 73, Johann Jakob Balmer (1825-1898) was a high school teacher at a girl's school in Basel, Switzerland. His primary academic interest was geometry, but in the middle 1880's he became fascinated with four numbers: 6,562.10, 4,860.74, 4,340.1, and 4,101.2. These are not pretty numbers, but for the mathematician Balmer, they became an intriguing puzzle. Was there a pattern to the four numbers that could be represented mathematically? The four numbers Balmer chose were special because these numbers pertained to the spectra of the hydrogen atom. By the time Balmer became interested in the problem, the spectra of many chemical elements had been studied and it was clear that each element gave rise to a unique set of spectral lines. Balmer was a devoted Pythagorean: he believed that simple numbers lay behind the mysteries of the universe. His interest was not directed toward spectra, which he knew little about, nor was it directed toward the discovery of some hidden physical mechanism inside the atom that would explain the observed spectra. Balmer was intrigued by the numbers themselves.

In the mid-1880's, Balmer began his examination of the four numbers associated with the hydrogen spectrum. At his disposal were the four numbers measured by Anders Jonas Angström (1814-1874): 6,562.10, 4,860.74, 4,340.1, and 4,101.2. These numbers represented the wavelengths, in units of Angströms, of the four visible spectral lines in the hydrogen atom spectrum.
In 1885 Balmer published a paper in which his successful formulation was communicated to the scientific world. Balmer showed that the four wavelengths could be obtained with the formula that bears his name (wavelength = B x (m^2)/(m^2-n^2), with B = 3645.6 Angströms). He had found a simple mathematical formula that expressed a law by which the hydrogen wavelengths could be represented with striking precision. He further suggested that there might be additional lines in the hydrogen spectrum. Other spectral lines with their own wavelengths were predicted by Balmer and later found by other scientists. Angström measured the wavelengths of the spectral lines of hydrogen, but Balmer showed that the wavelengths of the spectral lines are not arbitrary. The value of the wavelengths are the expression of one particular mathematical formula and this Balmer Series equation altered how scientists thought about spectral lines. Before Balmer published his results,

The Balmer Series for hydrogen.

scientists drew an analogy between spectral lines and musical harmonies. They assumed that there were simple harmonic ratios between the frequencies of spectral lines. After Balmer's work, all scientists recognized that spectral wavelengths could be represented by simple numerical relationships.

Balmer disappeared from the ranks of working scientists and continued his classroom work teaching young ladies mathematics. Neither he nor his students recognized that his paper on the spectrum of hydrogen would bring him scientific immortality. The spectral lines of hydrogen that were the focus of Balmer's attention are now known as the Balmer Series.

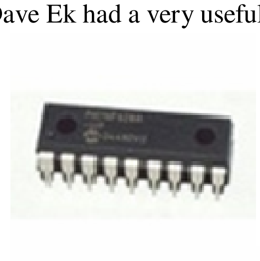
Cloning Digital Setting Circle (DSC)

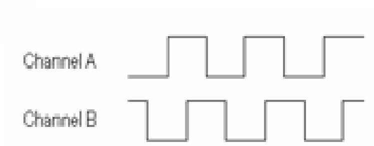
By Allen Malsbury

Shortly after completing a truss type Dob telescope, a friend loaned me a set of low resolution encoders and an old Advanced AstroMaster Digital Setting Circle (DSC) computer. He said, "You can use these 'til the cows come home." Even though I was getting very good at finding objects using my atlas, PDA with Planetarium and hopping my RACI finder, I decided to give them a try.

As fate would have it, that the old Advanced AstroMaster would power up, but it just did not work any more. Too many years in the garage I guess. (Those cows never left the barn.) At first I wasn't sure which was broken, the AstroMaster or the encoders. Testing with a multi-meter determined the encoders were working fine.

