Saskatoon Skies

Volume 23, Number 6 | June, 1993

In This Issue:

****

Saskatoon Skies Information

Commercial vendors wishing to advertise in the "Saskatoon Skies" may do so at the following rates: $50.00 per page, $25.00 per half page and $12.50 for business card ads. Individual RASC members and other parties (at our discretion) may advertise items and events for free.

Next months deadline is Saturday, July 3, 1993. Please have any submissions in to me by then in order to be included in the next issue. Submissions may be in typewritten form or on a floppy diskette (3.5 or 5 inch size and formatted for MSDOS) preferably as ASCII files. Electronic submissions are preferred as it saves me some typing. Mail or bring your submissions to:

Gordon Sarty
422 Edmund Park,
Saskatoon, Sask.
S7H 0Z4
phone: 374-8803

OR

Saskatoon Centre RASC
Box 317, RPO, University
Saskatoon, Sask.
S7N 4J8

Saskatoon Skies is a monthly publication of the Saskatoon Centre of the Royal Astronomical Society of Canada.

Minutes of the April Executive Meeting

University Observatory
April 19, 1993

Attendees: Ed Kennedy, Jim Wood, Rick Huziak, Bill Hydomako

ITEM	DETAIL	ACTION
1.	Meeting called to order, 7:08 p.m.	R. Huziak
2.	Daryl Rybotycki resigned due to a move to Edmonton.	R. Huziak
3.	Upcoming Astronomy Day, May 1. We will need people to work.	R. Huziak
4.	Dr. Eric Valk will be speaking at the next meeting. Eric has worked at the Dominion Radio Astrophysics Observatory.	R. Huziak
5.	Partial Eclipse of the Sun on May 21; we will be organizing a public display.	R. Huziak
6.	Jim Wood to investigate if some materials in the Centre's library should go to the University Archives.	R. Huziak
7.	*Sky and Telescope* has sent us some sample material for use at Astronomy Day and offered to send us more.	R. Huziak
8.	*Astronomy* magazine offered the Centre brochures to set out at our meetings.	R. Huziak
	The intent is that the Centre will get $2.00 per subscription made via the brochures.	R. Huziak
9.	Kim Mysyk is interested in organizing a search team to look for meteorites in next two months.	R. Huziak
10.	We have received a thank you note from Mrs. Sarah McDonald in response to our letter.	R. Huziak
11.	Stan Shadick has asked us to remove our stuff from the dark room so that the area can be renovated.	R. Huziak
12.	Meeting adjourned 7:45 p.m.	R. Huziak

Minutes of the April General Meeting

Room B-111, Health Sciences Building, April 19, 1993

ITEM	DETAIL	ACTION
13.	Meeting called to order. 8:06 p.m.	R. Huziak
14.	Note supernova in M81.	R. Huziak
15.	Motion to adopt minutes.	M. Wesolowski
	Second.	J. Young
16.	Review of topics covered in the executive meeting.	R. Huziak
17.	The telescope committee will be looking at a new observing site for the 16" telescope. To investigate for next meeting.	R. Huziak
18.	Kim Mysyk gave a short discussion on a meteorite search.	R. Huziak
19.	Presentation tonight by Jim Young - Computerized Astronomy	J. Young

THE JUNE GENERAL MEETING OF THE SASKATOON CENTRE

Monday, June 21, 1993
8:00 p.m.
Health Sciences Building, Room B-111
University of Saskatchewan Campus

The Saskatoon Centre is pleased to announce the following programs for the June General Meeting.

1. Buying Your First Telescope

A video by well-known amateur astronomer, Charles Scovil. This is an excellent video giving advice for both new and advanced amateurs who would like to buy their first instrument. 40 minutes of good suggestions and helpful hints.

2. Concepts in Beginning Astronomy

A presentation in beginning astronomy by Sandy Ferguson.

3. Astronomy Day and Solar Eclipse Sun-Day

Results and a slide presentation by Sandy Ferguson and others on these recent Centre events.

This meeting will interest all members in it's diversity of topics. New members are especially invited to attend to learn the basics of amateur astronomy. The meeting is open to the general public. Note that this is the last general meeting until September. Watch the newsletter for upcoming summer Centre events. Rick Huziak

Minutes of the May Executive Meeting

University Observatory
May 17, 1993, 7:00 p.m.

