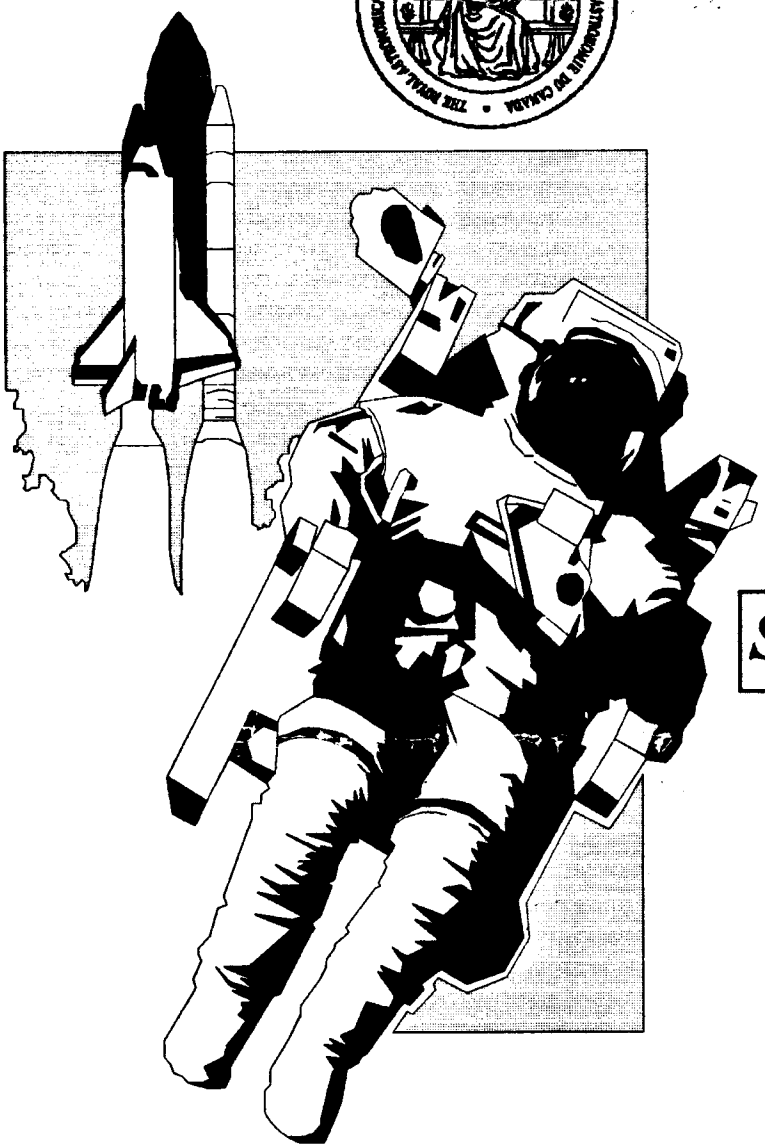
Saskatoon Skies



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Special Announcements

June is the last meeting before the summer break. The General Meeting is scheduled for June 17th at 8:00 p.m. The meeting will be located in Room A-226 in the Health Sciences Building on the U of S Campus. Mark this off on your calendar and plan on being there.

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Galileo Probe Data Spurs New Concepts For Jupiter's Circulation and Formation

Measurements returned by NASA's Galileo probe into Jupiter have provided dramatic new evidence about circulation processes within the planet's atmosphere and prompted scientists to propose radical new theories about Jupiter's original formation.

The new concepts arise from the probe's successful parachute-borne descent into Jupiter on Dec. 7, 1995. The probe made the first quantitative measurements of the Jovian atmosphere below its outer clouds, reaching a region below where heat from the Sun can penetrate. This means the probe sampled the upper part of what is believed to be Jupiter's well-mixed, relatively uniform interior atmosphere.

Several members of the probe scientific team announced new mid-term findings today at a meeting of the American Geophysical Union in Baltimore. "The returns from the probe's scientific instruments have sparked a lively worldwide scientific debate about theories of planetary formation and about internal mechanisms in the huge Jovian atmosphere," according to Dr. Richard Young, Galileo probe scientist at NASA'sAmes Research Center, Mountain View, CA.

Prior to the probe mission, the leading theory of Jovian weather assumed that, like on Earth, most action occurs in the thin, cloudy, solar-heated exterior region -- the so-called "skin of the apple." Winds within Earth's 100-mile-deep atmosphere are primarily the result of differential sunlight at the poles versus the equator, and heat released due to water condensation.