I looked on the internet for a way to connect the encoders to my Laptop and/or PDA. I found several very informative websites that discuss how digital setting circles worked. Dave Ek had a very useful site:

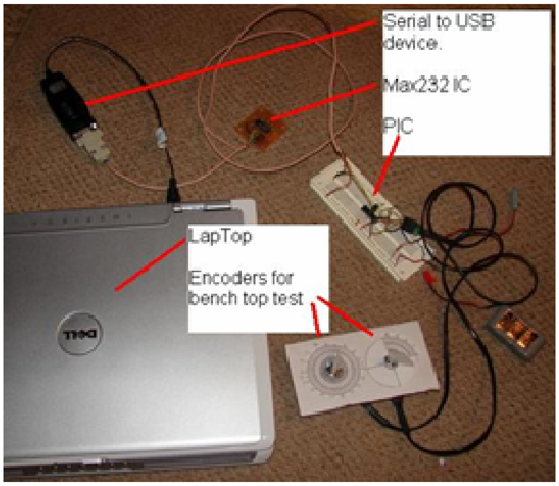




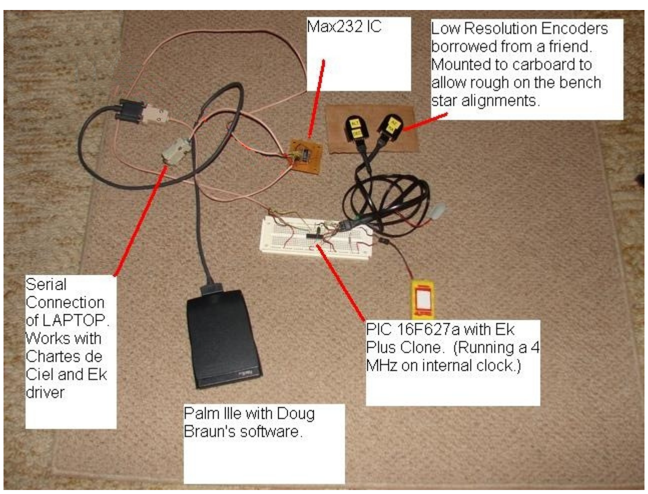
http://digicircles.eksfiles.net/index.php . The heart of Dave's digital setting circles design is a PIC. The PIC monitors two encoders, one for altitude and the other for azimuth. It also is used to report their relative positions to another external computer, a laptop or PDA, using a serial communication port. The encoders used by Ek were the optical type. Optical encoders have two channels, A and B. The PIC monitors both channels, determines if an encoder is turning one way or the other and counts the square wave pulses produced by the etched wheel inside the encoder breaking a beam of light. The PIC's program can determine which direction the wheel turned because the two channels are out of phase by ½ of a square wave pulse. Optical encoders are available through US Digital (www.usdigital.com) and can be purchased with as many as 10,000 countable events per revolution

As mentioned above, the encoder counting circuit communicates with an external computer, a laptop or Palm Pilot via a serial communication port. All of the heavy-duty astronomical calculations are done by the software on the laptop and/or in the Palm. All the "box" has to do is count up or down, remember those counts and send them back to the external computer when asked to. This is the important part. The "box" just counts up or down over and over. It only transmits the encoder position when instructed to so by the external computer. That's it! Easy, right? The trick is that the DSC unit has to count very fast to keep up with the encoder pulses. It also has to count while communicating with the main computer without missing a beat.

Ek's DSC system used an older PIC that was very popular at the time. Ek's program is available online in HEX format, but I found it did not work with the PIC I had. Since I had done a few other hobby projects using PIC's, I felt I might be able to "clone" Ek's box with the parts I already had in the drawer. Turns out, this was easier –said –than done.