Attendees: Mike Williams, Jim Young, Al Hartridge, Jim Wood, Gordon Sarty, Rick Huziak, Bill Hydomako

ITEM	DETAIL	ACTION
1.	Meeting brought to order by Rick Huziak. - Minutes from previous meeting not available. - Partial eclipse of the Sun: arrangements made to use parking lot at Mendel Art Gallery starting at 6:00 a.m. Sandy Ferguson is doing advertising. Rick would like to see an eclipse sign. Rick described the *Sky Facts* brochure regarding the partial solar eclipse; safe ways to view the sun accented. Legal aspect of the brochure discussed, disclaimer included with brochure. *Sky Facts* will be issued for every important astronomical event to help advertise.	
2.	Hand truck to move Eetook; will *not* take money from the telescope fund.	
3.	Light Pollution Committee. Gord Sarty has written letters to IDA etc. for comments on our plan. Had a good response from the IDA. Next step to write to city councillors, etc. [Many thanks to Al Hartridge for taking these 3 minutes, in Bill Hydomako's absence. We also thank Al for doing the minutes last October as well - Ed.]	
4.	Rystrom observatory – someone is building a new house to the east south east. We need to talk to these people about light pollution.	R. Huziak
5.	The dome at Rystrom's is peeling badly. We need to repair the dome. [Yes, the surface area of a sphere is $4\pi r^2$. - Ed.]	R. Huziak
6.	Motion to spend up to $250.00 for repair cost to Rystrom Observatory Carried by show of hands. No opposed.	Jim Young
7.	Report on site survey by Al Hartridge, Gordon Sarty and Bill Hydomako.	
8.	Jim Wood spoke to Patrick Hayes about where to archive the Saskatoon Centre historical material.	Jim Wood

Minutes of the May General Meeting

Room B-111, Health Sciences Building May 17, 1993

ITEM	DETAIL	ACTION
1.	Meeting called to order 8:08 p.m.	R. Huziak
2.	May 21; there is a partial solar eclipse. We will be setting up in the parking lot at the Mendel.	R. Huziak
3.	Short report on the new Dark Site Survey.	A. Hartridge
4.	Short report on Archives for Saskatoon Centre materials.	
5.	Introduction of Becky Miller. (+Short talk on the bar effect.)	Ed Kennedy
6.	Tonights presentation by Dr. Eric Valk on the Dominion Astronomical Observatory	
7.	Meeting adjourned, 9:20 p.m.	R. Huziak

WELCOME NEW MEMBERS

Since publishing the membership list last month, we have been delighted to welcome the following new members to the Saskatoon Centre.

Darryl Wright	1301 Park Ave.	Saskatoon, SK	S7H 2N7	(306) 221-6439
R. Morris Yelland	709 King Street	Saskatoon, SK	S7K 0N6	(306) 933-2808

UNIVERSITY OBSERVATORY HOURS FOR JUNE AND JULY

The U of S Observatory will be open to the public on Saturday evenings from 10:00 to 11:30 p.m. during June and July. Visitors will be able to view Jupiter, the Hercules star cluster, Alberio and other celestial objects. Observatory assistants will be present to answer questions about astronomy and to assist the public in viewing through the telescope. The observatory is located on campus, one block north of the corner of Wiggins Ave. and College Drive. For more information, call Stan Shadick at 966-6434.

EDITOR'S NOTES

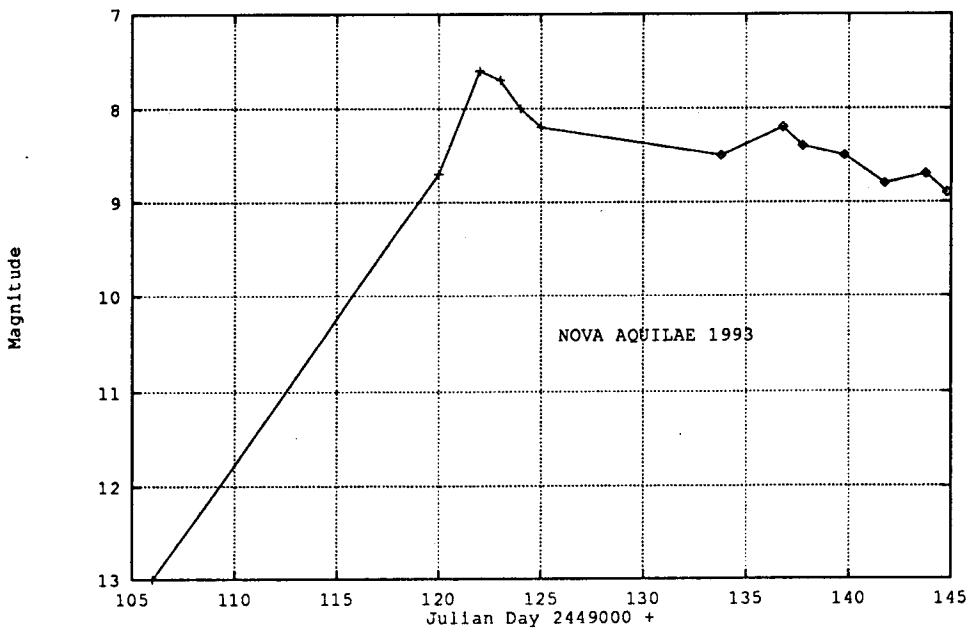
Well, I just finished my first shift as a U of S Observatory Assistant. The number of people who came to look through the telescope was astounding! So here's an idea; if you want to promote our club in a serious way, come out any Saturday night (with or without your telescope) to the Observatory, especially in the summer. The line ups at the big telescope are very long and there are alot of people tooling around looking at posters. If one or two of you were outside showing more telescopic views or just inside chatting, everyone would be more entertained. And people would learn about the RASC. Perhaps I'll get my wrists slapped for saying it, but there may even be an opportunity to meet someone of the opposite sex! Of course I'll inform Stan Shadick of this invitation but there's no reason to deny the public of more astronomy!

