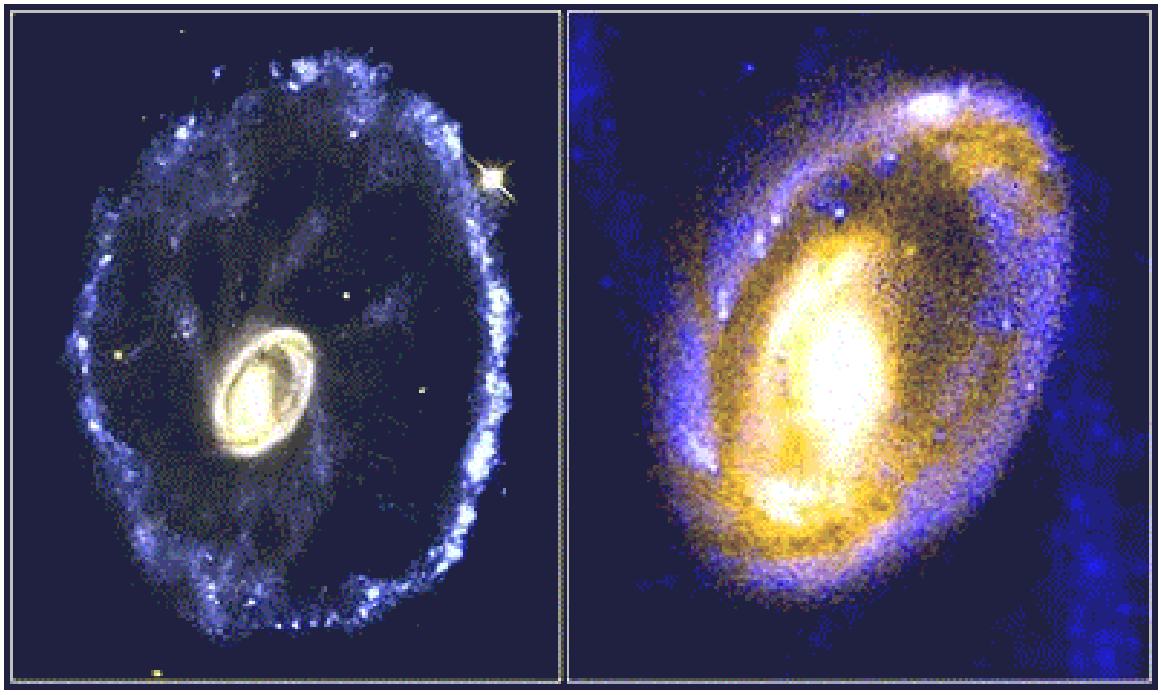
Regulus

Newsletter of the RASC Kingston Centre Issue 97-01
January/February 1997



November 26, 1996 Photo No.: STScI-PRC96-36a

Researchers analyzing the Hubble Space Telescope's dramatic pictures of the Cartwheel galaxy have discovered immense comet-like clouds of gas speeding through the heart of the galaxy at nearly 700,000 mph.

Located 500 million light-years away in the constellation Sculptor, the galaxy looks like a wagon wheel. The galaxy's nucleus is the bright object in the center of the image; the spoke-like structures are wisps of material connecting the nucleus to the outer ring of young stars. The galaxy's unusual configuration was created by a nearly head-on collision with a smaller galaxy about 200 million years ago.

This close-up image of the galaxy's nucleus reveals the comet-like knots of gas. These knots are mostly confined to the core's left side and appear as white streaks inside the blue ring. The "heads" are a few hundred light-years across; the tails are more than 1,000 light-years long, the longest of which is nearly 5,000 light-years. The structures look like comets because they probably were spawned by a collision between high-speed and slower-moving material. This collision created an arrowhead-shaped pattern called a bow shock, which is similar to the wake of a boat speeding across a lake.

Credits: Curt Struck and Philip Appleton (Iowa State University), Kirk Borne (Hughes STX Corporation), and Ray Lucas (Space Telescope Science Institute), and NASA

The Centre

The Newsletter of the Kingston Centre of the Royal Astronomical Society of Canada

Newsletter Submission Info:
Deadline is the Friday before regular meetings in odd numbered months. The preferred method is EMAIL, then disk, lastly paper (I hate retyping... too many mistakes happen). email: ***kell@cliff.path.queensu.ca***
Fax: 1-613-545-2907 (with cover page to Kevin Kell)
Post: Box 2033 Kingston Ontario K7L5J8 Canada
ascii or most major word processors (WP6.1 for windows preferred) via email or 3.5" DOS floppy disk

