

# AURORA



Volume 25, Number 9

The Royal Astronomical Society of Canada - Windsor Centre

May 2000

## Sunspot Numerology by Bert Huneault

As I write this (April 9), solar activity is more moderate than it was on April 2 when the Sun was peppered with spots (solar chicken pox!) and the daily Boulder sunspot number exceeded 300 for the first time since last November. Today's number is only 167. But the daily sunspot number is not as significant as the monthly-averaged value when it comes to determining the present phase of the current solar cycle (Cycle 23). According to the experts at NASA's Marshall Space Flight Center, "...on a daily or weekly basis the sunspot number can fluctuate wildly, but when we average the counts over a month they agree fairly well with our predictions". And their latest results suggest that Cycle 23 will peak beginning in mid-2000.

However, the scientists point out that we should not expect to be able to isolate the precise date and time of a solar maximum because, in reality, no single episode marks the summit of the solar cycle curve. Instead, the solar maximum usually lasts for an extended period of time such as a year or more.

Figuring out the "sunspot number" is not a simple task. Looking at the Sun through a pair of properly filtered binoculars might reveal two or three large spots; peering through a high-powered telescope might uncover 10 or 20; a powerful space-based observatory might see close to 100. So, which is the correct sunspot number?

There are two official sunspot numbers in common use: the daily "Boulder Sunspot Number" and the "International Sunspot Number". The former is computed by the NOAA Space Environment Center in Boulder, Colorado; and the latter is published daily by the Sunspot Index Data Center in Belgium.

Both are calculated from the same basic formula, but they incorporate data from different observatories. The formula, devised by Rudolph Wolf in 1848 is:  $R = k(10g+s)$  where R is the sunspot number, g is the number of sunspot groups (regions) on the solar disk, s is the total number of individual spots in all the groups, and k is a variable scaling factor that accounts for observing conditions and the type of telescope; k is usually less than 1. Scientists combine data from numerous observatories (each with its own k factor) to arrive at a daily value.

NASA says that even after the sunspot peak is past, there will still be lots of geomagnetic activity such as aurora, the reason being that late in the solar cycle coronal holes can dip down near the Sun's equator, thus facing the Earth; and this has little to do with sunspots. Coronal holes allow the Sun's high-speed solar wind to escape and buffet Earth's magnetosphere, possibly resulting in power outages, problems with magnetic navigation systems, dazzling displays of Northern Lights and disrupted short-wave radio communications.

People with home computers and access to the Internet can find out a lot more about the Sun, sunspots, solar cycles, etc, at the website of the Royal Greenwich Observatory whose URL is: <http://science.msfc.nasa.gov/ssl/pad/solar/greenwch.htm>

The website contains fascinating information as well as numerous photos and diagrams of the Sun, the corona, the solar wind, prominences, sunspots, coronal holes, solar flares, the Maunder Minimum, and all kinds of other goodies.

Other excellent websites are the Space Environment Center at [www.sec.noaa.gov/](http://www.sec.noaa.gov/) and the Big Bear Solar Observatory operated by the New Jersey Institute of Technology. At the latter's URL [www.bbo.njit.edu/](http://www.bbo.njit.edu/) you can see daily full-disk solar images in white light.

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# Calendar of Events

## Our next meeting...

Tuesday May 16, 2000  
8:00 p.m.  
at  
St. Stephen's Church  
Howard Road, 1.4 kms. south of  
Hwy # 3

