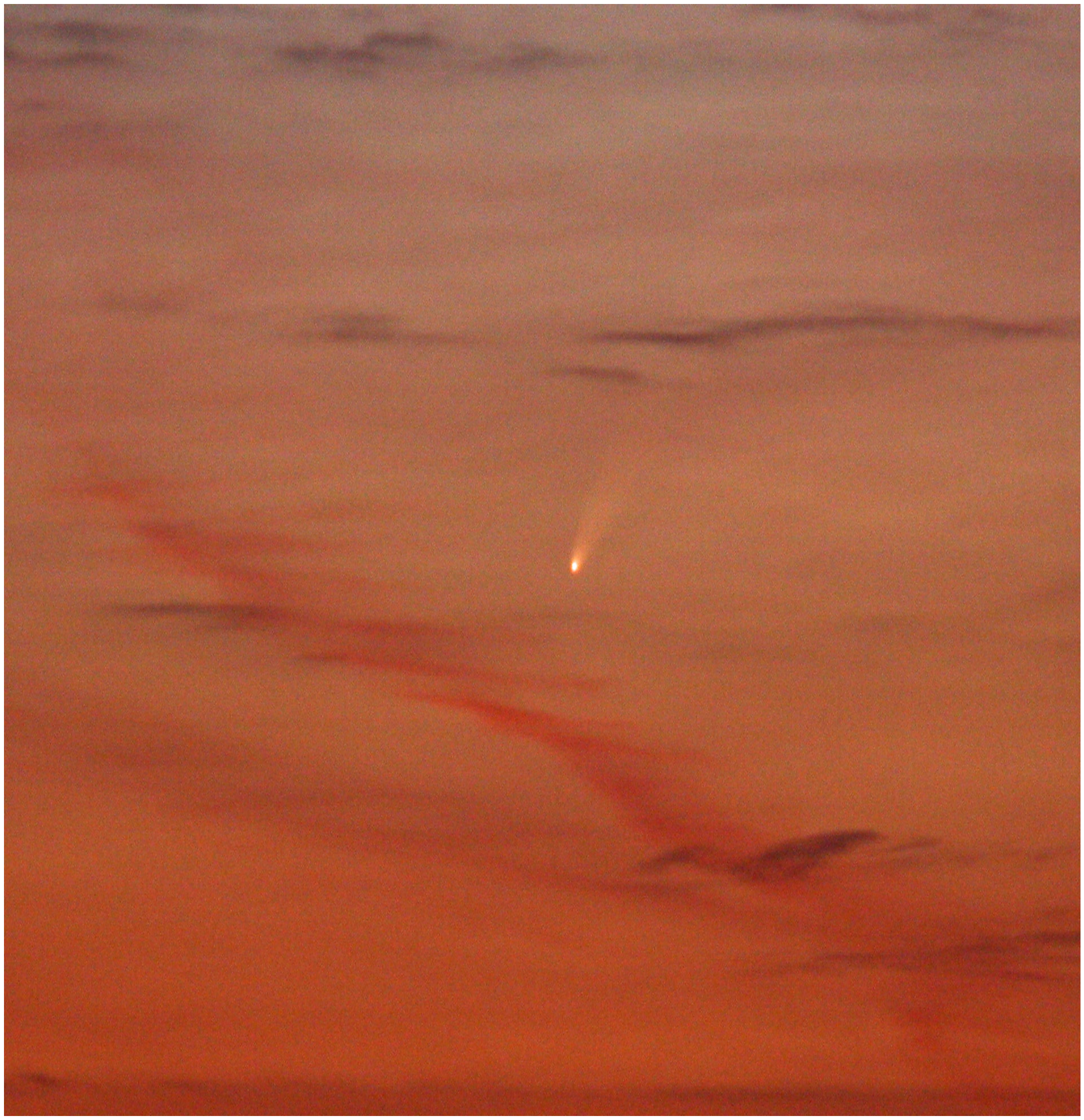
Aurora
The Royal Astronomical Society of Canada - Windsor Centre
Volume 32, Number 7
Feb 2007

Comet McNaught



Paul Pratt's shot of Comet McNaught from the top of the hill at Malden Park on January 10, 2007 at 17:54.