Our Web page can be found at:
http:/www1.kingston.net/~rasc

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Upcoming Meetings

Friday 1997 January 10 Walter Smith, RASC Kingston Centre, "Manifest Destiny or Stellar Superstition? -- the Origins of Astrology"
Friday 1997 February 14 Dr. Vic Hughes "My Love of Radio Astronomy" (Valentine's Day, eh?). Dr. Vic Hughes, of Queen's Physics Dept., has had a long and illustrious career in radio astronomy. In addition to being one of Canada's pioneers in the field, he has also worked at Jodrell Bank in England, where he was a featured speaker at their recent 50th anniversary celebration/symposium. For our Valentine's Day meeting, Dr. Hughes will speak about his love affair with radio astronomy as well as his investigations of radar evidence of UFOs.
Friday 1997 March 14 Steve Manders, RASC Kingston Centre, "Convection Currents in the Sun"
Friday 1997 April 11 Dr. Jayanne English of Queen's Physics Dept., is a postdoctoral fellow in astronomy. Her talk will be on "Visualization in Astronomy"--the many different tools and techniques that astronomers now have for visualizing astronomical concepts.
Friday 1997 May 09 Cathy Hall & Walter McDonald & Doug Clapp, RASC Kingston & Ottawa Centres, "Star Hill Inn Expedition"
Friday 1997 June 13 GA Prep Meeting
1997 June 28 - July 01 General Assembly
Friday 1997 July 11 Post GA Stress Blowout; Kevin Kell, RASC Kingston Centre, "Reports from Mars"
Friday 1997 August 08 TBA
Friday 1997 September 12 Member's Night
Friday 1997 October 10 Annual Elections
Friday 1997 Nov 14 TBA
Friday 1997 December 12 Annual Holiday Dinner & Awards

Regular Meetings of the Kingston Centre are held on the 2nd Friday of each month (unless noted otherwise) at 20:00 local time in **Room B-201, Mackintosh-Corry Hall** at Queen's University (parking available off Union Street at Frontenac).

Regulus is published 6 times per year. Views and opinions expressed herein do not necessarily reflect the official position of the Royal Astronomical Society of Canada or its officers and members.
Subscriptions: Members of the Kingston Centre receive Regulus as a benefit of membership. Non-members may subscribe for $15 per year.
Advertisements are free to members of the Centre. Commercial advertising is $25 per half page, $50 for full page and must be camera ready copy.
Contributions are more than welcome. Submitted material may be edited for brevity or clarity.

From The Editor

This issue was to start off with a new layout but boy, getting out of the Christmas humdrums sometimes takes far longer than it should! Then a file corruption just before the file print run and ugg another 2 hours retyping material and laying it out again. Again this issue we will be mailing to all past and present Center members as we still do not have a comprehensive list from UTP!

From The Prez

Nothing this issue... maybe next!

From The Secretary

Hmmm.. Nothing this issue either.

From The Treasurer

We have received our first bit of information from UTP and it has a lot of problems (late, missing info, etc).

Last Meeting Minutes

We had a draw for a couple of Christmas Items and the winner of the first gift was Susan Gagnon, the winner of the second was Susan Gagnon... Hmmm :) Steve Manders gave his presentation on:
The winner of the Centre's annual service award went to... me (Kevin - Newsletter guy).

National News

The Handbooks have arrived! The Handbooks have arrived! And in some instances, twice! Also the last issue of the old Journal/Bulletin arrived right around Christmas. And again some people got two. This phenomenon is a Canada wide event, but not everyone is part of it.

General Assembly News

None at the moment. Final prices from Quene's Convention services have not been passed onto us yet, but the scheduling as been locked down fairly tight.

Software News

A new version of Traksat, a satellite tracking prediction & display program has been released but is unreviewed as of this moment.

The shareware software mentioned above is also located at the following Kingston BBS's
✶Observatory East (Mark Kaye) FidoNet 1:249/109
2400-28800 bps 8N1V.34
✶ StarStream (Kevin Kell) FidoNet 1:249/112
14400-28800 bps 8N1V.34
✶ Moonlight Cascade (Kim Hay) FidoNet 1:249/133
2400-28800 bps 8N1V.FC

Internet Tidbits

There are *so* many neat and interesting sites... This is my attempt to point out some of the interesting ones I have stumbled across on the topic of amateur telescope making:
http://www.tiac.net/users/atm
http://www.halcyon.com/rupe/atmj/
http://www.efn.org/~mbarterls/
http://webspace.com/markv/telescopes.html

Submissions from the Members

Observing Astronomers by Laura Gagne

This spring and summer in eastern Ontario has been pathetic for astronomers. It seems that when we finally get a clear day, the clouds roll in from nowhere just as the sun sets. We have nothing to observe but clouds! The July meeting of the Kingston Centre emphasized this point as several members gave reports on observing clouds. I think of myself as a people watcher, since this is a way to pass time between clear nights. Lately I have turned to those near and dear to my heart - the astronomers. I have divided the bunch, those I know and those I have only read about in books, into a few categories. If you find this hobby interesting, perhaps you can think of a few I may have missed. Any resemblance to persons living or dead is purely

coincidental (of course, it's only based on observations, and what I didn't observe, I made up). Without further ado, I present to you "Observing Astronomers, a Beginner's Guide".

Type 1. The Variable Astronomer
This type becomes very avid for short periods of time, then tends to disappear into obscurity for a long time. They seem to follow a pattern that can be predicted by the events unfolding in the night sky. Comets may pique their curiousness and make them brighten considerably until the comet has faded. Their names may appear on centre registers, but hardly anyone can recognize them.