## Main Speaker...

Steve Pellarin

## Topic...

## Activities...

**Earth Day** - Sunday, April 16, at Ojibway Park.

**Lyrid Meteors Peak** - Friday, April 21 - Saturday, April 22.

**May Day Observing** - Saturday, May 6, at Dan Taylor's house.

**Windsor Centre Picnic** - Saturday, June 3, at Tim Bennett's house.

**Council Meeting** - Tuesday, June 6, at Steve Pellarin's house. The meeting will begin at 7:25 p.

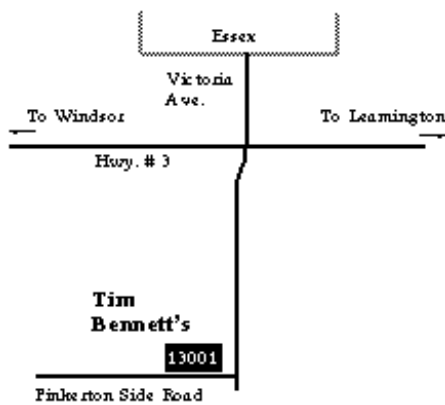
## Observing Nights

**Frank Shepley's**.....Last Quarter Moon

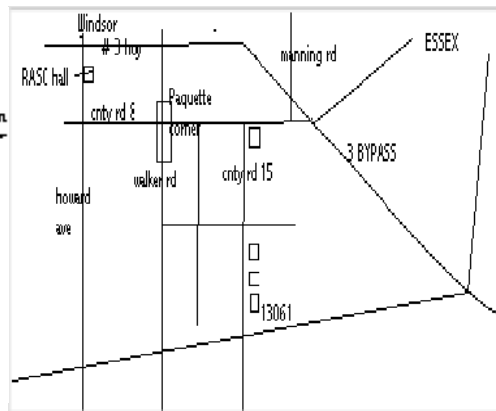
**Dan Taylor's**.....New Moon

(please call before showing up)

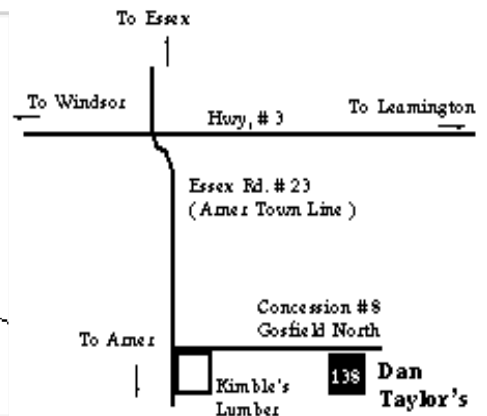
## Maps



Tim's House (776-8901)



Ken's House (984-4975)



Dan's House (776-4493)

## Submissions

Aurora is published monthly except for August. The September, November, January, March, May and July issues are full newsletters (usually 6 pages) with a number of member submitted articles. The October, December, February, April and June issues are short flyers (2 pages) with one short article. 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. I will accept Emails at the address below, floppy disks, or written submissions.

Editor: Steve Mastellotto

Email: mastels@towers.com

## Membership

The Windsor Centre of The Royal Astronomical Society of Canada meets on the 3rd Tuesday of every month (except July and August) at St. Stephan's church. 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, a subscription to SkyNews magazine and access to the Centre's library and telescopes.

Membership is \$36.00 - 1 year, \$72.00 - 2 years and \$108.00 - 3 years. Life memberships are also available.

Contact Frank Shepley at (519) 839-5934 or visit our website at:

# Joseph von Fraunhofer

by Chris Plicht

*The following biography is part of a series of biographies of interesting historical figures with a connection to astronomy. The series is written by Chris Plicht (Compuserve ID 100277,1136) and can be found on Compuserve's Astronomy Forum.*

Joseph Fraunhofer was born on March 6, 1787 in Straubing as the eleventh and last child of Franz Xaver Fraunhofer, a glazier. Seven of his brothers and sisters died early, as did his mother, aged 54, when Joseph was 10. One year later his father died, aged 56. Joseph was not sent to school regularly but had to help his father in the workshop. They were different times then, everyone had to help in the family; there was just no time and money to send the children to school. The Bavarian state had improved much on the educational system, but only in 1802 public schools with compulsory participation were introduced.

Franz Xaver Fraunhofer, Joseph's father, was neither poor nor rich, when he died. He owned a house, located very conveniently in the center of the town. This 5 storey building, slightly changed over the years, still exists.

Joseph started an apprenticeship with a wood turner, but changed to a glazier soon since he was not strong enough for the hard work. He began his work on August 23, 1799 in the workshop of Weichselberger in Munich. There, in the capital of Bavaria, which was 50 times bigger than Joseph's home town, life was even harder. A sister, already living in Munich, cared for his clothes.

Weichselberger was a strict master. Beside teaching him the business of a glazier he ordered Joseph to do every day's housework, but that was usual those days. But worse was that Weichselberger forbade him to visit Sunday school and reading. Joseph Fraunhofer was eager to learn and tried to get books wherever he was.

The collapse of two houses on July 21, 1801 changed Fraunhofer's life forever. One of these houses was rented by Weichselberger: in the ruins died the master's wife, but Joseph was found almost unhurt when he was rescued after 4 hours. On the scene of the disaster were two persons who would change the future of his life: Maximilian Joseph, later to be King Max I., and Joseph Utzschneider, a politician and entrepreneur. Just some weeks before this event Utzschneider had left his political posts to concentrate on his business: making fine instruments and optics.