The Details:

Camera Model	Canon EOS 30D	**Shooting Mode**	Program AE
Tv (Shutter Speed)	1/13	**ISO Speed**	400
Av (Aperture Value)	5.6	**Exposure Compensation**	-1/3
Lens	EF300mm f/4L IS USM +1.4x	**Focal Length**	420.0 mm

In This Issue

Calendar of Events

Our next meeting…

Tuesday, March 20, 2007 8:00 p.m.
at
K of C Maidstone Recreation Centre
10720 County Road 34 (Old Hiway 3)

Main Speaker…

Dr. Denis Tetreault, UofW, Earth Sciences

Topic…

Planetary Geology

Coming Events

Astronomical Events:

March 3 — **Moonrise Total Lunar Eclipse (east of Saskatchewan) - See the Observer's Handbook page 121**

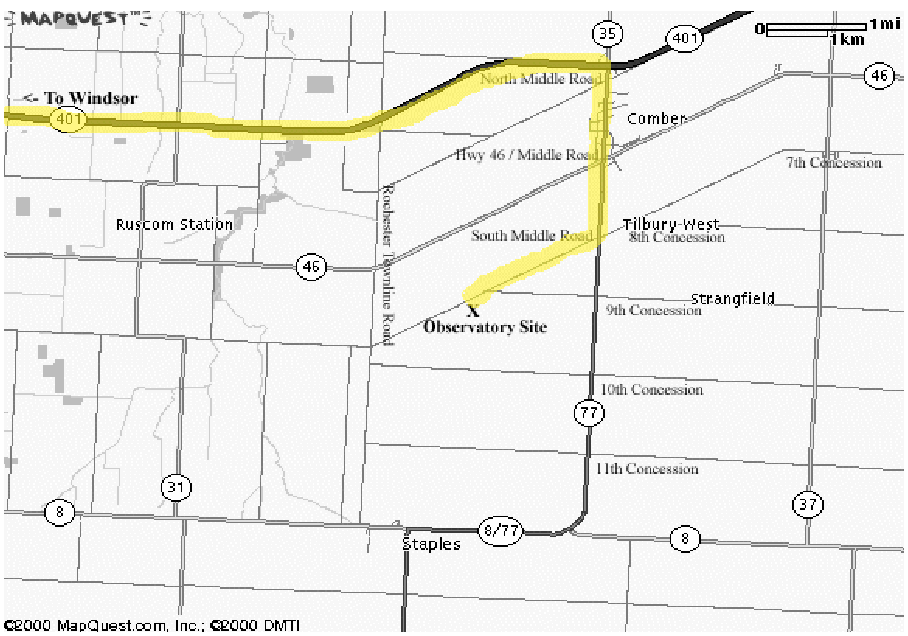
March 11 — **DST begins (You know…. Winter Ahead; Fall Back)**

Observatory Open House:

SATURDAY	Start	Moon age
February 24	7:00 p.m.	7 days

See THE last page for a year's list

Feb 13th — **Council Meeting at Pierre Boulos'**



Hallam Observatory Site

Directions: The map above shows the Comber area and it includes the major highways (401, 77, 8 and 46) that are in the area of the observatory.

The most direct route from Windsor is "highlighted" on the map which is to take 401 East to Highway 77 South to South Middle Road. While on South Middle Road you go about 1 kilometer and just after the barely discernable point where Concession 9 joins it you will find the observatory site on the South side of the road.

If you hit the Rochester Townline Road (i.e. you come to a stop sign and have to turn left or right) you have gone too far.

Submissions

Aurora is published monthly except for August. The October, December, February, April and June issues are full newsletters (usually 6 pages) with a number of member submitted articles. The November, January, March, May and July issues are short flyers (2 pages) with one short article. September is a dual issue with the full 6 page newsletter mailed just **before** the meeting and a flyer available **at** the meeting. Submitted articles can be of any length from a paragraph to multiple pages. I can scan pictures and/or diagrams (both prints and film) to support your article and the originals will be returned to you. Submission deadline is the 1st of the month.

Editor: Ken Garber Email: kgarber@cogeco.ca
Ass't: Dan Anzovino Email: danzovino@sympatico.ca

Membership

The Windsor Centre of The Royal Astronomical Society of Canada meets on the 3rd Tuesday of every month (except July and August) at the K of C Maidstone Recreation Centre. In addition to regular meetings the centre hosts a number of observing nights, a picnic and a December social. Members receive a copy of the Observer's Handbook, the RASC Journal (optional at extra cost), a subscription to SkyNews magazine and access to the Centre's library and telescopes.

Annual Membership Fees are Regular - $55.00, Youth - $34.25 and Life - $2100.00. **** NOTE New Rates ****

Contact Ken Garber at (519) 966-3478 or visit our website at: http://www.mnsi.net/~rasc for more information.

Meeting Minutes for January 16th as recorded by Dave panton

Chaired by incoming President Dr. Pierre Boulos
The minutes from the November meeting were read, Steve Mastellotto made the motion for acceptance, Randy Groundwater seconded and the motion carried.