There are some interesting events happening in the sky this month. As those of you who read *Sky & Telescope* will know, Comet Shoemaker-Levy (1993e) suffered a wrenching near-miss as it passed extremely close to Jupiter last year, tearing it apart into a row of individual comets. More than 200 observations received in the last two months allowed Brian Marsden at the Smithsonian Astrophysical Observatory and Syuichi Nakano in Japan to calculate that there will be *another* close encounter with Jupiter around the end of July 1994! This one will be even more devastating than the last. Marsden estimates that more than half of the "nuclear train" could collide with Jupiter during a 3-day interval. On May 29, the "comet-ensemble" was about 4 degrees WSW of Jupiter, at right ascension 12h 6.0m, declination -1° 53′ (2000 coordinates). It is only magnitude 13.7, putting it beyond reach of most amateur telescopes, except perhaps those of Scott Alexander, Al Hartridge or Al Walker.

In addition, there's been a nova in Aquila! It's moderately bright, as the light curve below shows, at magnitude 8.5. As I've learned from the AAVSO, the nova was discovered photographically by Minoru Yamamoto (Doi-cho, Okazaki-shi, Japan) at magnitude 7.6. It has 1950.0 coordinates r.a. = 19h 10m 34.69s, decl. = +01° 29′ 14.0″. An AAVSO finder chart with comparison stars appears on the back page of this newsletter. In the telescope the nova appears as one of three stars in a row, like a miniature Orion's belt. The nova is at one end of the "belt" and has been the brightest of the three stars.

As for the light curve below, the plus signs represent AAVSO supplied data that I have averaged in daily bins and the diamonds are my own observations. The point at magnitude 13 represents a prediscovery observation of the nova being less than 12th magnitude. To convert the time, Julian day 2449140 is June 1 at 6 a.m. C.S.T.

For you asteroid fans, I have converted the data on pages 157 and 158 of the *Observer's Handbook 1993* into finder charts. There will be a few copies available at the next general meeting and they are similar to the charts published in the lengthy March issue of *Saskatoon Skies*. Please give me a call if you want a set of finder charts, then I can ensure that there will be enough copies.



ASTRONOMY DAY 1993

May 1st, Astronomy Day, proved to be much more pleasant weatherwise than last year (when it snowed, rained, blew and otherwise made for a miserable day!) It was a bright, warm Saturday. So warm and fine, in fact, that many potential visitors to our set-up at the Market Mall may have decided to remain outdoors, rather than spend their day shopping indoors, therefore, missing the opportunity to catch our Society's wonderful presence in the Mall!

On Friday, April 30th, Mike Wesolowski was a guest of Carol Blenkin's on her morning show on CFQC-TV, where they promoted the Centre and Astronomy Day, in particular.

The display panels and tables were set up next to the Food Court (very convenient!) where many excellent photographs taken over the years by our members were exhibited. There was lots of information on the group available to hand out, together with a number of free giveaways, compliments of Energy Mines & Resources Canada (meteorite posters) and Sky and Telescope (bumper stickers and catalogues). Popular astronomy books, periodicals and other astronomical items (planispheres, etc.) were also available for inspection.

Adjacent to the display tables, Allan Hartridge had set up his Schmidt camera equipment. Scott Alexander's 14.5″ Dobsonian drew a large crowd, as it always does, and Don Friesen brought his refractor, set up with projecting equipment to view the Sun through the skylights. In addition, my 10″ Dobsonian was there for comparison purposes with Scott's, and the Astroscan sat on a table, as an example of a good "first" telescope.