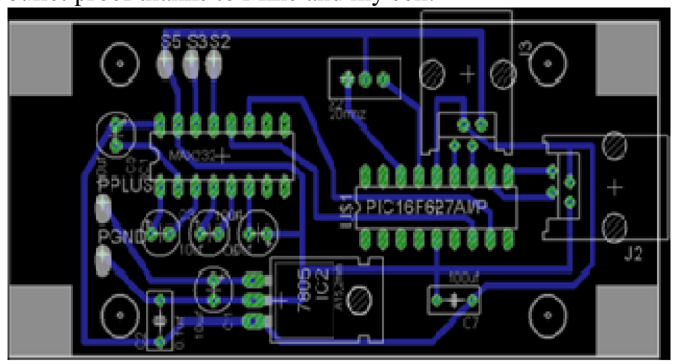


I use a 16F127 PIC instead of one Ek used. The 16F127 has a built-in UART (serial port) making serial communication very easy. I had a bench top “clone" working within a few days. It didn’t work well, but it worked. The basic circuit has very few components. It has the PIC, and a Max232 IC which protects the PIC from serial port voltage levels. The Max232 has a few associated capacitors. There is a voltage regulator too, that keeps the supply voltage at a steady +5V. This regulator is also flanked by two capacitors.
I came across another very useful website:http://palmdsc.dougbraun.com/. Doug Braun wrote an excellent Palm OS application, PalmDSC. It did exactly what I needed. PalmDSC is freeware and can communicate via the Palm’s serial (or Bluetooth) port to a DSC box like Ek’s or my clone.

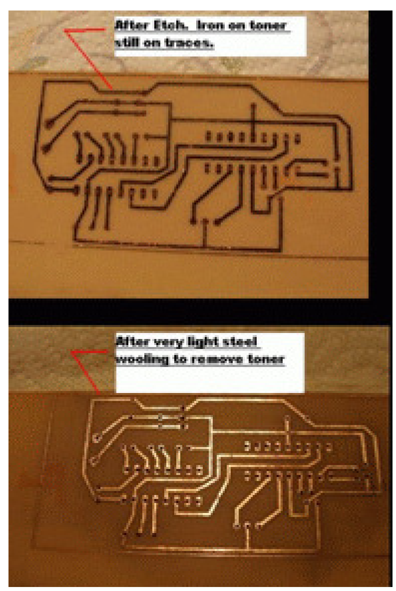


I decided to try connecting my Palm IIIx to the bench top clone. After tracking down two badly soldered joints in the cable I made, I had my old Palm connected to the “clone” (Doug is a good guy and was willing to give me lots of help troubleshooting my system from start to finish.)

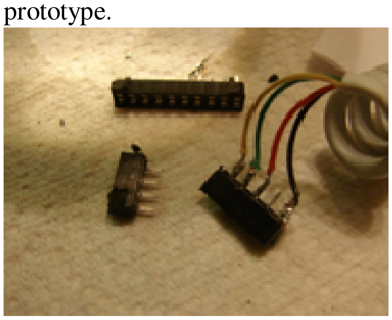
My bench top version had two problems. The code I wrote could not count fast enough. Sometimes the bench top unit would get lost, especially during rapid encoder movements. Other times it would lock up. Mike, a true programming expert, provided a suggested fix for the slow counting issues. It worked like a charm. My son, another smart guy, was able to eliminate the conflict between the PIC serial port and encoder monitoring routines. He did this using an interrupt protocol giving priority to the encoder counting routines while buffering the serial port. The final code was bullet proof thanks to Mike and my son.



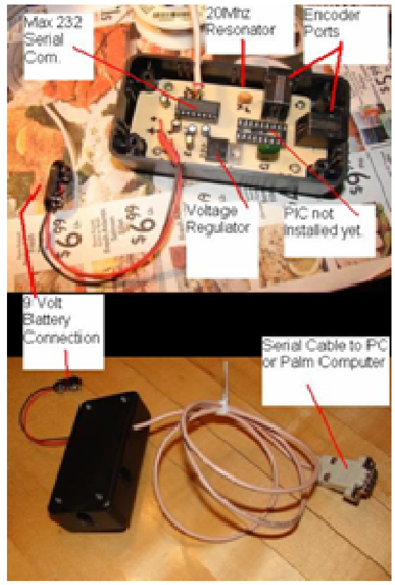
It was time to move up from the bread board to a prototype unit. This required designing and making a printed circuit board. I used a program called Eagle (which can be found at the following site: http://www.cadsoftusa.com/freeware.htm.) If you don’t like Eagle there are other programs available for free on the internet. Most printed circuit board suppliers have design software available for free.