Pierre remarked in following Steve Mastellotto's presidency he had to match a very high standard of leadership. He asked for a round of applause for Steve.

Pierre welcomed all to the meeting and asked guests to indentify themselves for special welcome. Steve Podgeniac came to see the main presentation and had enjoyed a meeting in the past.

Keeping with the new meeting format Pierre explained the main presentation would be the next feature and introduced Paul Preney. Paul is a long time member of Windsor Centre, is teaching and also working on his Phd. in computer science.

Main Presentation: by Paul Preney

Using Computer Programs to Simulate Astronomical Events

Paul explained periodic fixed images can be downloaded from the internet, saved and stitched together using appropriate software to produce animations. Eclipses, occultations and transits are especially interesting when animated. Paul explained the meaning of each term and then ran examples of simulations he created.

They need not be from Earth and Paul showed Sun/Earth/Moon motion simulations producing total and partial solar and lunar eclipses as viewed from all three. Further out, newly captured views from behind Saturn facing the Sun revealed it's rings are ever more complex and greater in diameter than previous observations indicated. Earth from this vantage was visible as little more than a small dot.

A series of animations of last Summer's total eclipse viewed from space gave a new perspective. The Moon's shadow was a small black dot (the umbra) in the centre of the ever more washed out penumbra's shadow. It slowly traversed Earth's face and was best seen by Earth bound observers in Libya.

Most spectacular, were Pauls complex animations of the Cassini spacecraft's Huygen lander parachuting to the surface of Saturn's moon Titan. Shot straight down through a fish eye lense the view became ever more detailed. On the same screen additional information was presented showing the status of the the descent. On landing the view switched to a desolate plane of small rocks, seen by the lander in the last few moments of battery life.

The applause was spontaneous. Paul listed his four image sources; Blue Marble, Wikepedia, X-Planet and Now you see it now you don't. Pierre thanked Paul for his very creative presentation. >>>>

Coffee Break and 50/50 Draw:
It turned out to be a dry, low cal break. Many were concerned Tom may have met a mishap on the way but prevailed without his usual hot beverages and Tim Horton's goodies.

The 50/50 draw was won by Bert Huneault. A Gemini Tour CD donated by Pierre was also drawn for and presented to Amalia, Juliana's little daughter.

Correspondence Secretary: Dave Panton
There was no correspondence to report. Joady Ulrich completed the annual activity report to RASC.

Treasurer: Ken Garber
The bank balance is $4713.13 and the bill for the new computer in the observatory is paid. There are 89 paid up members. Ken has 14 year 2007 calendars for sale. There are Orion catalogs at the desk for the taking as well as some obsolete Observer's Handbooks and other RASC Centre's newsletters.

Librarian: Rick Marian
A box of discarded science and astronomy books declared surplus from the Essex Library will be disposed after members select any of personal interest.

Newsletter Editor: Ken Garber
Articles from members for the Aurora are always welcome.

Director of Public Education: Randy Groundwater
Randy hosted a group of 20 scouts at the observatory on a cloudy night and found the new computer helpful displaying astronomical images and operating the telescope on a demonstration basis. The 90 minute session thus went well in spite of conditions.

The 5th Belle River Brownies pack will be hosted on June 24th. The Belle River Beavers are set for a presentation in March. Belle River Brownies are also on the agenda.

Mike Mastronardi did a presentation to a class of grade six pupils at Anderdon Public School.

Director of Public Relations: Tina Chichkan
Tina had a nil report.

Light Pollution Abatement: Dan Taylor
Dan made a presentation to the Detroit River International Crossing people to further reinforce the principles of full cutoff lighting, sensible lighting fixtures and energy conservation. LED light fixtures are new and were also of interest for the study. Suggestions were made to curfew late night decorative lighting if such were installed on the span.

Dan reminded members to use the City of Windsor 311 line to report non lighting issues. Also he suggested becoming involved in Ward meetings to promote full cut off lighting.
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Meeting Minutes for January 16th continued

The new parking light fixtures in Yorktown Plaza are less than ideal, throwing bright light well beyond that of FCO fixtures. Dave Panton will follow up by calling Windsor's 311 line and see what develops.

National Council Representative: Tim Bennett
Tim was not available, alternate rep Steve Mastellotto had nothing to report.

Observatory:
Steve reminded all the next open house is set for Saturday, January 27th. Dave Panton gave a brief report on progress made in bringing the telescope pointing accuracy up to specifications.

Director of Observing for January: Steve Mastellotto

Telescope Eyepieces

Beginning with a talk on eyepieces, Steve reviewed the various terms used in describing eyepieces, their meanings and how they characterize each. Focal length and how it relates to magnification with each telescope is the most important. Barrel diameter to match focuser diameter is obvious but one of the more subtle is field of view.

