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From the Eyepiece
By: Mark Kaye

I should have written last month's article earlier. No sooner than I sent off the article lamenting the never-ending clouds, it cleared up. I enjoyed a very rewarding, but extremely cold and windy night of observing. I spent a lot of time going over the spring galaxies. I am particularly weak in this area, as the weather at our Observatory seems to be particularly bad in the spring. After the Sun rose, I had whittled my Messier list down to six items remaining. It was also the point were I realized that I had not looked at Comet Kudo-Fujikawa and gave myself a good kick. When it comes to Messier objects, I have observed all of them before, but never bothered to record them. Now that I am making a list, it seems that I am having trouble finding clear skies to fill it. A few globulars in the spring skies and three open clusters in Puppis and I am done. January has not been a fabulous month for observing this season. It seems that winter has remembered to arrive this year. The gray skies are terrible, but then when it is clear, there is a steady gale and heavy negative temperatures. We hit -24C under clear skies this morning. Last winter, the coldest we ever reached was -16C, something we have been getting below every night for the past two weeks. Where this fits into the global warming picture, I am not quite sure.

I am very pleased to announce that Steve Barnes has been hard at work organizing the May 10th annual banquet. He has managed to arrange for Alan Dyer of the Calgary Science Centre to come and talk to us as the guest speaker. This should be quite an evening. Alan is an excellent and dedicated astrophotographer as well as being a top-notch writer and speaker. We should be in for a really big treat. Be sure to mark this date on your calendar, as this is a banquet that you will not want to miss. If you want to help with the preparations for the event, you can contact Steve or Grant Maguire to offer assistance.

Other than that, it is pretty quiet around the club. The cold makes it hard to do any work on the observatory and several projects were cut short by the extremely cold fall and early on set of winter. Once the weather warms up, we can turn our minds back to these projects and the general up keep of the property. Lets all hope for clear skies for the coming months.

Clear skies!
MK

http://www3.sympatico.ca/mark.kaye/

LAST CALL FOR 2002 *SATURN STUDY* REPORTS
By: Michael Spicer

The 2002 Saturn Study has been a great success and is now in the compilation stage as an article is prepared for submission to the RASC ***Journal***. Observing co-ordinator Michael Spicer asks that observers send in their last report sheets as soon as possible. Report sheets can be downloaded from the RASC Hamilton Centre's web site by clicking on "download ***Orbit***" and then downloading the February 2002 ***Orbit*** and printing pages 9 and 10.

You may send in your observing report(s) to 2002 Saturn Study c/o RASC Hamilton Centre, Box 1223 Waterdown, Ontario L0R 2H0 or you may mail them directly to Michael Spicer, 25 Redbury Street Unit 20, Hamilton L8W 1P7, or you may bring them to the next Hamilton Centre meeting at the Steam Museum, on February 6, 2003.

We'd like to thank all the members who participated in the Saturn Study and we look forward to their continued co-operation as we prepare for observing the planet Mars later in 2003. If you have any suggestions on how the Mars observing project should be organized, please share your thoughts with our observing director, Gary Colwell, or with Michael Spicer.

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2003 VARIABLE STAR OBSERVING PROJECT

By: Michael Spicer

Last spring Michael Spicer addressed the Hamilton Centre about observing the naked-eye variable star R Corona Borealis, and several members assisted him in preparing a light curve for that irregular variable throughout 2002. At least one member of the Centre, Ken Lemke, has taken out a membership in the AAVSO as a result of being introduced to variable star observing – congratulations, Ken and keep up the good work! The Hamilton Centre is encouraging members to take part in an observing project to foster the observation and recording of the brightness of variable stars during the coming year.

Without a doubt, information on variable stars collected by amateur observers is one of the most valuable collections of data in the astronomical world. Millions of individual observations have been collected in the last century, contributing to accurate light curves of thousands of variable stars of all types. Professional astronomers routinely rely on these light curves to assist their own research. Your observation of even one variable on one evening could be a valuable contribution to that pool of data. Please take up the challenge of participating in this project.