Type 2. The Meteor Astronomer
These folks "discover" astronomy and blaze right into the hobby full steam ahead. They rush out and buy equipment most of us only dream about, subscribe to every magazine they can find, and join a local astronomy club. They flash brilliantly out into their suburban backyard to test out the new telescope only to be disappointed that it doesn't deliver Hubble-quality images. As soon as they find out that observing is an art that can take years of work to perfect, they disappear from the scene never to be heard from again. The beautiful equipment which they now refer to as junk usually ends up languishing in storage somewhere. If you are able to find one of these guys, you might be able to get yourself some really nice stuff at a great price!

Type 3. The Pulsar Astronomer
These people love to say things like "I am a Member of the ROYAL ASTRONOMICAL SOCIETY OF CANADA". [Ed: eh?] They don't attend meetings, never read the Journal, and purchase books by famous scientists just to own them, but not to read. They try to attract attention to themselves by seeking out prestigious organizations to join and try to impress people by naming famous people who are associated with those organizations. You will probably never directly observe this type as their beacons only point towards the famous scientists in our midst (of course if you are one of these famous people you will be amazed at how many you can detect).

Type 4. The Supernova Astronomer
This type of astronomer starts out as a typical main-sequence astronomer who belongs to one of the centres somewhere out there. The centre may recognize their brilliance, but they usually go unnoticed by the rest of the country. Through persistent effort and unbelievable dedication, they rise up to make a major name for themselves. Some of them even become legendary heroes for other aspiring astronomers. Even when they end their lives, their light lives on in the many people whose lives they have enriched.

Type 5. The Dark Companion Astronomer
These are the people who do all the work behind the scenes but never bask in the glory. They form the backbone of the society and it is their tireless work that makes everything happen. They are very difficult to find, since the only thing you may observe is the effect they have on the society as a whole. If you are fortunate enough to observe one, then be sure to thank them and let them know how much you appreciate their contribution.

Type 6. The Deep Sky Astronomer
These folks live far away fro many active centres, some even outside of Canada, but they are still important to the society. Their support and contributions to astronomy shine brilliantly even from a distance. Try to locate some on your vacation, at a star party, or at the next GA (that will be at Kingston Centre don't forget!).They are challenging but worth discovering!

Type 7. The Accretion Astronomer
This type of astronomer can usually be found on city sidewalks, in public parks, or giving public lectures about astronomy. Some of them even write wonderful popular books so that everyone can learn about the night sky, regardless of their level of education. Their goal is to seek out new enthusiasts and interested people, to allow the public to explore strange new worlds and deep sky wonders, and to boldly lead people where they have never gone before. These are the people who cause our numbers to grow. Since they usually shine at magnitude -5 or brighter, they are easy to spot and great fun to observe. There people also have a tendency to enrich the lives of all with whom they come in contact.

Type 8. The Main Sequence Astronomer
This category encompasses the vast majority of the membership. People in this group join as novices and grow steadily as they acquire new skills and knowledge of the wonderful universe in which we live. They are steady and reliable and without them the society wouldn't be much of a society.

There are the main types of astronomers that make up the RASC. When viewed as a group, they form a breathtaking and awe-inspiring impression not unlike the milky way on a clear, dark night. I am very proud and honoured to be part of such an exceptional group of people. Have fun observing astronomers , and call me if the sky clears!
Clear Skies

DYNAMIC DOUBLE STAR SYSTEMS
By Ray Berg

Variable star observers often encounter double stars when making their rounds, but casual observers who seek only double stars may overlook magnitude variations, particularly subtle changes, in the objects they encounter. A notable exception, and a favorite of mine each winter, is the renowned multiple system of Theta Orionis, or the Trapezium, in the Great Nebula of M42. The northernmost (BM Orionis) and the westernmost (V1016 Orionis) components are eclipsing binary variables, and I find that the appearance of the Trapezium is changed significantly when either of them is at minimum light. BM Orionis varies between magnitude 7.9 and 8.7 over a period of 6.7 days. The portion of the deepest eclipse lasts about 9 hours. V1016 Orionis has a slightly larger magnitude range of 6.7 to 7.7, with a considerably longer period of 65.4 days. The eclipse portion for this binary lasts approximately 20 hours, including 2.5 hours at minimum light.

The popular long period Mira-type variable star S Orionis varies in 414 days over the wide range of magnitude 7.2 to 14.0 and is also a true double star. Depending on the brightness of S Orionis at any given time, it's nearby 11th magnitude companion is at times easy to identify, at others more difficult and occasionally is the only component visable in my 8-inch telescope and moderately light polluted skies in Crown Point, Indiana. This was the case this past November when the primary was at minimum light, below magnitude 13.0.

Quite the opposite is true of another of my favorites which I have been following this summer and autumn. Struve 370 is located in Aquila at R.A. 19h14.7m and Dec. +09.25 degrees (1950). Here the primary is constant at magnitude 8.5 and has an Algol-type eclipsing binary for a secondary which "blinks" in and out of the range of my 8-inch scope (depending on sky conditions) over a magnitude range of 9.5 to 12.9 during a short 3.4 day period.

There are a number of other known double stars with variable conponents and some of them are described in the Webb Society Deep-Sky Observer's Handbook, Volume 8 Variable Stars, which also lists further references on the subject. I find following these varying systems particularly fascinating and covertly hope to discover previously unreported brightness variations for myself in other double star systems that I study. At any rate, the dynamic aspect of certain double stars has provided an additional dimension to my observing.