The diameter of the circle we see in the eyepiece sky at night tells us how much of the sky can been seen. Measured in arc minutes it is called field of view. It is usually less than a degree. "Apparent" field of view in more expensive eyepieces can spread that tiny "looking through a straw" view out into a wide panorama of the same scene. The effect is breath-taking and the observer feels "out in space with the stars"

Other factors such as "eye relief" tell us if an eyepiece can be used while the observer wears glasses. "Parfocal" is an important term for a matching set of eye pieces. They can be changed without need for refocusing. Basic, perfectly functional eyepieces need not be costly, so it is best to spend only what you can afford.

Observing

Steve asked if any had seen all three recent major astronomical events. Steve barely missed seeing the Jupiter/Mars/Mercury gathering in the morning sky. Dan Taylor saw some of the Geminid meteors. Comet McNaught was viewed by Randy and son David. Tina spotted it from a park area near her home. Paul Pratt, using a telephoto lens shot a nice photograph from Essex County's highest elevation in Malden Park

Steve then reviewed astronomical items of interest in January and February as featured in the RASC observer's handbook. Objects of special interest are The star Sirius in Canis Major. It is a double that can be a challenge to split. H4395 is a nice orange and blue double. NGC 2362 and the Wild Duck Nebula NGC 2359 are also interesting sights.

Pierre thanked Steve for his two presentations.

For future meetings Pierre welcomed questions of all kinds from members, answers to be sought and presented later. Other thoughts were to have a "Question of the Month" and also solicit "seed ideas" for articles in the Aurora.

Ken Roung reported he is trying out his new 12 inch Dobsonian telescope. Built on a light bridge it features a high quality hand figured mirror.

Meeting adjourned 10:20 p.m.

David J. Panton, Recording Secretary

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335 Years Ago

(February 22, 1672)

Newton discusses the theory behind his Reflecting Telescope which he sent to the Royal Society of London in 1671.

This is an image of a replica of what it looked like (6 inch scope)

Image and text provided by Pierre Boulos

When a Star Meets an Asteroid by Dave Panton

The asteroid Dynamene occulted a star we could see on Oct 8 2006.

These events are pretty rare at any single location. We were fortunate to have three in this area over Thanks Giving weekend. Steve Mastellotto videotaped one the morning of Oct 7th at Hallam but lost the second to a passing cloud.

A third was to occur just after 9:00 p.m. on Sunday evening Oct 8th. Having observed one a few years ago with Larry Burgess at Hallam, I was keen to see another "naked eye" only using a telescope.

Conditions to witness the occultation first hand at the eyepiece were far from ideal. The magnitudes were 11.3 for the star and only 12.6 for the asteroid. The Moon would be nearly full in the South East and the event to the South near the ecliptic. I tried to locate the star Saturday night but failed mainly for lack of preparation.

Most of Sunday afternoon was spent preparing appropriate sky maps. First were Uranus maps in mirror image form to match the 40 mm eyepiece view. Dynamene would not be far away so similar maps were prepared for the time of occultation. The plan was first to locate the easy target Uranus in the eyepiece and orient it's map to match the surrounding star pattern as seen in the eyepiece. Then the asteroid map would be marked in the same orientation and the telescope slewed to the target star.

It turned out the map had to be rotated upside down and turned a bit more clockwise to make it match the Uranus star field.

This significantly improves one's chances of finding the target star in the eyepiece. Practice asteroid occultation simulations were also run on Starry Night Pro 4.52 to help get a clear sense for its motion.

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Juliana Grigorescu , with her lap top computer joined the expedition late in the afternoon . All was set to make the attempt. Given the slightly hazy sky and big bright moon, conditions were not promising.

About 45 minutes prior to the occultation the star was located. In the 40 mm eyepiece it seemed fuzzy and maybe a bit elongated. Boosting magnification with the 18mm eyepiece quickly revealed there were two objects very close together, one brighter than the other. Were these Really the targets? Now it was a waiting game. My afternoon efforts included extrapolating likely occultation times for Hallam. There was enough uncertainty to require constant observation a few minutes prior to avoid a total loss should it be early. The event would last less than 36 seconds.

At the eyepiece the two objects became one and then dimmed as Dynamene blocked the star's faint twinkling. With desk atomic clock in hand the best I could do was glance down and get a single 9:09:22 timing. This was within the expected time zone . The star's twinkling began to return but the two were still one to the observer's eye. More time should split the two and confirm the sighting.