It was through this event that Fraunhofer became known not only in the neighborhood, but also at other places. His master Weichselberger could no longer forbade him the visit to Sunday school, so he went there for four years. Maximilian Joseph presented him some money and assured him of his fatherly protection. Fraunhofer kept the extra money for a while and later bought a glass cutting machine and a grinding machine with it. Utzschneider seems to have supported Fraunhofer with books and

talks about optics and physics. The probability of earning better money with making spectacle lenses was well known to Fraunhofer.

Joseph Fraunhofer left the workshop of Weichselberger, who had moved to a different place in Munich (Kaufinger-Gasse), on April 30, 1804. The certificate of apprenticeship gives October 1804 as the last month of Fraunhofer working there, but Fraunhofer redeemed himself from the 6 years contract. He went to work with Joseph Niggel, who had learned how to grind lenses in the convent at Rott. To earn some money Fraunhofer started to draw, engrave and print business cards. Unfortunately he did not earn enough to keep on with his studies, he returned to his former master Weichselberger as journeyman.

Utzschneider, who had met Fraunhofer first in the damaged house, sent him to meet a Benedictine monk named Ulrich Schiegg. This monk examined Fraunhofer for some days and recommended him to Utzschneider and Reichenbach. Fraunhofer left the glaziers workshop finally on May 19, 1806.

Georg Reichenbach and Joseph Utzschneider had founded a workshop in Munich in 1802 to produce geodetic instruments; good maps were rare these days and the State as well as the Army needed them. Reichenbach studied at the military academy in Mannheim, was sent to England to learn about James Watt's steam engines, and returned to Mannheim in 1793. During his time in England he also learned about optical instruments from Ramsden, Dollond and others. Around 1800, while being with the Bavarian army in a camp at Cham, he thought about and developed a dividing machine to engrave circles with the highest precision. Later the astronomer

Bessel found an average error of only 0.325 arc seconds on the instruments made by Reichenbach.

Reichenbach had some instruments on his shelves, almost ready to be sold. The only thing missing were the optics. It was Fraunhofer's first task to grind and polish these when he joined the workshop. His assets were his craftsmanship, some books, probably some English telescopes and instruments made by Georg Friedrich Brandner (1713-1783) in Augsburg. The instruments with the first Fraunhofer optics went to the observatory at Ofen, near Budapest in Hungaria. Fraunhofer started to analyze every step in the making of a lens and introduced new techniques in grinding them. He developed a polishing machine that made the process more independent from the workers craftsmanship. Another area of work was the composition of the polishing material and the cement that was used to put the lenses together. And Fraunhofer introduced an absolutely plane sheet of glass as a test device to check for the



(Continued on page 4)

# Joseph von Fraunhofer

*(Continued from page 3)*

shape and concentricity of the polished lens surface. With these new materials and methods Fraunhofer reached a much better surface quality within the first years.

The next change came at the end of 1807 when Utzschneider moved the whole business to Benediktbeuern where he had founded a glass melting workshop. This small glass factory should supply the raw material for the optics, glass of a higher quality than could be purchased on the market. During his calculations and tests for perfect optics Fraunhofer had found the glass to be a major variable in the process. It was there that Fraunhofer met the Swiss Pierre Louis Guinand.

Utzschneider had met Guinand in Neuchatel, Switzerland, during his travels, searching for sources of streak-free glass. In 1806 they agreed on a contract that brought Guinand to Benediktbeuern for 500 Guilders a year. His task was to make high quality crown and flint glass and he introduced a stirrer to the process. The quality of the glass was acceptable for lenses, but it still varied from batch to batch.

In 1809 Utzschneider ordered Guinand to introduce Fraunhofer to the secrets of glass melting. He used the same scientific means as in figuring his lenses and changed the volume of the melting pots, searched for better raw materials like quartz, lime and potassium carbonate. He even developed new glass sorts, suited to make bigger and better optics. From 1809 on Fraunhofer had responsibilities like an entrepreneur: he was made a companion of the firm and got one third of the profit, less 400 Guilders for company expenses, plus a 480 Guilders salary. In the same year Fraunhofer presented a production plan that required one instrument per day leaving the factory. Beside the small telescopes the company made microscopes, opera glasses, loupes and finally the big astronomical telescopes and heliometer.