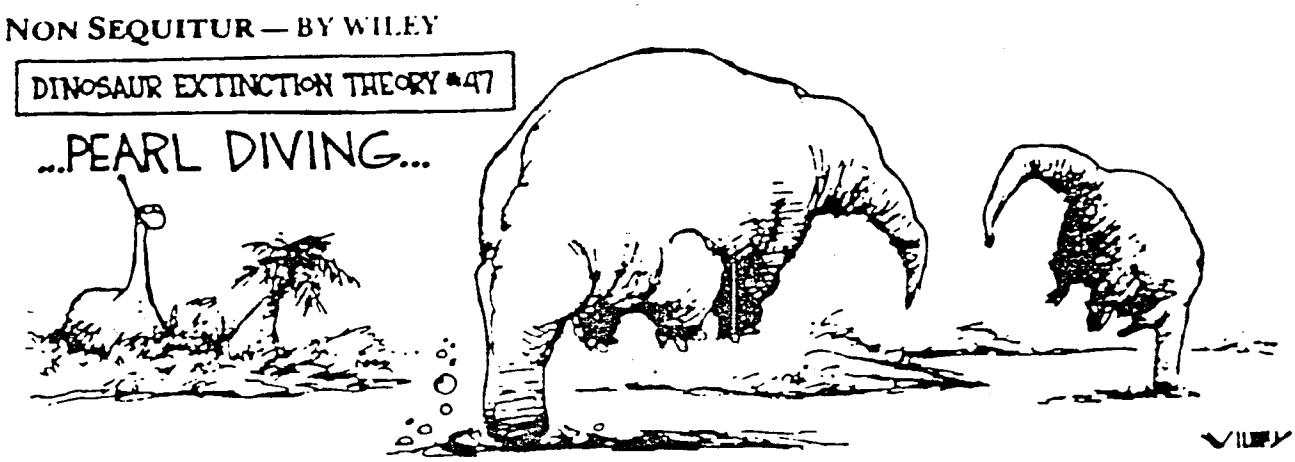
Throughout the day there were lots of discussion with educators, interpreters from municipal agencies, students, and many others who dropped by to talk about the RASC and astronomy in general. It is certainly apparent that there is a lot of interest in astronomy in the Saskatoon area and there is always the hope that this will lead to new members.

Outside in the parking lot Don Friesen and Mike Wesolowski took turns operating Rick Huziak's solar scope and Don's mounted binoculars (with SolarScreen filters) and drew alot of interest and attention from passersby. The sun was rather unimpressive that day, with only two very small sunspots in view.

In the evening, the planned starnight in Diefenbaker Park was very successful. The sky had turned a little mushy from the daytime, but nevertheless was good enough to show the Moon, Jupiter, Mars, Alberio, and one or two deep sky objects through Scott's 14.5″, Don's binoculars and my 10″. The turnout by the public was quite impressive – interested observers were already arriving when Mike Wesolowski and I turned up around 8:30 p.m. to check out the site and start setting up! Although I didn't do a head count, there appeared to be about 20 people per line-up at one point, so well over 60 people would have dropped by over the course of the evening. It was delightful to see Saskatoon Centre member Arthur Cockerton, who made the trek from Regina to be part of the festivities!

Many thanks to Jim Young, Kim Mysyk, and Laurie Mathiason, who took time out of their weekend to look after our tables and provide information to the public. Special thanks to Don Friesen, Mike Wesolowski, Al Hartridge, and Scott Alexander, who, in addition to being at the mall all day, also trucked panels, boxes, telescopes and other papaphernallia around town. See you all next year!!

Sandy Ferguson



SOLAR ECLIPSE REPORT
by Mike Wesolowski

Predictably, Friday morning, May 21, 1993 dawned with just a hint of blue sky, and that was only if you had a good imagination. As readers may recall, this was the morning of a partial solar eclipse of the sun, and a number of members had planned to converge on the Mendel Art Gallery where we intended to present a "sun-day" (on Friday morning) to members of the general public. The news media had been informed of the event, and provided with information about how to observe the sun safely. Members had their telescopes and a number of other observing devices to demonstrate.

As zero hour approached, Don Friesen and Richard Huziak set up their telescopes/binoculars underneath a (full cutoff) street lamp - no worries about light pollution today! Other members (Bill Hydomako, Sandy Ferguson, Gordon Sarty, Al Hartridge and myself) stood around waiting for the hoped-for barrage of "customers". Carol Blenkin also visited with her two dogs, who had high hopes of relieving themselves on somebody's telescope mount; they were persuaded that this was not a prudent course of action before any damage was done.

To make a long story short, the first half of the eclipse was not visible. What was especially frustrating (to us and to the few members of the public who showed up) was that sunbeams were visible to the southeast of us, indicating a hole in the clouds. After maximum eclipse, some holes did open up for us, causing a flurry of activity on our part. I believe that those members of the public who were present were impressed by what we could show them of the eclipse.