Dave Ainslie, in from harvesting happened to visit at this point and soon was telling stories of his many adventures back packing in Europe and Asia as student back in the sixties.

Forty five minutes after occultation Dynamene was easily visible as a dim object moving away from the star it had just occulted, good bye little star. Outside, Sandpipers were crying as they flew in the moonlight. Good fortune smiled, allowing the event to be observed from Hallam that night.

The reward far exceeded the effort.

Dave Panton

For Sale

FOR SALE 6 inch **Meade Starfinder** Reflecting Telescope with Equatorial Mount. Package includes:

1 - Meade Multicoated 9mm eyepiece
1 - " " 12mm "
1 - " " 15mm Super Plossl eyepiece
1 - " " 25mm eyepiece
1 - 2x Telenegative Amplifier (Barlow)
1 - Red flashlight
1 - Instruction Manual
Price $600.00
If you are interested contact John Murray directly at 519-944-7052 or via email at jmurray100@cogeco.ca

FOR SALE

Celestron Nexstar 114. It is 2 years old and only used once. Note this is a goto computerized telescope and he is including a 25mm eyepiece. Alan King can be reached at 519-326-1361 or at jackall2@cogeco.ca

Centre Internet Communications

A Newsgroup/discussion board has been set up for Centre members on Yahoogroups. Created by Pierre Boulos, the list is called **RASCWINDSOR**.

To find out more about the ***rascwindsor*** group and to subscribe , please visit
http://groups.yahoo.com/group/rascwindsor

A Little Fund Raising

Got any Canadian Tire money lying around that you'd like to get rid of?

Why not donate them to the Centre?

To date we've collected almost $70. Some of this will go towards preparing the site against wasps and other creepies. We're always buying bits and pieces - be it hardware or a can of bug spray.
Bring them along to any meeting and throw them into the box on the treasurer's table, and they will be put to good use.

Time to Renew??

Don't forget that you can renew your membership at the treasurer's desk, by snailmail to the National, or online at the RASC 'store' at
http://www.store.rasc.ca/

And don't forget that the printed Journal is now optional extra. Look for the option on your form.

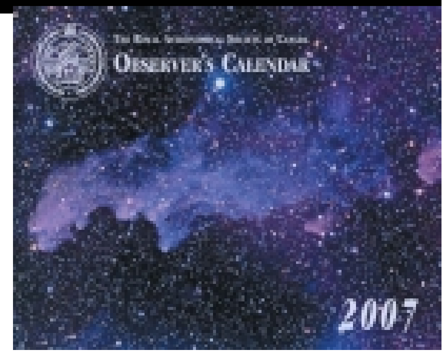
Got Yours yet ? ? ?

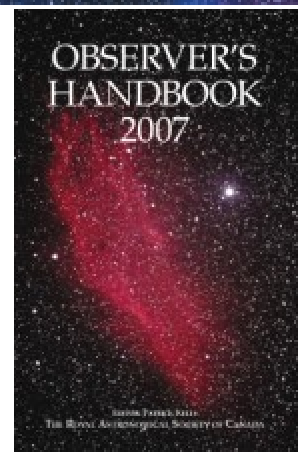
Still available…

The 2007 RASC Calendar . . . . Only $12.00

Already have one?

Then how about a gift for someone?





AND also available
(in very limited quantities)…

The 2007 Observers' Handbook

and the 2006 Observers' Handbook

2007 Observatory Open Houses

As compiled by Randy Groundwater

Here is the schedule for the coming year. All are Saturday evenings. The dates will be repeated in the flyer or full newsletter as the dates approach.

Note that the August Open House will not interfere with Starfest / Stellafane, as both are being held the weekend before.

The October Open House is scheduled one week earlier than optimum, in case we're all at Pt. Pelee the following weekend helping out with their planned nature night walk. Here we go:

SATURDAY	Start	Moon age
February 24	7:00 p.m.	7 days
March 24	7:30 p.m.	6 days
April 21	8:30 p.m.	4 days
May 19	9:30 p.m.	3 days
June 23	9:45 p.m.	9 days
July 21	9:30 p.m.	7 days
August 18	8:30 p.m.	6 days
September 15	8:00 p.m.	4 days
October 13	7:00 p.m.	2 days
November 17	7:00 p.m.	8 days
December 15	7:00 p.m.	6 days

THE SUN AND ITS MULTI-FACETED ACTIVITY by Bert Huneault

"Solar minimum", experienced in 2006-2007, is as good a time as any to take a closer look at our Sun and examine the many aspects of solar activity. In the literature and media, amateur astronomers often come across colourful terms such as coronal mass ejections, prominences, faculae, sunspots, plages, solar flares, filaments, solar wind, coronal holes, etc. This paper discusses the terminology, and attempts to concisely describe the various solar phenomena. Information to compile this glossary comes from several sources, including books, magazines, the Internet and personal notes and records. The solar features are listed alphabetically.