Guinand left Benediktbeuern in 1814 and went back to Switzerland. It was Fraunhofer who had now the full responsibility for glass melting and calculating the lenses. It was the same year when Reichenbach left the firm and Utzschneider made Fraunhofer his partner. His salary had grown to 1500 Guilders, free lodging and heating in winter. A list describing 37 instruments and including prices offers a heliometer at 1430 Guilders, some 'comet seekers', astronomical telescopes, terrestrial telescopes, loupes and prisms. A microscope with six objectives and two eyepieces is listed at 520 Guilders, smaller microscopes and a traveling microscope are mentioned. The biggest instruments are the astronomical refractors, starting at 18 centimeter (6.5 inch) diameter. The price is given as "... to be negotiated." These telescopes required a lot of know-how and engineering, like streak-free glass and a springloaded lens mounting that kept the objective parts axially and radially in the designed position.

The 'depth' of the production was immense. Almost everything was made by the Utzschneider and Fraunhofer company. Brass and forgings were purchased, all other parts were made by employees in the workshop or at their homes. Nuts and bolts, clockworks, tripods, precision shafts, everything was made. The wooden tubes for the telescope were made by the carpenter Riesch. He used a big drill to make the holes in wooden shafts and glued the bigger tubes together from many thin sheets. Fraunhofer calculated, designed and tested every instrument, wrote the manuals and watched the disassembling and packaging process for the bigger telescopes.

In 1817 Utzschneider faced financial troubles. He had invested a lot of money in a weaving mill that could not sell enough of the fabrics to get his investments back. The additional break down of a bank forced Utzschneider to sell the former convent buildings in Benediktbeuern back to the state. The glass works, the carpenter and some minor workshops stayed there, the main part was transferred to Munich. This relocation delayed the completion of a major telescope: the big refractor for the Russian observatory in Dorpat.

The objective lens for this telescope was finished in 1819, the complete instrument was shipped in 22 crates in 1824 and arrived in Dorpat on November 10 that year. Based on Fraunhofer's description of the instrument, its individual parts, the probable errors that could be made during assembly and the handling of the complete instrument it was erected without any problems. Fraunhofer stayed in Munich. The complete instrument saw 'First Light' in the early hours of November 16. It was first located in a room that allowed a view of about 10 degrees on both sides of the meridian, it was moved to a domed tower 6 months later. With the telescope came four eyepieces for magnifications between 175 and 700 times, plus four micrometers of different kinds. Within the following three years the astronomer Struve observed and measured the distances of over 3000 double stars.

It was around 1813 when the glass works and the optics workshop still did fine, that Fraunhofer researched the different sorts of glass. He re-discovered the dark lines in the spectra. These lines had been seen before by Wollaston, but he did not pay them the same interest as Fraunhofer. 574 lines were described by him, to the stronger he assigned the letters A to Z, which are still used today. The drawing of the spectrum, which still exists, and the printing plate engraved by himself are masterpieces in their own right.

After this basic work he used his instruments on the light of electric sparks, different light sources and stars. Fraunhofer wrote down his findings and presented them to the Bavarian Academy of Sciences on April 12, 1817 which published it in the same year. Other works on the theory of light were published in the following years.

The 'Civil Order of the Bavarian Crown' elected Joseph Fraunhofer as a member and he was knighted on August 15, 1824. During the years in Munich Fraunhofer taught at the University of Bavaria. One of his pupils was Friedrich August Pauli, who also worked at the glassworks for six months. Fraunhofer offered his company to the Bavarian King in a letter dated April 24, 1826, mentioning Pauli as his only possible successor as a leader of the company.

Joseph von Fraunhofer died on June 7, 1826 and was buried three days later at the S<sub>ü</sub>dfriedhof (southern cemetery) in Munich next to Reichenbach. The Munich firm kept on building telescopes and other instruments according to Fraunhofer's plans, Utzschneider himself attended the glass melting pots until 1832.

In 1839 he sold the firm to Merz, who had already hired Mahler. They now renamed the company "G. Merz & Mahler".

Georg Merz died on January 12, 1867 and left the business to his sons, Sigmund and Ludwig Merz. Sigmund Merz turned over the business to his nephews Jakob and Matthias Merz in 1883.

# Aurora of April 6, 2000 Report from Sky&Telescope Website

Many skywatchers who went outside to view the Moon, Mars, Jupiter, and Saturn grouped together on April 6th were treated to a bonus spectacle -- a surprise auroral display. According to reports sent to

Sky&Telescope and also collected at the Auroral Activity Observation Network, the dramatic red display was visible across Europe and seen as far south as New Mexico and Florida. The shock wave of solar wind hit the Earth at about 12:40 p.m. Eastern Daylight Time (16:40 Universal Time) and the visible display lasted until about 10:30 p.m. EDT.