Comet Watch

Comets Currently Visible from
http://encke.jpl.nasa.gov/whats_visible.html
Last Updated: 1997 January 03

Long-Period Comets C/1995 O1 (Hale-Bopp)

Short-Period Comets 46P/Wirtanen, 81P/Wild 2, 118P/Shoemaker-Levy 4

C/1995 O1 (Hale-Bopp)
This possible super-star comet is visible in the early evening... it is headed for solar conjunction. It is currently m1~3.5 and is routinely being observed with the naked eye.

46P/Wirtanen
This comet is well-placed for observation in the evening sky. observers. The comet is currently about 13th magnitude. It should brighten by a couple of magnitudes as it approaches perihelion on March 14, 1997. It will slowly drift northward into May reaching +30 degrees in mid-May.

81P/Wild 2
This comet is well-placed for observation most of the night, with Northern Hemisphere observers somewhat favored. The comet is currently about magnitude 11.4 and it should brighten to m1~9.5 by the end of February 1997. The comet should remain near peak brightness and well-placed into May. Perihelion is on May 5, 1997.

118P/Shoemaker-Levy 4
This comet is well-placed for observation in the middle of the night. It is close to its peak brightness of 12th magnitude. It should remain visible into March 1997 as it moves slowly northward.

Space Calendar

The Space Calendar covers space-related for the coming months. This Calendar is compiled and maintained by Ron Baalke. Please send any updates or corrections to
baalke@kelvin.jpl.nasa.gov
You can find this on the web at:
http://newproducts.jpl.nasa.gov/ calendar

This Month in Space History -
January 1997
Jan 09 - Jupiter Passes 0.8 Degrees from Neptune
Jan 10 - Asteroid 1991 VK Near-Earth Flyby (0.0749 AU)
Jan 10 - Asteroid 892 Seeligeria Occults PPM 184042 (9.4 Magnitude Star)
Jan 11 - 210th Anniversary (1787), William Herschel's Discovery

of Uranus Moons Titania and Oberon
Jan 12 -[Dec 31] STS-81 Launch, Atlantis, 5th Shuttle-Mir Mission, SPACEHAB, SAREX-II, Kidsat
Jan 12 - Comet Shoemaker-Levy 4 Perihelion (2.02 AU)
Jan 12 - Mercury Passes 2.7 Degrees North of Venus
Jan 12-16 - 189th American Astronomical Society (AAS) Meeting, Toronto, Canada
Jan 20 - Comet Hale-Bopp Crosses the Orbit of Mars
Jan 21 - Asteroid 1994 PC1 Near-Earth Flyby (0.0651 AU)
Jan 23 -[Jan 05] Asteroid 249 Ilse Occults SAO 99272 (7.5 Magnitude Star)
Jan 24 - Asteroid 16 Psyche Occults 7.7 Magnitude Star
Jan 24 - Mercury At Its Greatest Western Elongation (24 Degrees)
Jan 25 - Asteroid 1989 UQ Near-Earth Flyby (0.2286 AU)
Jan 27 - Asteroid 168 Sibylla Occults PPM 156600 (7.8 Magnitude Star)
Jan 28 - Mars Occults 7.2 Magnitude Star
Jan 30 - Comet 1996 R2 (Lagerkvist) Perihelion (2.4783 AU)
Jan 31 - Possible Mercury Occultation of SAO 187956 (9.3 Magnitude Star)

February 1997
Feb 01 - Venus Passes 1 Degree South of Neptune
Feb 03 - Comet Russell 4 Perihelion (2.23 AU)
Feb 06 - Comet Holt-Olmstead Perihelion (2.15 AU)
Feb 06 - Venus Passes 0.3 Degrees South of Jupiter
Feb 07 - Mercury Passes 1.4 Degrees South of Neptune
Feb 07 - Venus Passes 0.2 Degrees South of Uranus
Feb 10 - Comet Shoemaker-Holt 2 Closest Approach to Earth (1.9245 AU)
Feb 12 - Mercury Passes 1 Degree South of Jupiter
Feb 13 - STS-82 Launch, Discovery, Hubble Space Telescope Servicing Mission #2
Feb 13 - Mercury Passes 0.9 Degrees South of Uranus
Feb 16 - Jupiter Passes 0.2 Degrees North of Uranus
Feb 23 - Asteroid 1991 CS Near-Earth Flyby (0.2229 AU)

March 1997
Mar 02 - Mercury Passes 0.8 Degrees from Venus
Mar 09 - Solar Eclipse, Visible from Russia, Arctic
Mar 09 - Comet Hale-Bopp Crosses Over Earth's Orbit
Mar 10 - Asteroid 1990VA Near-Earth Flyby (0.2069 AU)
Mar 14 - Comet Wirtanen Perihelion (1.065 AU)
Mar 15 - Mars Pathfinder Passes Mars Global Surveyor En Route to Mars