ACTIVE REGION: A localized area of the Sun's outer atmosphere where powerful magnetic fields, emerging from subsurface layers, give rise to temporary features which may include sunspots, granules and faculae in the photosphere; spicules, plages, fibrils, flares and filaments in the chromosphere; filaments and prominences in the corona.

CHROMOSPHERE: A narrow region of the Sun's atmosphere that lies between the relatively-cool photosphere and the super-hot corona. The layer is about 10,000 km thick and has temperatures between 5,000 and 20,000 K. Its structure (e.g. plages) is best revealed in the red light of H-alpha.

CME: See Coronal Mass Ejection.

CONTINUUM: Spectrum composed of a continuous range of emitted or absorbed radiation, e.g. an unbroken spectrum spanning the range of optical wavelengths from the IR to the UV; or an unbroken emission band in the radio region.

CORONA: The tenuous, uppermost level of the Sun's atmosphere, lying immediately above the chromosphere. It consists of hot (1 to 4 million Kelvin), low-density gas that extends for millions of kilometres from the Sun's surface.

CORONAGRAPH: A telescopic attachment comprising a disk that blocks out the bright, direct light from the Sun (or from a star). It is most commonly used to photograph the sun's corona, but can be used to find near-solar comets and even extrasolar planets.

CORONAL HOLE: A region of the Sun's corona which appears dark in pictures taken with a coronagraph or during a total solar eclipse; it shows up as a void in X-ray and extreme UV images. Coronal holes are of very low density; typically 100 times lower than the rest of the corona. They have an open magnetic field structure, i.e. magnetic field lines emerging from the holes open up and extend indefinitely into space rather than looping back into the photosphere. This allows charged particles to escape from the Sun and results in coronal holes being the primary source of the solar wind and the exclusive source of its high-speed component which can exceed 2,000,000 km/hour. Coronal holes were discovered in the 1970s in solar X-rays by equipment aboard Skylab. A stream of solar wind flowing from a coronal hole, when reaching Earth can spark a geomagnetic storm and generate aurorae.

CORONAL MASS EJECTION (CME): A huge eruption of material from the Sun's corona into interplanetary space. CMEs, sometimes associated with solar flares, are the most energetic of solar explosions, roughly approaching the power of one billion hydrogen bombs! These bursts of solar wind result in the ejection, over the course of several hours, of up to 100 billion kilograms of multi-million degree plasma at speeds exceeding 1,000 km/second (2 million mph!). Fast CMEs, i.e. those which outpace the ambient solar wind, give rise to large geomagnetic storms when they encounter Earth's magnetosphere. Such storms can upset power grids, generate aurorae, disrupt radio communications, damage satellite systems and threaten the safety of astronauts.

FACULAE: Latin for “little torches”, they are patchy white-light blotches in the photosphere, mainly seen towards the solar limb where the photospheric background is dimmer and the contrast is more favourable. They are most often found near active regions such as sunspots, or where such a region is about to form; and can remain for months after the sunspots in the active region have decayed. They are areas where the solar magnetic field is concentrated in much smaller bundles than in sunspots. While sunspots tend to make the Sun look darker, faculae make it look brighter. Faculae are visible in white light, but are best seen in blue light; they are not visible in H-alpha light.

FIBRILS: Dark, elongated, curvilinear chromospheric patterns seen in H-alpha light. The structures are aligned by the magnetic field, and this alignment is particularly strong near sunspots where they resemble the patterns formed by iron filings between the poles of a magnet. Fibrils connect spots and plages of opposite polarities.

FILAMENTS: Long strands of relatively cool hydrogen suspended by magnetic fields above the solar photosphere; they appear in H-alpha light as dark lines on the Sun’s disk. A filament on the limb of the Sun, seen against a dark sky, is called a prominence. Filaments have been seen to twist, undulate and even to wink in and out of visibility as their motion Doppler-shifts the absorption of radiation out of the narrow passbands of optical filters. Filaments snake across the Sun like rivers of cool plasma.