Variable star observing is on the upswing in Canada, as Dr. Geoff Gaherty of the Toronto Centre mentioned in his talk on variable star observing at the HAA meeting on January 10. Project co-ordinator Michael Spicer will be speaking at an upcoming Hamilton Centre monthly meeting to organize a group interested in doing variable star observations. Participation requires only a pair of binoculars or a small telescope, and no previous variable star observing experience is required! Anyone can participate ("Those who have eyes, let them see").

The project will supply participants with a **manual** containing the basic information needed, plus **workshops** to hone your skills with other observers, and a complete set of the most up-to-date **AAVSO star charts** on 2 CDs, kindly provided by the American Association of Variable Star Observers. Interested members are asked to contact the observing director Gary Colwell, or project co-ordinator Michael Spicer.

Webcam to Astrocam Transformation

by
Kevin Hobbs
January 29, 2003

The intent of this article is to describe the transformation of a standard Web cam into a Long Exposure Camera suitable for Astrophotography. Unfortunately, nothing really new or revolutionary is contained in this article. Instead it is simply a description of the steps I took in this adventure.

It all started when I attended the excellent seminar put on by Roger Hill at the observatory during the blizzard of January 2, 2003. Roger provided the foundation and inspiration to embark on the project. The presentation can viewed on Roger's website http://j.roger.hill.tripod.com/.

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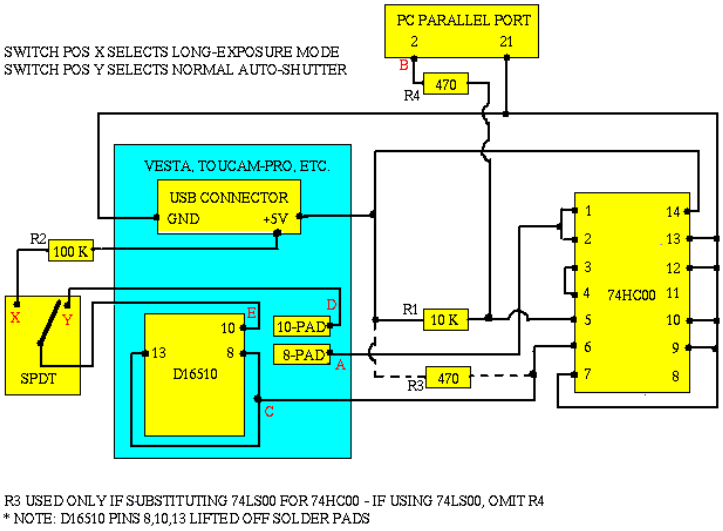
After some quick research on the web, the most obvious choice for the conversion was the Philips ToUcam PRO USB PC-camera (PCVC740K). The reasons were many:

- Many members already had this camera (there is safety in numbers).
- A summary table of available web cams was found at http://homepage.ntlworld.com/molyned/web-cameras.htm which rated this model as "AAAAA" (their highest rating).
- The best illustrated step-by-step instructions that I could find were at http://members.bellatlantic.net/~vze29wzh/toucam740mod.htm.
- Much information, pictures, and schematics were available on the web describing the SC (Steve Chambers) modification for this particular camera. See below.



R3 USED ONLY IF SUBSTITUTING 74LS00 FOR 74HC00 - IF USING 74LS00, OMIT R4
* NOTE: D16510 PINS 8,10,13 LIFTED OFF SOLDER PADS

Roger directed me to http://www.pocketscope.com/product_catalog.htm who had these hard to get cameras available. I placed my order via their website. The camera arrived in less than a week and the total financial damage associated with the purchase was about $165 CDN:

- $80.00 US Camera
- $8.35 US Shipping
- $23.64 CDN GST/PST/Handling

I installed it on my computer and tested it's basic operation.

On January 21 I finally had some free time available to start thinking about doing the modification. A quick sift through the junk box uncovered the following suitable parts for the project:

- Hitachi CCD Camera (blown CCD) for a case
- Kellner Eyepiece (junk) for scope focuser attachment
- All the electronic components shown in the mod schematic (74LS00 since I didn't have a 74HC00)
- I also had a Peltier cooler and a fan but decided to leave these for a possible future part two upgrade.