According to mission scientists, Galileo probe data strongly suggest that circulation patterns in Jupiter's cloud tops and its interior (which runs 10,000 miles deep) are part of one continuous process. Dr. David Atkinson of the University of Idaho continues to report persistent Jovian wind velocities of over 400 mph. The probe detected no reduction in wind speed, even at its deepest levels of measurement, approximately 100 miles below Jupiter's clouds.

Galileo scientists regard this finding as confirmation that the main driving force of Jupiter's winds is internal heat radiating upward from the planet's deep interior. The strength of the Jovian winds and the fact that they do not subside with depth is very significant, according to Dr. Andrew Ingersoll of the California Institute of Technology, Pasadena, CA.

"This may be evidence that Jupiter has high-speed wind currents extending thousands of miles deep into its hot, dense atmosphere," Ingersoll said. Such interior currents are believed by probe scientists to be the source of the dramatic banded appearance of Jupiter's cloud tops.

The most difficult probe finding for scientists to explain continues to be the extreme lack of water detected in the Jovian atmosphere. Pre-probe mission scientific estimates based on planetary formation theories, data from the earlier NASA Voyager spacecraft flybys of Jupiter and observations from the impacts of the fragments of Comet Shoemaker-Levy 9 with Jupiter forecast Jovian water levels at or well above those found in the Sun. However, probe scientists report that Jupiter is extremely dry -- with water levels (based on oxygen content) at one-fifth to one-tenth of the solar amount.

This finding is now well established, having been confirmed by analysis of data from five of the probe's science instruments. For example, the virtual absence of Jovian water clouds and the low relative frequency of lightning are all consistent with dry atmospheric conditions. Where is the water that should remain from Jupiter's formation in the same primitive nebula of gas and dust that spawned the Sun and the other planets? Several theories have been proposed.

According to one theory, Jupiter's true total water levels are probably at or above solar, with the bulk of Jovian water trapped in the planet's deep interior. According to this view, Jupiter began as a solid, rocky/icy proto-planet that grew to 8-10 times the mass of the Earth by gathering up ice grains and dust in the original primordial cloud. This process may well have concentrated water ice in the solid body, trapping it in the core while drying out surrounding regions.

As the solid body of the proto-Jupiter became larger, it attracted the already-dried-out surrounding lighter gases, mixing them with its existing atmosphere. This atmosphere would contain carbon and other gases that were originally locked in the core but had escaped as methane, ammonia, hydrogen sulfide and other volatiles as the core heated up. This process would produce a gas mixture similar to that found by the Galileo probe. It also would explain the enhanced carbon, sulfur and nitrogen levels found on Jupiter, which are significantly enriched relative to their abundance on the Sun.

In fact, this water-locked-in-the-Jovian-interior theory explains many of the measurements made by the probe. However, "there are problems with this new view, as there are with all the other current theories," said Dr. Tobias Owen of the University of Hawaii. "The primary one being, how does the ice stay in the hot planetary core while carbon-containing gases escape?"

An alternative theory suggests that the probe entered the Jovian atmosphere in an area comparable to the Earth's desert regions. This theory is supported by Earth-based telescopes and other spacecraft that observed extreme dryness at the probe's entry point on Jupiter's north equatorial belt. This theory holds that, like on Earth, Jupiter's atmosphere

How to Reach The Editor

If you have an article or an ad or picture that you want to submit to the Saskatoon Skies please mail them to the address below. If you have any questions please call. Check the last issue of the newsletter to find out when the deadline is to make sure you don't miss getting your submission put in the issue you want it in.

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is heated by the Sun at the equator, causing air to rise until clouds form and water is lost. The dry air then may flow north and south, descending in "desert" regions. If a large enough downdraft exists, it might be sufficient to explain the dryness that the Galileo probe encountered.

However, several scientists find fault with this "huge downdraft" theory, doubting that such a massive downdraft and continued dryness could exist at the depth and pressure levels to which the probe descended. While such a downdraft might explain the observed dryness, its persistence down to 20 times Earth's atmospheric pressure is very hard to explain, according to Ingersoll.

"This explanation is particularly difficult when considering that Jupiter emits more heat from its interior than it receives from the Sun," he said. "This up-flowing interior heat should block a huge, deep downflow of dry air. It should evenly mix Jupiter's atmospheric water vapor at this pressure level, preventing the existence of a very dry region such as that found by the probe."