FLARES: Extremely bright, transient emission features lasting from a few minutes to a few hours. Solar flares are a rapid and violent release of energy in the chromosphere due to extreme magnetic field stress; the field lines suddenly snap like over-twisted rubber bands. The immense amount of energy is liberated as super-hot material (plasma) is explosively heated and expelled into space. Flares produce dramatic gusts in the solar wind, as particles jet out from the flare at speeds sometimes approaching half the speed of light. In just an hour or two the flare material can reach the vicinity of Earth and become potentially dangerous to unshielded humans in orbit; it can also create aurorae. Very large solar flares occasionally give birth to CMEs. By heating and expanding Earth’s upper atmosphere, flares can cause satellites in low Earth orbit to experience increased air resistance and rapid orbital decay. Flares are occasionally observed in a plage, but they more often occur above sunspots; and are accompanied by bursts of radio emission observed with radio telescopes and by gamma ray and X-ray bursts detected by satellites. At ground-based observatories, flares are seen in optical wavelengths as bright areas on the Sun.

GRANULATION: The mottled appearance of the Sun’s photosphere when seen in high resolution. It is caused by hot gases rising from the solar interior. Granulation looks a bit like rice pudding, with individual bright “rice grains” known as granules. The granules, visible in white light but best seen in green light, are convective cells about 1,000 km in diameter (as wide as Texas!). Each granule lasts on average about five minutes and represents a temperature about 300° higher than the surrounding disk areas.

HYDROGEN ALPHA (H-alpha): The first atomic transition in the hydrogen Balmer series, the alpha line has a wavelength of 656.3 nanometres. This absorption line of neutral hydrogen falls in the red part of the visible spectrum and is convenient for solar observations of flares, filaments, prominences and the fine structure of active regions. H-alpha filters allow only a very narrow band of light to pass through, typically 0.05 to 0.08 nm (0.5 and 0.8 angstroms). Note: an angstrom is a ten-millionth of a millimetre (10 to the -10 metre). While all Hα filters are capable of showing limb prominences, only filters with a bandwidth less than 1 angstrom allow features of the Sun’s disk to be seen. Sub-angstrom (very narrow-band) telescope filters show the greatest solar detail, but are more expensive.

IONIZING RADIATION: Radiation that has enough energy to eject electrons from electrically neutral atoms, leaving behind charged atoms, i.e. ions. Alpha particles (helium nuclei), beta particles (electrons) and gamma rays are three types of ionizing radiation.

PHOTOSPHERE: What we see when we look at the Sun is the photosphere. It's not a discrete surface but covers the range of depths from which the bulk of solar radiation escapes. Since the Sun is a ball of gas, the photosphere is not a solid surface but is actually a layer over 100 km thick (very, very thin compared to the 700,000 km radius of the Sun). As we look down into the atmosphere at the surface of the Sun the view becomes more and more opaque. The point where it appears to become completely opaque is called the photosphere. Thus, the photosphere may be thought of as the imaginary surface from which the solar light that we see appears to be emitted. Its "surface" temperature is about 6,000°C. The diameter quoted for the Sun usually refers to the diameter of the photosphere. When we look at the centre of the solar disk, we look straight in and see somewhat hotter and brighter regions. When we look at the limb, or edge, of the solar disk we see light that has taken a slanting path through this layer and we only see through the upper, cooler and dimmer regions. This explains the "limb darkening" that appears as a dimming of the solar disk near the limb. Photospheric features include sunspots, faculae and granules.

PLAGES: Bright regions surrounding sunspot groups. Plage areas have temperatures a few hundred degrees hotter than their surroundings, and usually appear a few days or even some weeks before the first sunspots and may outlive the spots by several weeks or months. Although these patchy brightenings are typically found near sunspots, they can appear anywhere in the chromosphere where a strong magnetic field prevails. Not to be confused with photospheric faculae, plages are normally only visible in the monochromatic light of spectral lines such as Hα. Plages are irregular in shape and variable in brightness, marking areas of nearly vertical emerging or reconnecting magnetic field lines. Note: Plage is a French word for "beach".

PLASMA: A hot ionized gas. Sometimes called "the fourth state of matter" plasma contains charged particles (atomic nuclei, electrons and protons) and has some neat properties; for example it can glow brightly and interact with electric and magnetic fields. Plasmas are the most common form of matter, comprising more than 99% of the visible universe, and permeate the solar system, interstellar and intergalactic environments.

PROMINENCE: Manifestation of the same phenomenon as "filament" (q.v.). Condensations in the chromosphere and corona, prominences are gigantic eruptions of dense hydrogen which can be viewed extending to great heights above the Sun's surface. Sunspots generally occur in pairs connected by a loop of magnetic field lines. When hot ionized gas travels along the looped field lines, it forms an arch-shaped solar prominence, the top of which can be as much as 100,000 km above the photosphere. The localized magnetic field of a prominence interacts with the field of the rest of the Sun, causing the prominence to be buoyant like a balloon.