The equipment roster was impressive, not so much for the numbers but for the diversity. Richard Huziak had his solar telescope, as well as some old overexposed black and white film, and a pinhole camera. Don Friesen brought a filtered pair of binoculars on a tripod as well as a small refractor for eyepiece projection of the sun's image. Sandy Ferguson brought a #14 welder's filter. Gordon Sarty brought his 2″ refractor and did solar projection. I brought a pinhole camera as well as some Solar Screen filters mounted in slide holders. I suppose I should also mention that the clouds were used as filters too; most, if not all of us could not resist the occasional glimpse at the sun through the clouds (breaking our own rules!).

Many thanks to those who showed up as Centre representatives for this event. Special thanks to Sandy Ferguson who took on the job of getting information out to the media, Richard Huziak and myself who prepared the information, and Don Friesen who made a large sign that was displayed on Spadina Crescent intended to convince the public to visit us. Hopefully the next eclipse will occur under better circumstances (weather-wise) and we'll be able to put on a better show.

STARNIGHTING AT THE BRIGHTWATER BIBLE CAMP

On June 1st, Mike Wesolowski was requested to do a mini starnight at the Brightwater Bible Camp for the Caswell School upper grade classes, who were there on a nature excursion. Because Mike requested to borrow my telescope for the event, I requested to tag along. Mike agreed, and off we went to face the screaming terrors. As always it seems, the weather began nice, mostly clear with a few clouds, but as we set up at about 9:30 p.m., a major cloud bank set in and covered up the moon and Jupiter, our main targets for the night. Boldly, Mike plodded in to announce to the kids that we would not be able to see anything tonight, but he invited the kids outside to see the telescope anyway. About 30 kids took up the offer, and soon we were inundated with curiousness. As we discussed what we should be observing, the clouds magically parted (even though we had forgotten the sacrificial chicken at home). Soon we were catching glimpses of the moon and a bit later Jupiter cleared. The kids were awed by the craters of the moon, and even more impressed with Jupiter's belts and the two moons that were visible. We got a lot of intelligent questions, and once there was something to see, the kids became very disciplined and even lined up (i.e. de-mobbed) at the telescope to view these objects. All in all the mini-starnight was quite successful and a bit of fun. Mike does a lot of these mini events, and Mike and I do a lot of in-class lectures through the year for school kids of all ages. We believe that science and astronomy education can be fun, and bringing science and astronomy right to the kids and the classroom will get these guys and gals interested in a future in the physical sciences. Anyone else who may be interested or able to give mini-starnights and classroom lectures, please contact Mike or me.

Richard Huziak

UPCOMING EVENTS FOR 1993

June 19 Observers' Group meeting at Rystrom Observatory. Jupiter, Mars and Saturn will be visible, together with brighter summer objects. Time: anytime after 10:30 p.m.

June 21 Happy Solstice!!

July 2-5 The RASC General Assembly (our Society's annual get-together) is being held in Halifax this year. If anyone is interested in attending and wants to know more about the agenda, facilities, etc., give Jim Young a call at 343-0971. He will be attending as Saskatoon Centre's National Rep.

July 23 & 24 Public Starnight in Diefenbaker Park: Members will have their telescopes set up in the park so that the citizens of Saskatoon can get a look at a crescent Moon , Mars, Jupiter and Saturn and some summer objects. A few early Perseids should also be around. More on this next month.

August 6 - 16 *Sky and Telescope* is organizing a FIRES FROM HEAVEN AND EARTH trip to Italy to view volcanos and the Perseid meteors at their very peak activity (some predict thousands of meteors per hour at that time!). Contact Gord Sarty at 374-8803 for more information.

August 12 The annual Perseid meteors peak at 0900 local time this morning, so it might be a good idea to have an observing session on the night of the 11/12. The Moon will be 2 days past Last Quarter and a bit of a nuisance in the early morning, but still worth observing the shower. More about this later.

August 11 - 15 Alberta Star Party – Eagle Lake Campground, Strathmore, Alberta. This annual observers' camping event is popular with everyone in the western Centres. Saturn will be the prominent planet all night with Venus in the morning, and the Perseids will be around. So come along and observe under terrific dark skies! For more information call Rick Huziak at 665-3392.

August 18 - 22 Mount Kobau Star Party at Mount Kobau, B.C. The other great Western Canadian astronomical get-together. For information on location, camping, etc. call Rick Huziak at 665-3392.

September 17 - 18 The Vancouver Centre of the RASC sponsors the Manning Park Star Party near Hope, B.C. For more information, contact Rick Huziak at 665-3392.