Modification Steps:

- I completely disassembled the ToUcam. It is fun to tear apart something brand new and expensive. I stared at the parts and started to question my sanity.
- I drilled the threads out of the Hitachi Camera Case Lens mount so that it would accept the Kellner eyepiece (guts removed) and grip it tightly. Now I had a case with a 1.25" barrel that would accept filters and go into any standard focuser.
- I modified the back panel of the Hitachi case to accommodate the Normal / Long Exposure switch, the USB cable, the Parallel port cable, and the ToUcam "live" LED (you don't want that light inside the camera with the CCD chip).
- I removed the CCD chip from the ToUcam PCB, and modified the aluminum CCD chip mounting plate from Hitachi camera to accept the ToUcam CCD chip. I used epoxy to affix the CCD chip to the Aluminum plate

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(thermal transfer compound was applied between the CCD and plate). This served to correctly position the CCD and relocate it away from other sources of heat on the ToUcam PCB. This also makes the future addition of the fan and Peltier / Thermoelectric cooler very simple if improved performance is desired.

- I attached a few inches of “wire-wrap” wire to each of the 14 pins on the CCD chip. The other ends would later be reattached to the correct CCD chip pads on ToUcam PCB to reconnect the remotely mounted CCD chip.
- I built the modification circuit “dead-bug” style on the 74LS00 integrated circuit. Any electronic craftsman is familiar with this quality construction practice! For additional elegance I affixed the whole mess to the Hitachi chassis with more epoxy.
- I recommend using 30-gauge wire-wrap wire for all connections because it is a single solid strand and puts little stress on the attachment point. This reduces the chance of ripping a pin of an IC. I also used epoxy to glue down the wires wherever possible to avoid undue stress at the connections that could result in disaster.
- The connection of wires to the CCD chip is just approaching the physical limitations of what is comfortable for traditional soldering techniques / equipment (due to the small scale and fine pin pitch (1mm). The modifications on the ToUcam Printed Circuit Board (PCB) are on an even smaller scale that will challenge even the most experienced electronics technician. The NEC uPD16510 CCD Driver IC pin spacing is 0.65 mm. Even with a special soldering iron, tweezers, magnifying glass, and spotlight, these modifications are extremely challenging!
- One of the biggest risks in the project is damaging the components and / or creating undetectable solder bridges on the PCB. The work itself is very tiring because of the level of concentration required. Performing this "micro-surgery" under a magnifying glass takes some getting used to. It is actually quite disconcerting to see the size of the end of a pair of tweezers and a fine soldering iron tip dwarfing the pins and pads that need to be worked on. I probably would have given up on the modification if it weren't for knowing that a large number of these modifications have been successfully completed by others!

Testing:

- Once assembly was complete, I attached the USB and Parallel Port cables from the SC ToUcam to the PC. I then fired up the computer and tested the cameras operation with the originally supplied Philips software. I pointed the camera at a fluorescent light, but since there was no lens in front of the CCD chip only a blurry image was obtained. I wrapped the original ToUcam lens with enough duct tape to increase its diameter until it fit snuggly inside the empty Kellner eyepiece. The image was good indicating probable success of the modifications.
- I then started up K3CCD tools to confirm proper operation of the Long Exposure function. There is an option box that must be selected to indicate that the camera is SC modified as opposed to original.
- Everything looks good, but real testing and imaging with the telescope will now have to wait until I have some more spare time available along with more hospitable weather conditions.

Summary:

- I would estimate that the complete transformation from start to finish took me about 8-10 hours. I would not recommend that any of the more difficult steps be attempted by anyone who is not extremely adept with precision micro electronic assembly.

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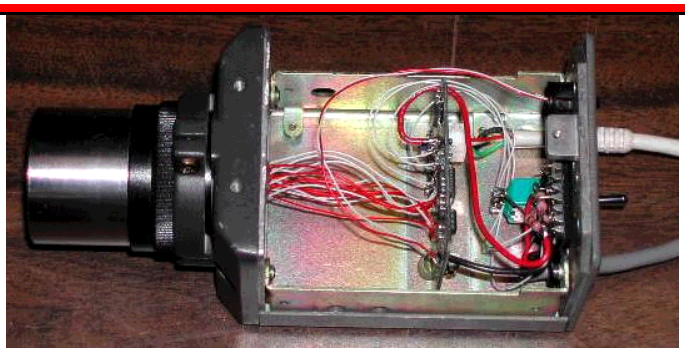

Figure 1: Eyepiece mount left, ToUcam PCB middle, SC circuit on rear panel.