Buy, Sell & Trade

RASC Promotional Items For Sale:
Items in stock: (Prices and shipping costs)
☆ The 3rd edition of the Beginner's Observing Guide have arrived!
☆**The 1997 Vancouver Calendars have arrived. We have 25 to sell this year. They are gorgeous. Mostly colour, outstanding and lots of information. $10.00 each (+ $2.00 shipping).**
✯ RASC lapel pins (blue, white & silver)$4.00 each (+$1.00 shipping)
✯RASC stickers (blue with white overlay)$1.25 each (add $0.50 shipping per order)
✯Golf shirts (white,sm,med) lt blue (med) $20.00 each ($4.00 shipping)
✯Toques (Black with Yellow writing)$15.00 each ($2.00 shipping)
✯RASC Mugs (Thermal mugs-Blue/ white) $4.00 each (1.50 shipping)
✯RASC Keychains (Clear acrylic-Blue/ white) $2.00 each ($0.50 shipping)
All taxes included in prices. If at anytime you have questions or future ideas for RASC Promotions please contact me with the address below. Mailto: Mrs. Kim Hay, [xxx] Canada phone: 613-xxx-xxxx email: ***[xxx]***
Check out the Kingston Centre WWW Home Page for pictures of the items mentioned above! Please make Canadian cheques and Money Orders payable to : Royal Astronomical Society of Canada (RASC)

Wanted to Buy: Mr. Todd Norris is in the market for a used telescope. If you have one that you're looking to sell, please contact him at 613-xxx-xxxx

The Second Servicing Mission: Making Hubble Even Better

During the second servicing mission, planned for February 13th 1997, astronauts will install two new instruments. This servicing mission, like the first, will take more than three years of planning and preparation and incorporate lessons learned from the first servicing mission. After the 1997 mission, two more missions, in 1999 and 2002, are planned for keeping Hubble Space Telescope functioning efficiently and improving its vision even further.

Expanding Hubble's Universe: New Instruments for 1997

Hubble's current cameras are showing us remarkable views of the very distant galaxies, but the light from more distant galaxies is shifted to infrared wavelengths by the expanding universe. Hubble's new camera, NICMOS, will be able to observe infrared light revealing the earliest stages of galaxy evolution.

NICMOS: The Near Infrared Camera and Multi-Object Spectrometer (NICMOS) will allow astronomers to use Hubble's exquisite detail to open a new "window" of the electromagnetic spectrum. Many secrets about the birth of stars, solar systems, and galaxies are available in Infrared (IR) light, which can penetrate interstellar dust that blocks visible light. Because NICMOS' advanced detectors must be kept cool to work best, they are contained in a dewer (similar to a thermos bottle), chilled with solid nitrogen to -351

degrees Fahrenheit (70 degrees Kelvin).

STIS: The Space Telescope Imaging Spectrograph (STIS) spans ultraviolet, visible, and near-infrared wavelengths. A spectrograph divides light into its component colors. This provides a "fingerprint" of a celestial object, which gives information about its temperature, chemical composition, and motion, among many other characteristics. STIS is unique because it can sample some 500 points along an astronomical object simultaneously. This means that many regions in a planet's atmosphere or many stars within a galaxy can be recorded in one exposure, vastly improving Hubble's speed and efficiency. STIS observations will lead to a greater understanding of the origin and evolution of galaxies, black holes in the nuclei of active galaxies, and star formation. STIS combines state-of-the-art detector technology with the latest in software, electronic, optical, and mechanical designs.

Sunspots caused by Syzygies by Hein van Asperen, Brockville, November 1996

My son who knew that I follow the sunspots, offloaded a file from the Internet. The title of the file is: “Sunspot cycles, are they caused by Venus, Earth and Jupiter syzygies?” I have to admit that I had to look up what SYZYGY meant. Syzygy: a point of opposition or conjunction of a planet with the Sun.

The article was written by Jean-Pierre Desmoulins, a French engineer/amateur-astronomer. He claims that the syzygies of Jupiter, Earth and Venus occurred in 22 year cycles in phase with sunspot cycles for three centuries. The article included a file in executable form named: Syzygies.

I had never heard about it before and decided to see if I could confirm it with my own solar observations. During the period of early 1991 to today I have extensive and detailed information about the spots and the corresponding regions and rotations.