September 17 & 18 Our second public starnight of the summer. Location to be announced. Saturn will be the best planet for this evening and some of the autumn objects will be available for viewing. Also the crescent Moon.

October 23 The Vancouver Centre of the RASC and The British Columbia Space Sciences Society present: The West Coast Amateur Astronomy Conference, "The Gathering of the Clubs" from noon to 5:30 pm (or later if the weather permits) at Vancouver's H.R. MacMillian Planetarium. Jack Newton will give an illustrated lecture on CCD Color Imaging. Contact Gord Sarty at 374-8804 for forms.

Contact me at 382-0898, or those mentioned, for further information on the above.

Sandy Ferguson

IAPETUS / SATURN ECLIPSE

There will be an eclipse of Iapetus by Saturn and its rings, on July 20 - 21, 1993. (Another occurred in May.) . Timing is as follows:

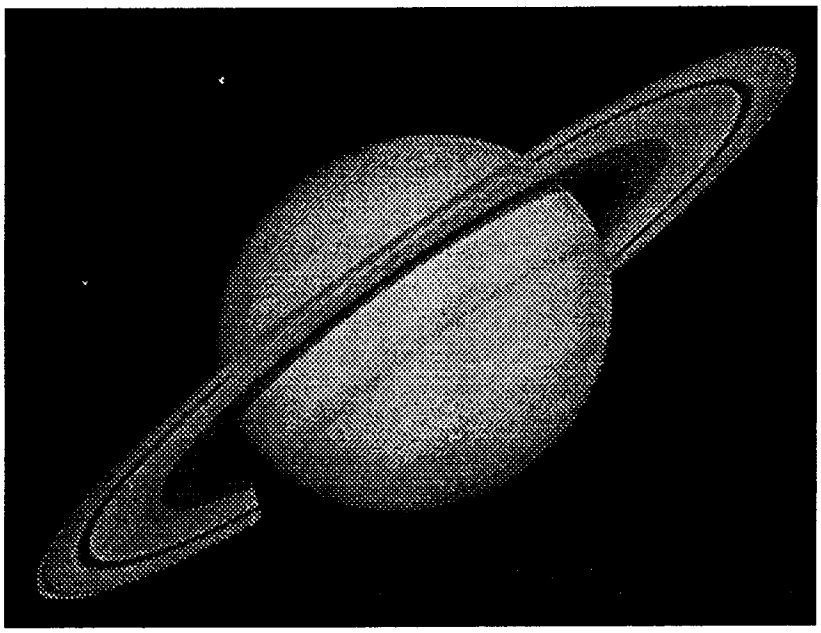
Saturn ingress 21:16 U.T. ; 3:16 p.m. C.S.T., July 20 (not visible from Saskatoon)
egress 05:08 U.T. ; 11:08 p.m. C.S.T., July 20
A-ring ingress 05:13 U.T. ; 11:13 p.m. C.S.T. (grazing)
egress 09:38 U.T. ; 3:38 a.m. C.S.T. , morning of the 21st

John Spencer writes:

"Times could be 30 minutes later according to an alternate ephemeris, and photometric observations are important for refining Iapetus' orbit. Because the Sun's size projected on the rings as seen from Iapetus is 3100 km it's unlikely that we will learn anything new about the rings themselves from the observations. See Soma (1992), Astronomy and Astrophysics 265, L21-L24 for more details. Thanks to Andy Odell of Northern Arizona University for bringing the events to my attention."

(Timing information adapted from internet news from: baalke@kelvin.jpl.nasa.gov (Ron Baalke) as forwarded from John Spencer (spencer@lowell.edu).)

Iapetus varies between 10th and 12th magnitude as it circles around Saturn. (The reason for the change of brightness is not known, but some theorize that half the satellite is covered with ice, making that half brighter.) On the night of the eclipse, Iapetus will be to the north of Saturn (possibly around 11th magnitude), moving from west to east. Iapetus will not be visible from Saskatoon until it emerges from Saturn's shadow at 11:08 p.m. According to the diagram on page 138 of the *Observer's Handbook 1993*, the A-ring is the outermost ring (see Voyager photo below). It appears that Iapetus will skim along the shadow from the north-east section of that ring. (All directions mentioned are sky north-south-east-west not planet north-south-east-west.)



Iapetus will probably fade and brighten many times as it passes through the complex ring shadows between 11:13 p.m. and 3:38 a.m. Sunset is around 8:43 p.m. on July 20 and sunrise is around 5:04 a.m. on the morning of the 21st. So, if you can get Wednesday, July 21st off work, you can pull an all-nighter to watch the complete eclipse of Iapetus by the northeastern side of Saturn's ring system.