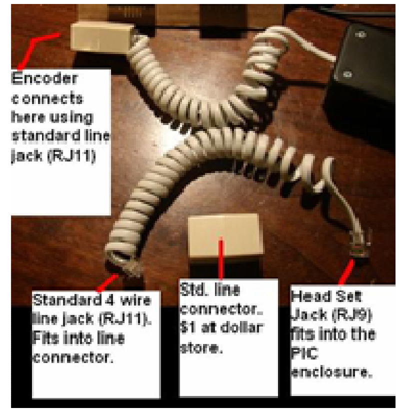


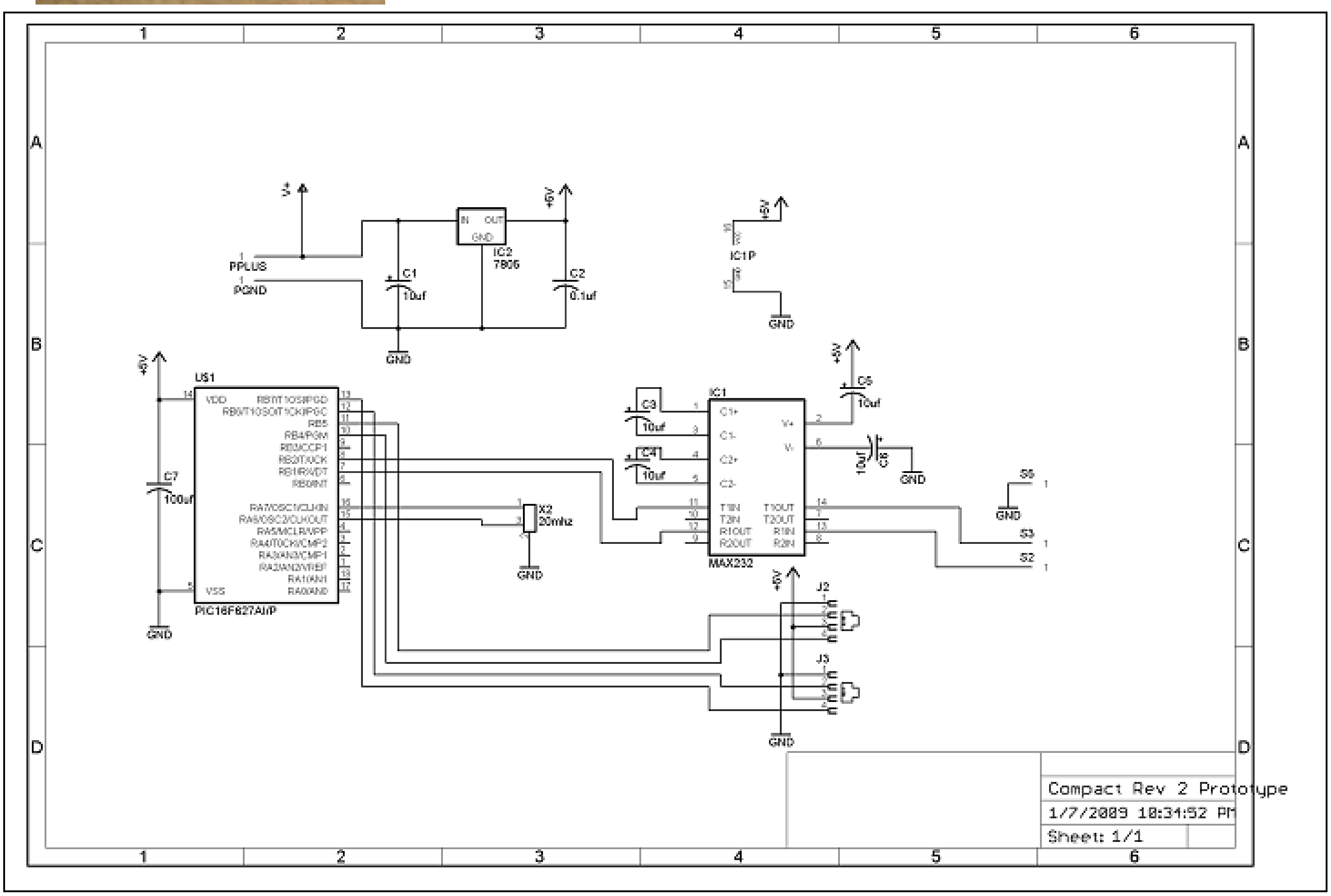
I purchased a 2 x 4 “box” at my local Radio Shack and designed the prototype PCB around it. I had read that you can use a laser printer to print your PCB traces and then transfer that image onto the copper of a PCB using an iron. This only works with a laser printer that uses toner and a fuser system. Ironing re-softens the toner so it sticks tightly to the copper. Make sure the copper is bright and shiny first. Brillo works for that. It took some experimenting to figure out how to get the paper off the toner without lifting the toner off the copper. The best method I found was to wet the paper. With careful rubbing and scratching between traces, most of the paper can be removed without damaging the toner. Some of the paper fibers remain stuck to the toner, but not enough to stop the copper etch from getting to the copper between the toner covered traces. I like to drill all the holes before etching. This seems to work best for me. I drilled each hole by hand using a drill set purchased at Radio Shack. This took a little time and patience. Then into the etching solution it went. After etching, the toner was gently removed using a Brillo pad. The PCB board was trimmed to fit the enclosure. Next, I populated the board. During testing I found I had several traces that looked fine, but actually had breaks in them. Before I was done I checked every trace end to end to find all the breaks. I was able to fix all of them with solder. Again, Ok for a prototype.