SOHO (Solar and Heliospheric Observatory): This observatory in space is designed to study the internal structure of the Sun, its outer atmosphere and the origin of the solar wind. To view the Sun continuously, SOHO is operated from a permanent vantage point 1.5 million kilometres sunward of the Earth in an orbit around the L1 Lagrangian point where the gravitational attraction of the Sun and Earth are equal and opposite, i.e. in balance. Although hydrogen and helium make up 99.9% of the solar wind, sensitive instruments aboard SOHO have also detected isotopes of silicon, calcium, sulphur, iron and nickel.

SOLAR ACTIVITY CYCLE: The number of sunspots visible, on the average, varies with a period of about 11 years. During sunspot minimum, the Sun sometimes has no visible spots; but at maximum the Sunspot Number can exceed 200. The period of the sunspot cycle is semi-regular; the intervals between successive maxima have ranged from as little as 8 years to as long as 16 years. The current solar minimum marks the end of cycle 23 and the beginning of cycle 24. The Sun emits electromagnetic radiation over a very broad frequency spectrum, and surface regions near sunspots emit strong radiation at a wavelength of 10.7 cm (frequency of 2.8 GHz). This microwave energy varies slowly in intensity during the solar cycle, and the National Research Council of Canada continuously logs the amplitude of solar flux at that wavelength. That microwave flux is an easier-to-obtain and more reliable indicator of solar activity than the Sunspot Number. Sunspot observations are often obscured by clouds, but 10.7-cm radio flux penetrates clouds and can be measured regardless of cloud cover.

SOLAR ROTATION: The Sun rotates on its axis with a period of a little less than one month. Being a fluid gas, it does not rotate as a solid body, the rotation period being about 25 days at the Sun's equator, 28 days at latitude 40° and about 36 days at latitude 80°. In other words, the Sun rotates faster at its equator than at higher latitudes.

SOLAR SPECTRUM: The aggregate of all wavelengths emitted by the Sun, from the long radio and infrared waves, through visible light, to the short ultraviolet, X-ray and gamma-ray waves. Seen through a spectrograph, the solar spectrum consists of a continuum with thousands of dark absorption lines superposed (Fraunhofer lines). The Sun's visible spectrum contains the vast bulk of Old Sol's radiant energy and is the principal driving force for global climate.

SOLAR WIND: A plasma of charged particles (protons, electrons, and heavier ionized atoms) emanating from the Sun's corona and moving outwards in all directions at very high speeds (averaging about 400 km/sec, almost a million mph!). The expanding solar wind drags the solar magnetic field outward, forming the interplanetary magnetic field (IMF). It also produces aurorae, is responsible for the anti-sunward tails of comets, and distorts the symmetry of the Earth's magnetosphere. It can even have a measurable effect on the flight paths of spacecraft. The solar wind velocity is not constant, varying from a low speed (at Earth's distance) of less than 300 km/sec, to a high speed exceeding 800 km/sec flowing from coronal holes. The density of the solar wind is constantly changing, varying from less than 1 to over 100 protons per cubic centimetre; the highest densities occurring when a CME hits the Earth.

SPICULES: Narrow jets of gas which last several minutes and escape in rising motions of several tens of km per second. These linear, more or less vertical structures vary from 5,000 to 10,000 km in length. They occur in the upper chromosphere and are often visible in H-alpha light at the limb of the Sun.

SUNSPOTS: Sunspots are the sites of intense, concentrated magnetic fields emerging from the Sun's interior; these magnetic fields have flux densities from 500 to 4,000 gauss (Earth's flux density is about 1 gauss). These dark, long-lived photospheric features are typically 2,500 to 50,000 km in size. Moderate to large spots usually consist of a darker central region (umbra) and a lighter halo consisting of many short, fine fibrils (penumbra). In the umbra the magnetic fields tend to be nearly vertical in orientation, while in the penumbra the fields become more horizontal. The sunspots' strong magnetic fields are so intense that they block the flow of heat from nuclear fires below. This lowers their temperature down to about 4300°C; on the Sun, that's cool! Yet, the bright faculae and plages in the vicinity of sunspots increase even more than sunspots when solar activity grows stronger, so that an irradiance surplus is established. Some sunspots live only a few days or weeks, while others last longer than a full solar rotation.

SUNSPOT NUMBER: Also known as the Wolf count or the Zurich Sunspot Number, it is calculated daily by multiplying the number of observed sunspot groups by ten, and then adding this product to the total count of individual spots. During periods of sunspot minimum, the count is often zero; at solar maximum, it often exceeds 200. As a matter of fact, the Sunspot Number briefly peaked at 323 in 2002, during cycle 23's maximum phase.