Gord Sarty

VOYAGER SPACECRAFT FIND CLUE TO ANOTHER SOLAR SYSTEM MYSTERY

Nearly 15 years after they left home, the Voyager 1 and 2 spacecraft have discovered the first direct evidence of the long-sought-after heliopause – the boundary that separates Earth's solar system from interstellar space.

"This discovery is an exciting indication that still more discoveries and surprises lie ahead for the Voyagers as they continue their journey to the outer reaches of our solar system," said Dr. Edward C. Stone, Director of the Jet Propulsion Laboratory (JPL), Pasadena, Calif., and Voyager Project Scientist.

Since August 1992, the radio antennas on the spacecraft, called the plasma wave subsystem, have been recording intense low-frequency radio emissions coming from beyond the solar system. For months the source of these radio emissions remained a mystery.

"Our interpretation now is that these radio signals are created as a cloud of electrically charged gas, called a plasma, expands from the sun and interacts with the cold interstellar gas beyond the heliopause," said Dr. Don Gurnett, Principal Investigator of the Voyager plasma wave subsystem and a professor at the University of Iowa.

The sun is the center of our solar system. The solar wind is a stream of electrically charged particles that flows steadily away from the sun. As the solar wind moves out into space, it creates a magnetized bubble of hot plasma around the sun, called the heliosphere. Eventually, the expanding solar wind encounters the charged particles and magnetic field in the interstellar gas. The boundary created between the solar wind and interstellar gas is the heliopause.

"These radio emissions are probably the most powerful radio source in our solar system," said Gurnett. "We've estimated the total power radiated by the signals to be more than 10 trillion watts. However, these radio signals are at such low frequencies, only 2 to 3 kilohertz, that they can't be detected from Earth."

In May and June 1992, the sun experienced a period of intense solar activity which emitted a cloud of rapidly moving charged particles. When this cloud of plasma arrived at the heliopause, the particles interacted violently with the interstellar plasma and produced the radio emissions, according to Gurnett.

"We've seen the frequency of these radio emissions rise over time. Our assumption that this is the heliopause is based on the fact that there is no other known structure out there that could be causing these signals," Gurnett continued.

Because of the Voyagers' unique positions in space, they serendipitously detected and recorded the radio emissions. "Earth-bound scientists would not know this phenomenon was occurring if it weren't for the Voyager spacecraft," Gurnett added.

Exactly where the heliopause is remains one of the great unanswered questions in space physics.

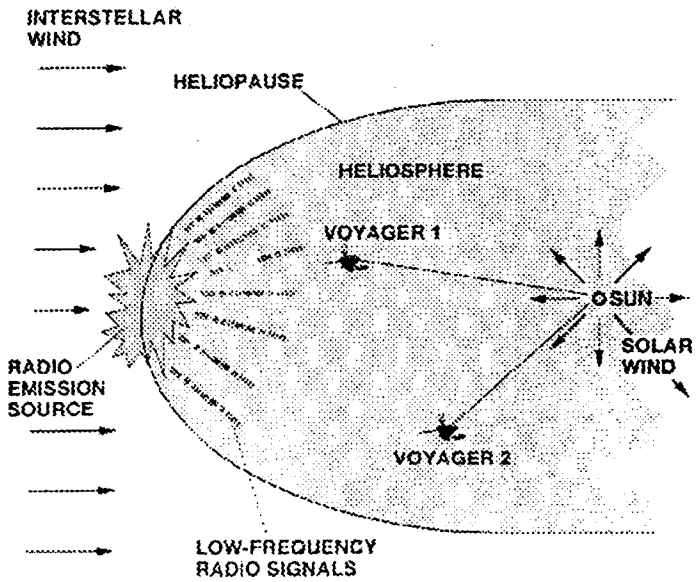
"It's this Voyager radio data combined with the plasma measurements taken at the spacecraft that give us a better guess about where the heliopause is. Based on the solar wind speed, the time that has elapsed since the mid-1992 solar event and the strength of the radio emissions, my best guess for the upper limit of the heliopause currently is about 90 to 120 astronomical units (AU) from the sun," said Dr. Ralph McNutt, a co-investigator on the Voyager plasma science experiment and a researcher at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md. (One AU is equal to 93 million miles (150 million kilometers) or the mean distance from the Earth to the sun.)