I could not find connectors that matched the encoders' five pin pattern, so I made a pair. I found that a socket used to hold an IC had the same pin pitch of 1/10". I made two temporary encoder connectors using parts cut from an IC socket. The balance of the encoder hookup cabling was made using standard phone jacks, plugs and sockets.



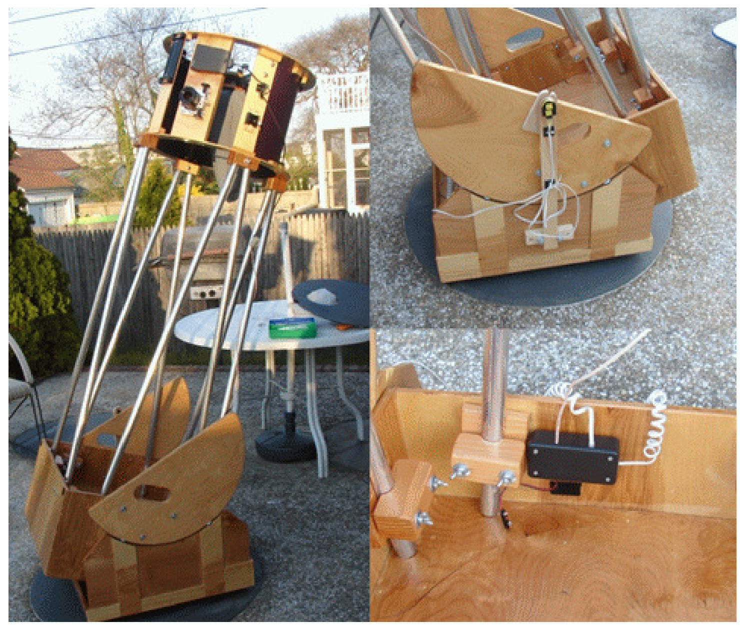




The last task was to mount the encoders on the telescope. I used a standard arrangement for the altitude encoder. I found a way to make mounting hardware with little additional expense. I purchased two plastic radio knobs each having a set screw. Encoders have ¼" shafts. The plastic radio knobs fit nicely on them and were could be anchored to the shafts using the set screws. Each knob cost $2. I Gorilla glued one into a plywood fixture mounted on the center axis of the altitude bearing. The altitude encoder was mounted on a long thin plywood arm. The loose end of the arm was gently restrained, but not anchored. The final version the azimuth encoder mount was actually in a very similar too the altitude mounting, except the plastic radio knob was Gorilla glued to a long plastic arm and the encoder was hard mounted to the center of the azimuth box using thin plywood. Finding a successful azimuth mounting detail took several attempts. When I designed and built this scope I really never planned on installing DSC's.

I velcroed the "box" inside the mirror box and the Palm IIIx just above the focuser.

I need to thank everyone who provided good advice, especially Dave, who just wouldn't give up on me or this project. Nothing left to do but find them DSO's with my new DSC's while I wait for the cows to come home.