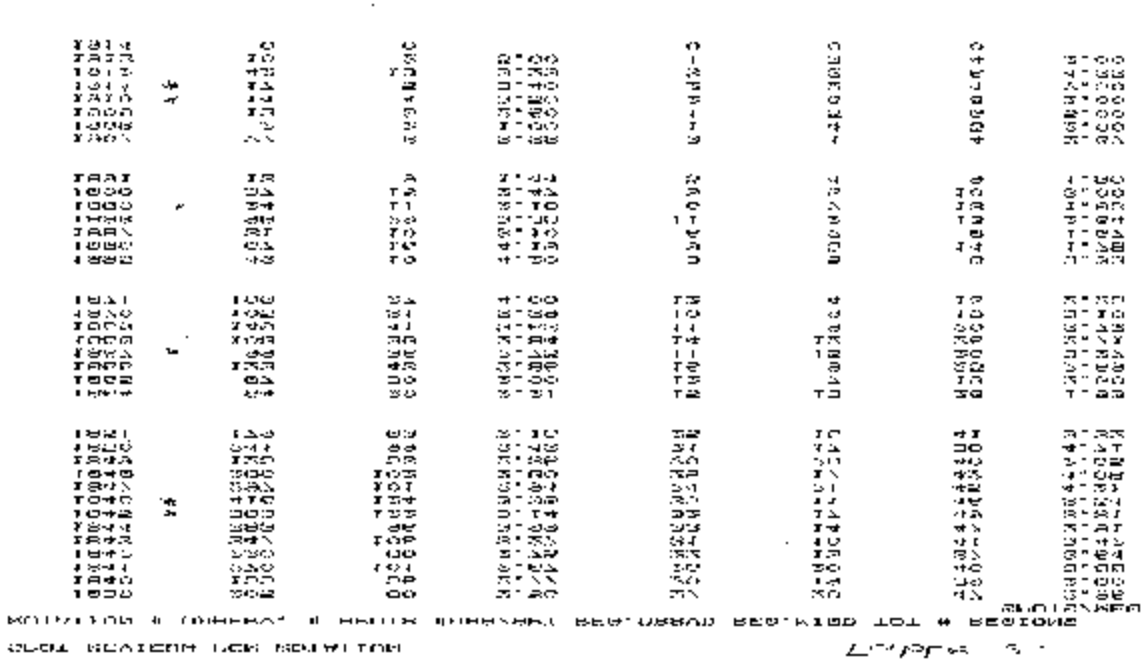
The information used for this study covers the second half of cycle 22. In that period I recorded 7806 observations (days with zero spots are not included), these observations resulted into 2639 spot coordinates (on average every spot was observer 2.96 times). The 2639 spots are spread over 870 regions. In the same period there were 626 regions I missed. The missed regions were mostly very small (0 and 10 “10-6 hemi”). The few regions with an area > 30 10-6 hemi were missed due to bad weather or away from home. This observing period covered the rotations 1839 to 1914. The observations are recorded on 76 sunspot maps. The map for rotation 1846 has 124 spots and the map for the last rotation did not have a single spot. To see how the spots were distributed over the solar surface, I recorded all spots on one map. Most spots occur within the latitude range of 20 degrees North to 20 degrees South; this was expected because it covers the latter half of the 11 year cycle.

The syzygy program calculates when a number of planets are in syzygy. The choice of planets is open. The author treats the influence of the planets as a tidal force, in other words the effect is inversely proportional with the cube of the sun-planet distance. Under these conditions we only have to deal with four planets: Mercury, Venus, Earth and Jupiter. Their relative effect (M/R^3) is: Mercury 0.94; Venus 2.17; Earth 1.00; Jupiter 2.26
For all other planets the M/R3 value equals 0.11 or less.
The program allows to specify with what time (days) interval the position of the planets is calculated and asks the maximum angular sector of syzygy and the syzygy modulo in degrees. With modulo of 360 degrees all planets are in conjunction (superior or inferior), with modulo of 180 degrees, some planets are on opposite sides of the sun. The final request is the names of the planets for which the syzygy is required.

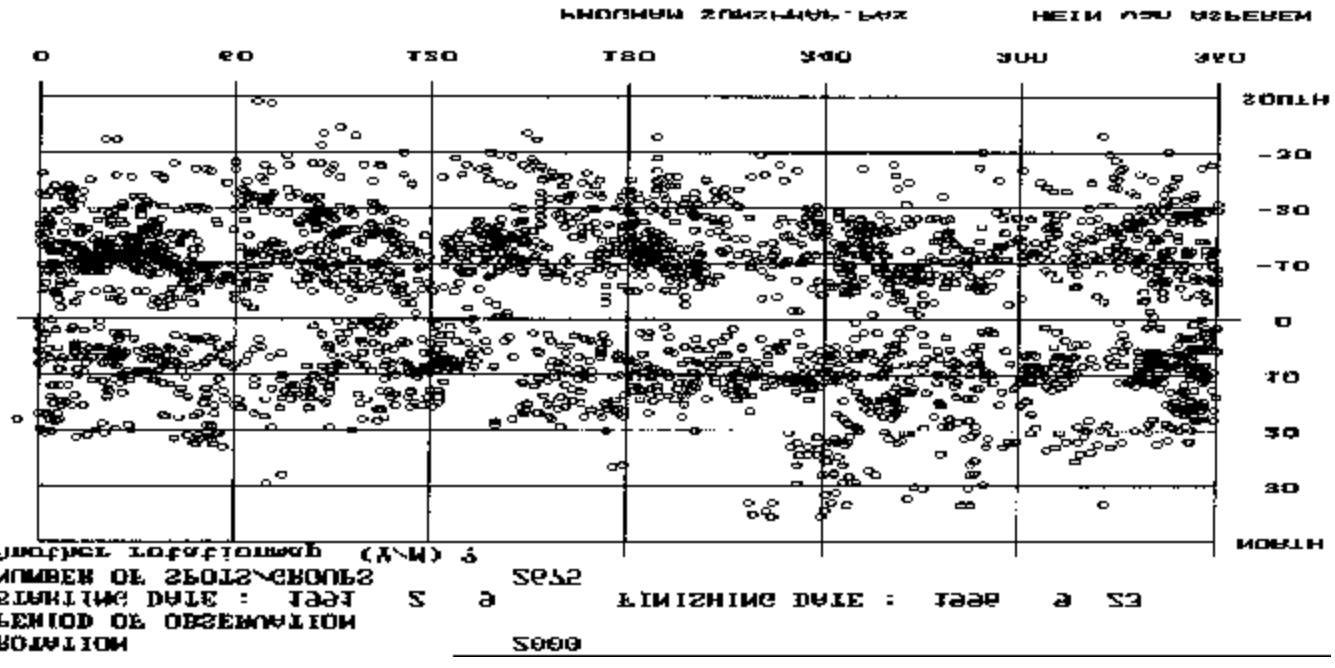
My first trial was for the four planets mentioned above. It shows that in 1991.638 the four planets are in syzygy (see table 1). The 0.638 fraction of the year corresponds with the 233rd day of the year, which was August 21st. In case you care to check the result of the program, the information correlates excellently with the information in the “Planetary Heliocentric Longitudes 1991" table listed on page 125 of the Observer’s Handbook 1991. August 21st is the last day in the 1845 Carrington rotation. If there is a syzygy effect my observations of the rotations 1845 and 1846 should show something. Table 2 displays a small section of the SPOT REVIEW PER ROTATION. I record as many individual spots (# spots) and cover as many days (# observations) as possible. Strong regions with many individuals spots show up easily. If there is a syzygy effect it may show up in the number of spots. As table 2 shows, the number of spots in the rotation 1845 and 1846 is higher than in the rotations before and after that time slot. This difference could be caused by the rapid movement of Mercury. That would mean that a syzygy for Venus-Earth and Jupiter should also result in an increase of spots.