Figure 2: Modified camera with USB and Parallel Port cables.

Figure 3: Front View with the Eyepiece focuser adapter removed.

Figure 4: Close up of CCD chip mounted on the Aluminum panel and the Eyepiece clamp.

Figure 5: Close up of the wires going to the ToUcam PCB.

Figure 6: Rear Panel, Parallel (bottom left), Long Exposure switch (bottom middle), USB (bottom right), LED (top right).

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UPDATE TO THE DOUBLE STAR PROJECT

By Michael Spicer

In 2002 the Hamilton Centre sponsored a Double Star observing project. The aim was to involve local observers in finding and observing double stars and recording information about them.

To date, 36 copies of the Double Star Observing Manual have been distributed and several workshops have been held for observers at the Powis Observatory in Waterdown. Project co-ordinator Michael Spicer reports that over a dozen observers have attended the observatory on one or more nights, and in his view, the project has been a great success. He notes that members who have been observing double stars seem to have increased their accuracy at locating stars from a chart and then estimating star separation (in arc-seconds) and star brightness (in magnitudes), all excellent preparation for participation in the upcoming variable star project.

A few members have suggested that more stars be added to the Double Star Observing Book, making it a more ongoing and complete sky survey. If you are interested, please contact observing director Gary Colwell or project co-ordinator Michael Spicer.

National Dark-Sky Week Set for April 1-8, 2003

Grassroots effort initiated by a High School sophomore is endorsed by the American Astronomical Society, the Astronomical League, and the International Dark-Sky Association

Reproduced from "International Dark Sky Association" web site

A grassroots effort to highlight the beauty of the night sky and to draw attention to the ever-increasing levels of light pollution across the United States caused by poorly designed lighting, has the endorsement of the American Astronomical Society (AAS) and the International Dark-Sky Association (IDA).

The AAS and the IDA believe that the opportunity to experience the natural night sky should be available to every citizen of our nation. This natural resource, which inspires our attempts to understand the cosmos, should be protected through the use of well-designed lighting systems that put light where it is needed and not waste energy through unnecessary illumination of the sky. Properly designed lighting systems provide safety and convenience without polluting one of our greatest natural assets.

This is the second year that Jennifer Barlow, a high school student from Virginia, has organized this grassroots campaign. "The night sky has been forgotten by many," she says, and she hopes that National Dark Sky Week will encourage people to "look up" and appreciate its wondrous features. As we re-establish that connection, we hope to raise awareness about how to reduce light pollution and protect our heritage of dark skies.

The American Astronomical Society and the International Dark-Sky Association encourage all Americans to use the evenings of April 1st to April 8th 2003, from 10 pm to 12 am (ET & MT) and 9 pm to 11 pm (CT & PT) to attend public star parties, visit their local planetarium or public observatory, or simply go outside to a safe, dark location to enjoy the wonder of the night sky. Learning the constellations, observing the planets, wondering about the stars and the Milky Way are one of the most basic of human experiences and should be enjoyed by all.

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National Dark-Sky Week is also endorsed by the Astronomical League, a non-profit federation of 250 astronomical societies and nearly 20,000 members, and by *Sky and Telescope* magazine.

More information on National Dark-Sky Week is available at http://www.nationaldarkskyweek.htmlplanet.com/

OBSERVING INDOORS – A WORTHWHILE WINTER PROJECT

By Michael Spicer

Face it, it's winter and the chill hits me right about the time the scope is set up to start observing. Especially in January, clear nights are accompanied by very cold temperatures and wind (Brrrrr! It hurts even to think of it). Yes, I travel south to the Carolinas to do some winter observing! On the other hand, there must be a way to observe from indoors without spending $20,000 on some radio-controlled remote observing station! There is and it costs almost nothing.

Heather Neproszel, our observatory's curator, recently put together a remote observing set-up for very little money. I have used it to remote observe from inside, and it can make a video recording of the observation for posterity, to boot! Here's what she did:

Telescope: Heather has a Celestron Nexstar 80GT refractor… a small telescope that sits on a light go-to mount that is electronically controlled by a Nexstar hand controller, similar to the Meade Autostar that is so popular on the more expensive, noisier telescopes. The controller can adjust the telescope to compensate for drift, keeping the object in the field of view. Heather bought a 24-foot extension cord for her controller and now can sit inside where it's warm while piloting her scope!