Are you a S*T*A*R Member?

S*T*A*R is the proud owner of a monstrous 25" Dobsonian Obsession reflector – which members can gain access to!

Meetings are the first Thursday of each month, except July and August, at 8:00 PM at the Monmouth Museum on the Brookdale Community College campus. Meetings generally consist of lectures and discussions by members or guest speakers on a variety of interesting astronomical topics. S*T*A*R is a member of United Astronomy Clubs of New Jersey (UACNJ), the Astronomical League (AL), and the International Dark Sky Association (IDA).

Memberships: ( )Individual....$25 ( ) Family...$35

Name____

Address______________________________________

City_______________________State___Zip________

Phone_______________________________________

Email_______________________________________

Make checks payable to: S*T*A*R Astronomy Society, Inc. and mail to P.O. Box 863, Red Bank, NJ 07701

2009 June Celestial Events

Supplied by J. Randolph Walton (Randy)

Day	Date	Time (EDT)	Event
Tue	2	2:12	Double shadow transit on Jupiter
		2:24	Ganymede occults most of Io
Sat	6	00:35	Jupiter Rises
		01:40	Saturn Sets
		03:20	Venus Rises
		03:25	Mars Rises
		04:40	Mercury Rises
		05:32	Sunrise
		19:55	Moon Rise
		20:26	Sunset
Sun	7	14:12	Full Moon
		20:50	Moon Rise
Tue	9	04:06	Double shadow transit on Jupiter
Sat	13	00:10	Jupiter Rises
		01:10	Saturn Sets
		03:12	Mars Rises
		03:15	Venus Rises
		04:25	Mercury Rises
		05:31	Sunrise
		10:48	Moon Set
		20:30	Sunset
Mon	15	12:50	Moon Set
		18:15	Last Quarter Moon
		23:40	Titan's shadow on Saturn
Fri	19	04:30	Mars, Venus, cr. Moon in grouping
Sat	20	00:40	Saturn Sets
		02:55	Mars Rises
		03:05	Venus Rises
		04:20	Mercury Rises
		05:31	Sunrise
		18:37	Moon Set
		20:32	Sunset
		23:45	Jupiter Rises
Sun	21	01:45	**Summer Solstice**
Mon	22	15:35	**New Moon**
		20:50	Moon Set
Sat	27	00:15	Saturn Sets
		02:45	Mars Rises
		03:00	Venus Rises
		04:25	Mercury Rises
		05:33	Sunrise
		20:33	Sunset
		23:15	Jupiter Rises
		23:52	Moon Set
Mon	29	07:28	**First Quarter Moon**
		13:33	Moon Rise
Wed	**Jul 1**	01:31	Ganymede eclipses Io
		22:49	Titan's shadow on Saturn

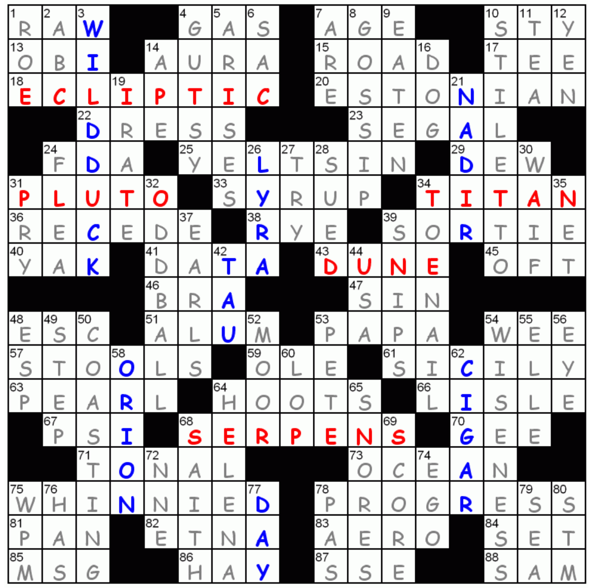
In the Eyepiece

Here is a list of objects for this month. This is reproduced from www.skyhound.com with the kind permission of its creator and author of SkyTools Greg Crinklaw.