A similar run for the planets Venus, Earth and Jupiter results in syzygies for the dates 1991.635 (obviously), 1993.248 (April 1 in the middle of rotation 1867), 1994.886 (November 11 one quarter in rotation 1889) and 1996.484 (June 25 at the end of rotation 1910). For the corresponding lines in SPOT REVIEW see table 2. It is obvious that rotations with a syzygy (*) are not the rotations with increased activity.

I must come to the conclusion that the syzygy effect is minor and only works perhaps only as an additional effect to whatever causes the 11 year cycle of the variation in sunspot



numbers.



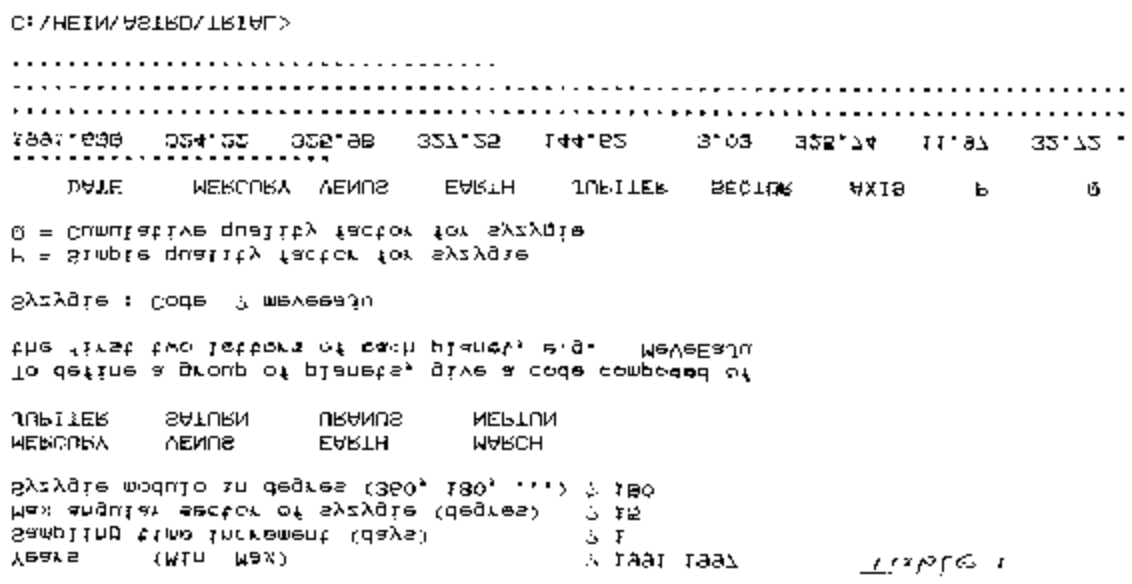


Table 1

Solar Winds by Steven Manders, December 1996

Solar winds are as close to nothing as you can get and still have something. Its density is measured in atoms per cubic centimeter, its velocity leaving the Sun is about 1,000 km/sec and the temperature reaches many hundreds of thousands of degrees.[1] At that high velocity it packs more energy per unit weight than an atomic bomb but the source of propulsion is still a mystery. The study of such hot ionized gases or plasma and its interaction with the magnetic field is called magnetohydrodnamics. The action is not that of a bar magnet and a piece of iron but more like a sail (magnetic field) in the wind.