Eyepiece: Many observers have used CCD cameras to collect images, but this requires really accurate alignment and they always seem to be at the scope, making "fine adjustments". Roger Hill has spearheaded using inexpensive web cams to obtain images via computer control, but Heather opted for buying a Meade Electronic Eyepiece. The Meade eyepiece is a small CCD camera powered by an internal 9-volt battery. The eyepiece sits in your telescope's 1.25" or .965" eyepiece holder. You connect it to a TV/monitor/VCR via a long single RCA jack (like most stereo or VCR wires). Images are collected in real time on the screen, can be taped like a movie on your home VCR. The image can be moved around on the screen by using the telescope's hand controller.

The whole arrangement took a few minutes to set up. Heather started making a movie of a conjunction of Jupiter's satellites Io and Europa in the early morning of 11 January, right after the HAA meeting. This little CDD set-up was good enough to see the moons of Jupiter very clearly, while also obtaining images of the polar cap and equatorial belts of Jupiter. She can't wait to try imaging Saturn and the Moon.

For under $100 this is a great way to observe the Moon, planets and their satellites, and in good conditions, even bright double stars and clusters. It's not sensitive enough to observe deep sky objects, but then, consider the cost! It helps to have remote 4-way electronic control of your telescope, either by using a go-to scope or outfitting your scope with RA-Dec motors. However, I tried recording the view through a 6" reflector set on a TAL mount with only an RA clock drive and the results were remarkably good. There was some drift because, as is well known, I am not the best at obtaining accurate polar alignment.

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Occasionally I would dart outside to the scope and make a small adjustment to re-centre the image on the screen. My point is you don't need a really expensive outfit to obtain excellent results!

Winter winds? I do not fear them (now).

March General Meeting has been changed
By Mark Kaye

Our regularly scheduled general meeting for Thursday March 7 2003 has been changed to Thursday February 27 2003. This change has been made to accommodate guest speaker, Mr. Rajiv Gupta.

Rajiv's topic is "Composite Digital Techniques for High-Resolution Astrophotography with Film".
The best deep-sky images now being produced are composites, formed by combining two or more individual exposures into a single image. Thanks to various powerful computer programs on the market, composite imaging is now easy. This talk will demonstrate some of these exciting techniques as applied to film, with several examples.

Over the past 8 years, Rajiv Gupta has been developing methods to produce finely detailed colour images using the black-and-white wonder film of astrophotography, Kodak's black-and-white Technical Pan. Rajiv is co-developer of RegiStar software, which automates the alignment of digital images, and is also editor of the Royal Astronomical Society of Canada's Observer's Calendar, in which many composite images have appeared, editor of the RASC Observer's Handbook, and President of the RASC. By profession, Rajiv is a mathematics professor at the University of British Columbia.

Fire Destroys Observatory in Canberra Australia

Partially reproduced from Sky & Telescope A ferocious bushfire swept across the western outskirts of Canberra, Australia, on January 18th, destroying the extensive observatory compound atop Mount Stromlo. The damage to the facility has been estimated at $20 million US. At least six telescopes have been lost, including the 1.9-meter (74-inch) Grubb-Parsons reflector, the 1.3-meter (50-inch) Great Melbourne telescope, and the 0.7-meter (26-inch) Yale-Columbia refractor. Also destroyed were the 23-cm (9-inch) Oddie refractor, which was installed on the summit in 1910, and a laser-ranging station with its 1-meter telescope. The fire then consumed the main administration building, which housed the observatory's library, but the visitor's centre and two office buildings containing computerized archives were spared. The fire advanced on the summit so quickly that the observatory staff had only 20 minutes to evacuate. No one there was injured, but the fire consumed the homes of eight staff members.
Ian Grubb, vice chancellor of Australian National University, stated, "Plans are already being put in place to rebuild at Mount Stromlo and restore the research school to its full capacity." Perhaps the most significant scientific loss, reports John Howard of the Canberra Astronomical Society, was the workshop containing a $5-million imaging spectrograph known as NIFS. The nearly completed instrument was just months away from being shipped to the 8-meter Gillett (Gemini North) telescope atop Mauna Kea, Hawaii.