Auroras most often glow green, the color emitted by oxygen atoms high in the upper atmosphere after they are struck by bombarding electrons from Earth's magnetosphere. Red displays are rarer, sometimes involving energized nitrogen molecules lower down in the atmosphere -- an

indication of a more potent geomagnetic storm. Auroras that extend away from the poles and closer to the equator, as occurred on April 6th, also reflect strong storm conditions.



Above: Sky & Telescope Contributing Photographer Johnny Horne captured this view of the April 6th aurora from northeast of Fayetteville, North Carolina, at about 9:30 p.m. Eastern Daylight Time (1:30 Universal Time April 7th). The 10-second exposure was on Fujicolor SG-800 film using an f/2.8 fisheye lens.

According to Cary Oler of Solar Terrestrial Dispatch, "Although there will probably be some residual substorm activity over the higher latitudes during the next 24 hours, there will not be a recurrence of the auroral storming for most middle-latitude locations."

You can learn about what causes auroras, what to look for, and how to photograph them, as well as the threats geomagnetic storms have on Earthly activities in a series of articles in

the March issue of Sky & Telescope.

## UNIVERSAL SCIENCE



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# March Meeting Minutes

## GENERAL MEETING MINUTES

March 21, 2000

President Susan Sawyer-Beaulieu called the meeting to order at 8:00 p.m.

President asked the membership to review the February 15, 2000 general meeting minutes.

**MOTION #1 3-21-2000** Ralph Humphreys put forth a motion to accept the minutes of the February 15, 2000 general meeting as printed in the flyer. Motion was seconded by Judie Goblirsch. Carried.

## REPORTS

*Secretary* - Joady Ulrich had nothing to report.

*National Council* - Tim Bennett mentioned that National Council decided as of September 1, 2000 membership fees will increase to \$40 regular, \$25 youth and \$800 lifetime. The new Handbook editor will be Rajiv Gupta. The Saskatoon centre has purchased a 16" telescope for its observatory with a \$3000 grant from the RASC Special Funds account. The General Assembly will be held in Winnipeg from June 30 to July 2, 2000. Tim has reservation forms available for the G.A. National will take a survey to determine whether we will continue to receive Skynews with the Journal.

*Treasurer* - Frank Shepley stated he has membership cards available. He has two calendars left at \$10 dollars each. Frank mentioned that due to the fee increase in September that by renewing now for three years members could save 4 dollars per year. For members receiving a notice for renewal and having already paid this year's membership fee should disregard any future notices.

*Librarian* - Tom Sharron mentioned that there is no deposit fee for use of library magazines and books. There will be a \$30 dollar deposit for use of telescopes, slides and projector. Tom is still in the process of organizing the library's assets. The club has purchased a new CCD camera which will be loaned out with a donated computer.

*Public Education* - Randy Groundwater will be giving a lecture for 15 students at St. Joseph's School in Comber.

*Editor* - Steve Mastellotto was absent.

## MEETINGS

Messier Marathon - Saturday, April 1st at Frank Shepley's residence.

Earth Day - Sunday, April 16th at Ojibway Park.

May Day Observing - Saturday, May 6th at Dan Taylor's residence.

Windsor Centre Picnic - Saturday, June 3rd at Tim Bennett's residence.

Council Meeting - Tuesday, June 6th at Steve Pellarin's residence.

John McDermott handed out a Handbook quiz which members can fill out for the April general meeting.

Frank Shepley stated that new members will receive from National a \$5 dollar coupon towards any RASC promotional items. Items can be purchased at a discount through Frank.

Pierre Boulos mentioned he was working at Wayne State University at their planetarium and suggested that the club organizing a field trip to visit the site.

*Director of Observing* - Robin Smallwood recorded about a dozen members attending the Messier Marathon in February. A number of members talked about the Lunar Eclipse viewed in January. Robin mentioned that the planets will disappear from the night sky during May. He handed out a skymap of the Ursa Major area and pointed out the various items which can be observed within the constellation.

President asked new members and visitors to introduce themselves.

50/5- draw was won by Jamie Burgess. \$13.00

Joady Ulrich gave a slide presentation on the Milky Way.

President thanked Joady for his presentation.

Meeting was adjourned at 10:10 p.m.