Several spacecraft have shed a lot of light on the subject. SOHO which is parked in a stationary orbit around the sun a million kilometers from Earth and Ulysses which has orbited over the solar pols, have been our most powerful tools. [2]

Ulysses has confirmed that the solar magnetic field is bent backwards about 45 degrees near Earth due to the solar rotation and drag from the winds.3 This would cause torque on the field where it enters the Sun at the poles and thus will steal angular momentum from the solar core while transmitting it to the wind. This angular momentum transmitted to winds below orbital velocity above the equator would fall back on the equator causing it to rotate faster than the core. The extremely low density of the solar convection layer would require only about a tenth of an Earth mass to cause its rotation to be faster than the poles as is observed. Thus we have a means of transferring angular momentum from a slowly rotating core to a faster rotating equator contrary to common logic. Friction is of no consequence in the Sun. Magneto hydrodynamics is everything.

There are no accepted explanations of the source of the propulsion yet. The gravity there is intense, the density in the outer half of the Sun is very low, the surface at the poles where the strongest winds originate is not turbulent and the corona above the surface is coolest there. The magnetic field is vertical there and can only push plasma sideways. Everything can be eliminated, almost.

The winds can be seen rising in parallel columns at the poles during eclipses and high resolution photos of the polar areas reveal that about 50 or so areas of dense vertical jets.4 It does not rise in wide sheets or bursts. This narrows the answer to some cause of parallel jets of plasma.

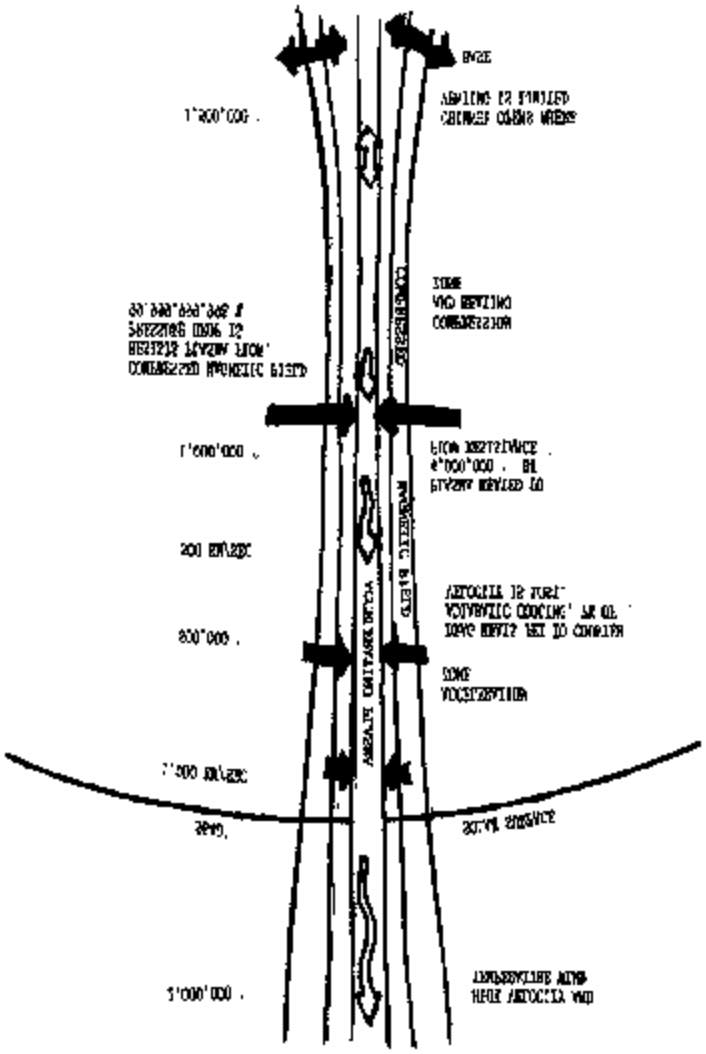
One possible answer is the torque from the extended rotating magnetic field would cause the field to bunch up where it enters the Sun due to irregularities from convection currents. This would in turn cause some plasma inside the bunched field to compress and vent out the top lowering the density inside the magnetic column heating it further and vent out the top in a chimney effect further compressing the field. This process has bene successfully modeled in

computer and it demonstrates that a pressure drop of 99.999 999 998% would result in temperature increased of several million degrees and venting velocities of 1,000 km/sec. Adiabatic cooling of the vented plasma would cause it to substantially cool as it rose and the final observed temperatures are reached by converting 7% of its potential velocity to heat due to drag just as the velocity reaches maximum below the surface. The depth of these chimneys is not certain but it can be quite variable. It occurs where the back pressure in the upper part of the chimney prevent rapid venting down deep allowing the magnetic field to open up which produces less heat in the plasma penetrating the magnetic walls. It seems to occur down to the bottom of the convection layer. There are no other viable explanations to date.

This process may also be the explanation for pulsars which are exceedingly dense collapsed stars with intense magnetic fields which rotate several times per second. They have a single intense jet on each side rather than multiple jets as the Sun and thus the star appears to blink as the beam passes out line of sight like a lighthouse beam.[5]

Radio galaxies appear to contain massive black holes with billions of solar masses and jets reaching tens of thousands of light years into space, emitting a hundred billion times the energy of the Sun.[6] Are the black holes venting themselves into space and thus loosing mass by this process or are they just accelerating accreting material?

Magnetic chimneys appear to be the answer to these problems which nothing else can explain and it can be modeled in a computer to duplicate observations giving it credibility.



SOURCE OF SOLAR WINDS

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