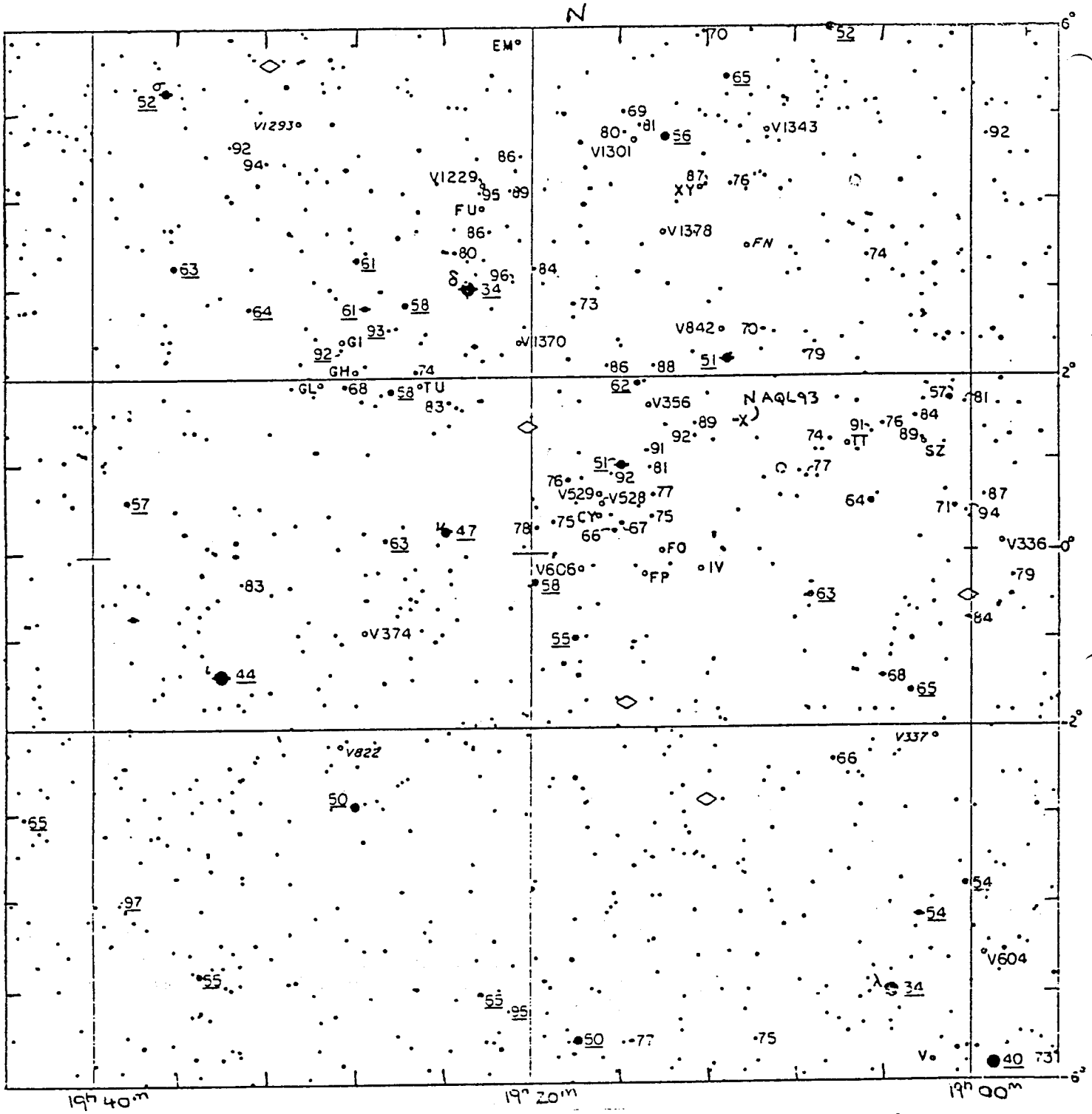
Voyager 1 currently is at 52 AU (4.9 billion miles or 7.8 billion kilometers from the sun), and Voyager 2 is at 40 AU (3.7 billion miles or 6 billion kilometers) from the sun.

Voyager 1 was launched on Sept. 5, 1977 and completed flyby exploration of both Jupiter and Saturn. The spacecraft now is rising above the ecliptic plane – the plane in which most of the planets orbit the sun – at an angle of about 35 degrees at a rate of about 320 million miles (about 520 million kilometers) a year. Voyager 2 was launched on Aug. 20, 1977 and also completed visits to Jupiter and Saturn and then went on to explore Uranus and Neptune, completing the reconnaissance of the giant outer planets. The spacecraft is now diving below the ecliptic plane at an angle of about 48 degrees and a rate of about 290 million miles (about 470 million kilometers) a year.

Gurnett presented his findings [on May 26] at a meeting of the American Geophysical Union in Baltimore. The Voyager Interstellar Mission is managed by JPL for NASA's Office of Space Science, Washington, D.C.

From: baalke@kelvin.jpl.nasa.gov (Ron Baalke)





Above chart is used with the special permission of Janet Mattei of the AAVSO.