Object(s)	Class	Con	RA	Dec	Mag
M 81 & M 82	Galaxies	Ursa Major	09h55m34.1s	+69°03'59"	7.8
NGC 3511	Galaxy	Crater	11h03m23.7s	-23°05'11"	11.5
Spindle	Galaxy	Sextans	10h05m14.1s	-07°43'07"	10.1
Ghost of Jupiter/Eye	Planetary Nebula	Hydra	10h24m46.1s	-18°38'32"	8.6
NGC 2903	Galaxy	Leo	09h32m09.7s	+21°30'03"	9.6
M 95	Galaxy	Leo	10h44m00.0s	+11°41'57"	10.5
M 96	Galaxy	Leo	10h46m48.1s	+11°48'54"	10.1
The Leo I Dwarf	Galaxy	Leo	10h08m30.6s	+12°18'07"	11.2
Markarian 421	Galaxy	Ursa Major	11h04m27.4s	+38°12'34"	14.8
NGC 3395	Galaxy	Leo Minor	10h49m52.4s	+32°58'35"	12.4
NGC 2818/A	Planetary Nebula in Open Cluster	Pyxis	09h16m01.5s	-36°36'37"	13.0
PHL 1811	Quasar	Cap	21h55m01.6s	-09°22'24"	13.8?
Focus On the Twin Quasar	Quasar	Ursa Major	10h01m20.8s	+55°53'54"	17.0
Hickson 44	Galaxy Group	Leo	10h18m00.4s	+21°48'44"	10.0
Abell 33	Planetary Nebula	Hydra	09h39m09.2s	-02°48'35"	13.4
Mu Boo	Multiple Star System	Bootes	15h24m30.9s	+37°22'38"	4.3+7.2
M5	Globular Cluster	Ser	15h18m15.4s	+02°05'00"	5.7
NGC 5897	Globular Cluster	Libra	15h17m24.0s	-21°03'26"	8.4
NGC 6207	Galaxy	Hercules	16h43m03.9s	+36°49'58"	12.1
NGC 6144	Globular Cluster	Scorpius	16h27m14.0s	-26°01'18"	9
NGC 6210	Planetary Nebula	Hercules	16h44m29.5s	+23°47'59"	9.3
A 39	Planetary Nebula	Hercules	16h27m33.9s	+27°54'29"	13.7
The Rumpled Starfish (NGC 6240)	Interacting Galaxy	Ophiuchus	16h52m59.0s	+02°24'02"	13.8

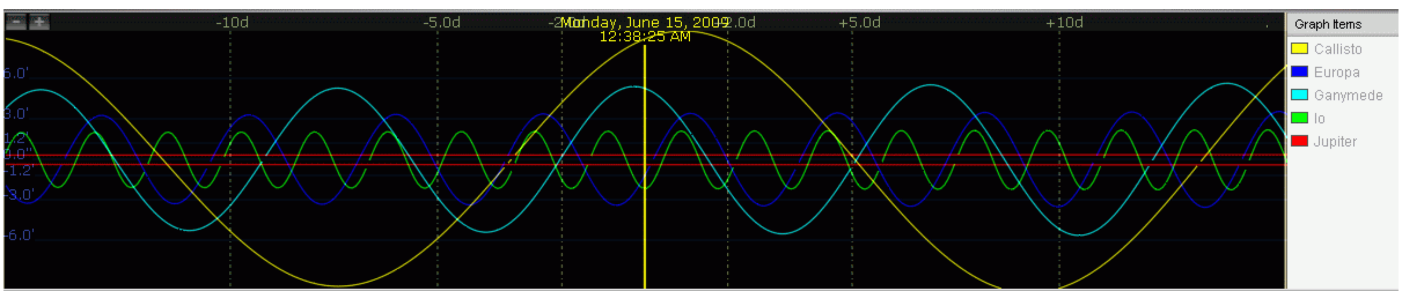
Moon Phases

AstroPuzzle Solution for May 2009



Jupiter Moon Calendar

Here is a graphical depiction of the visible moons of Jupiter for the month of June 2009.



Saturn Moon Calendar

Here is a graphical depiction of the visible moons of Saturn for the month of June 2009.