THE CASE OF THE BONUS

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EYEPIECES
By: Michael Spicer

Plossls have been a standard observing eyepiece for over a quarter century. They show bright, high-contrast images on a very flat distortion-free field with a minimum of ghosting. For high-power planetary viewing they are almost as good as orthoscopic eyepieces, yet their wider field of view makes them excellent eyepieces for deep-sky and lunar observing.

In an earlier Orbit article (October 2002, p. 7) I mentioned that in the last half of 2002 both Meade and Celestron were offering bonus eyepiece sets for US$99 with the purchase of new telescopes. Meade's set was the Series 4000 plossl eyepieces that have become common over the last decade. The set contains seven eyepieces: 6.4mm, 9.7mm, 12.5mm, 15mm, 20mm, 32mm and even the 40mm, all in 1.25" barrel size. The ubiquitous 26mm eyepiece comes with the qualifying telescope.

Experienced observers will know that the Meade Series 4000 eyepieces originally were made in Japan and were eyepieces of very good optical quality. Joe O'Neil of London, speaker at a recent Hamilton Centre monthly meeting, said the Japanese know how to make very good lenses and put the best non-reflective coatings on them. Lately Meade's Series 4000 plossls have been made in Taiwan. The Meade eyepieces in the 2002 bonus cases come from China. Chinese optics often varies in quality, so the optical quality of the newest Meade plossls was in question.

Celestron offered not its Ultima eyepieces but a new line of plossls with the Celestron name on each. The Celestron set has only 5 eyepieces, the 4mm, 6mm, 9mm, 15mm and 32mm, but also has a very good 2x barlow and a set of seven planetary and moon filters. I asked several dealers what the Celestron plossls were like and if there was any information on how optically good they were. All responses were that this was a new type of Celestron plossl and of unknown quality. Celestron of course touted them as superior grade eyepieces. They looked very much like eyepieces coming out of China made and sold under various low-quality or generic names, copying the Meade 4000 series with recessed lenses, dainty rubber eyecup, blackened interiors and knurled rubber eye grips on the largest eyepieces, at least.

I thought it best to acquire a few sets of Meade and Celestron eyepieces and to test them out against eyepieces of known quality - the older Japanese-made Meade plossls and Televue plossl eyepieces of the same focal length. I tested the eyepieces in a few different telescopes using a Denkmeier binoviewer - what better "blink comparison" could one use? Most of the testing was done in December 2002 through my 11" Nexstar SCT and a Televue apochromat TV-85, observing detail on Saturn and on several multiple stars such as the Trapesium in Orion's M42. I was surprised at the results of my tests.

The new Celestron eyepieces were all of very good optical quality. Images in them were especially bright and crisp, leading me to think that they had been optimally coated with anti-reflective material. They were as good as the older Japanese-made Series 4000 eyepieces but not quite as good as the more expensive Televue plossls. Televue plossls are noticeably better than any other eyepieces of that type on the market and experienced observers are usually willing to pay the extra cost to obtain them.

The new Meade eyepieces, on the other hand, were not so good. Images in them were generally dimmer and showed noticeably less contrast than in the new Celestrons, than in the old Japanese-made Meades, and certainly

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poorer than in the Televues. The Chinese-made Meades were still good eyepieces of course - but not as good as the new Celestrons. On the plus side, after you tighten the barrels to get rid of the nasty rattling that seems common in Meade eyepieces, they are really quiet - not at all like Meade LX-200 telescopes, eh?

I suppose it's difficult for Meade to flood the market with Series 4000 eyepieces and keep up their quality at the same time. These Chinese Meade plossls look the same but their performance suffers. I note that many sets of these new Chinese plossls are being sold on eBay and other web sites at a fraction of their retail price. There are occasional Japanese-made Meade plossls for sale at a slightly higher price, and I recommend you purchase those instead. Meade eyepieces have "Japan" or "Taiwan" cut into the barrel... the new Chinese-made Meades say nothing.

Ironically, on eBay and other web sites, the new Celestron eyepieces are undervalued. They sell for about US$20 - half the price of the new Meades - yet they are of better quality. You might want to snap up a set of the Celestron bonus plossl eyepieces now. Once the high quality of the new Celestron plossl eyepieces becomes better known, their price is sure to rise.

2003 Sidewalk Astronomy Program
By: Grant Maguire

Once again the very successful sidewalk astronomy program will begin this spring. The Hamilton Centre in conjunction with Sky Optics will be setting up our telescopes at the west end of Spencer Smith Park in Burlington.

The evening program runs from sundown until whenever, weather permitting. If the moon can be seen we will be there.

Hamilton Centre members are encouraged to bring their telescopes to the park or just come on down yourself, to help promote our hobby and the Hamilton Centre, to the public. The program is very exiting as you watch the reaction from people and especially children who have never seen the moon with that much detail.
Here are the dates for this years Program:

Friday May 9, 2003
Friday June 6, 2003
Friday July 4, 2003
Friday August 8, 2003
Friday September 6, 2003
Friday October 3, 2003

Annual RASC Hamilton Centre Banquet

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The Hamilton Centre is pleased to announce its annual banquet this year.

When: Saturday May 10, 2003 **Where:** Holiday Inn Select, 2525 Wyecroft Road, Oakville Ontario

Time: Happy Hour 6:00 pm Cash Bar
Buffet Banquet 7:00 pm featuring carved prime rib au Jus and Grilled Boneless Breast of Chicken (Lemon Terragon)

Featured Speaker: 8:00 pm Alan Dyer **Cost:** $45.00 per person

Topic: The Amazing Sky We all love astronomy because of the memorable views it provides of wonderful sights in the sky, scenes that often go totally unnoticed and unappreciated by our non-astronomy friends. Over the last few years Alan has been capturing some of these beautiful scenes on film. In a multi-media talk complemented by music and animations, he'll tour us through an amazing sky using images he has taken in Canada and around the world on various expeditions to eclipses and to the southern hemisphere. This is a non-technical "sight-seeing tour" suitable not just for astronomers but also for all those who live with astronomers. So no worries about film speeds and f-stops. Just sit back and enjoy the view.

February 2003 Sun Rise/Set Calendar for Burlington Ontario

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1 Rise 7:34 Set 17:30
2 Rise 7:33 Set 17:31	**3** Rise 7:32 Set 17:33	**4** Rise 7:31 Set 17:34	**5** Rise 7:30 Set 17:35	**6** Rise 7:29 Set 17:37	**7** Rise 7:28 Set 17:38	**8** Rise 7:26 Set 17:40
9 Rise 7:25 Set 17:41	**10** Rise 7:24 Set 17:42	**11** Rise 7:22 Set 17:44	**12** Rise 7:21 Set 17:45	**13** Rise 7:20 Set 17:46	**14** Rise 7:18 Set 17:48	**15** Rise 7:17 Set 17:49
16 Rise 7:15 Set 17:50	**17** Rise 7:14 Set 17:52	**18** Rise 7:12 Set 17:53	**19** Rise 7:11 Set 17:54	**20** Rise 7:09 Set 17:56	**21** Rise 7:08 Set 17:57	**22** Rise 7:06 Set 17:58
23 Rise 7:05 Set 17:59	**24** Rise 7:03 Set 18:01	**25** Rise 7:02 Set 18:02	**26** Rise 7:00 Set 18:03	**27** Rise 6:58 Set 18:05	**28** Rise 6:57 Set 18:06	

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R.A.S.C. Hamilton Centre Calendar of Events

February 2003

NOTE: Public Observing Night moved to the FIRST Fri. due to Valentines Day

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 New Moon
2 Jupiter at Opposition	3 Mercury @ greatest elongation W. (25 deg.)	4	5	6 General Meeting Steam Museum 8:00 PM	7 Public Observing Night Powis Observatory 8:00 PM	8
9 First Quarter	10	11 Saturn 2.3 deg. S of moon	12	13	14 VALENTINES DAY	15
16 Full Moon	17	18	19	20	21	22
23 Last Quarter	24	25	26 Happy Birthday Copernicus 530 Yrs!	27 General Meeting Steam Museum 8:00 PM Rajiv Gupta Speaker	28 Public Observing Night Powis Observatory 8:00 PM	

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