One possibility, Owen responds, is that "perhaps Jupiter's interior heat comes out only in certain regions where ascending currents bring up hot material from the planet's interior, like the heat escaping from the Earth's interior" in volcanoes and mid-ocean floor spreading zones.

A variation on the dry-region theory has been advanced by Young and others. "Jovian water distribution may vary radically over large latitude regions, with much of Jupiter's water being concentrated at high latitudes where most of the planet's lightning has been detected," he said. "More of Jupiter's interior heat is also emitted at high latitudes. Unfortunately, at the moment, we can't put all of this into a mechanism to explain how major parts of Jovian water could be concentrated uniquely at these high latitudes."

The Galileo probe successfully accomplished the most difficult planetary atmospheric entry ever attempted. It relayed a total of 61 minutes of unique science data to the Galileo orbiter passing 100,000 miles overhead for subsequent transmission to Earth. The probe descended about 400 miles into the Jovian atmosphere, taking measurements down to a level corresponding to 20 times Earth's atmospheric pressure. The Galileo orbiter has since embarked on a two-year tour of Jupiter and its moons.

Additional information on the Galileo probe, including a discussion of the craft's science instruments and a non-technical summary of the first scientific papers on the probe mission that were published in the May 10 issue of Science magazine, can be found on the Internet at the following URL: http://ccf.arc.nasa.gov/galileo_probe/

The Galileo probe is managed by NASA's Ames Research Center, Mountain View, CA. Hughes Spacc and Communications Co., El Segundo, CA, designed and built the probe. Lockheed Martin Hypersonic Systems (formerly General Electric), Philadelphia, PA, built the probe's heat shield. NASA's Jet Propulsion Laboratory, Pasadena, CA, built the Galileo orbiter spacecraft and manages the overall mission.

The Search For A New Observatory Site
by Erich Keser

With the great progress that is being made on the machining of a new, multi-purpose, research-quality telescope, thanks to Bill Hydomako and Usask machine shop, the need for a permanent site for this massive piece of precision machinery is becoming pressing. On Sunday April 21st, Rick Huziak and I spent five hours driving along the Grid Roads from South of the Rystrom Observatory, between Highway 1 1 and the Bradwell Road. We found and looked at several more potential sites, which will be described, and videotapes of which will be shown at the **June 17th RASC Meeting.**

The following Thursday, the University's Stan Shadick and Yanis joined Rick to look at the three most promising prospects on behalf of the University. Dr. Shadick has already contacted the owners of two of the sites- one is amenable to an offer from us, while the owner of the other is not. The third potential site is posted by Saskatchewan Wildlife Federation, and may be owned by the same Hartridge in-law who has generously allowed us to use his gravel-pit area. Enquiries are still in progress.

On Tuesday May 30th, Rick Huziak and I took advantage of the only clear night for some time to examine the same three prospects by night. The first site looked at was that of the amenable owner (a friend of a now-deceased Saskatoon Centre member). It appeared promising: easily reachable at the corner of the well-paved Rd 336 (old Blackstrap highway) and Tamkin Road, with utilities and several existing structures. Unfortunately, it appeared to be the place most strongly affected by light pollution, especially from the developing Blackstrap area. (A subsequent solo binocular excursion to look for the asteroid Vesta confirmed this- there was skyglow especially to the south, but also to the southeast and north, and only the zenith was really dark.)

We next examined the Wildlife Federation site. It is slightly more distant, and involves travel along several miles of gravel roads. It turned out to be somewhat darker, but would also need more site development- buildings, an access drive, trenching of power lines, and the full or part-purchase of a step-

down transformer.) The 40 km distant signal - tower hilltop 4 km of -rather poor- roads past Bradwell was also looked at. The elevation provided great horizons, but also made all the lights in the area quite visible. The adolescent beer party going on downhill, and fact that two party seekers accosted us, were not encouraging: this hill appears to be something of a hangout.

On the way back, after the Moon had already risen, we decided to take another look at an older possibility, the lot on which the Meadow Lark school had been until 1951. This is about a mile along the road to the Sheriff Fertilizer Distribution Depot, which runs south from Hwy 16, about two km. East of Clavet. We were happy to discover a power line, which had been missed before, and relatively little sign of light pollution.

As there had been no chance to check especially this last site under clear skies, Sandy Ferguson and I made a major detour on the way back from Regina to accomplish this. Unfortunately, the clouds which had parted at midnight were returning. Nevertheless, the accessibility, the seclusion and the well-developed nature of the site impressed us, and the skies appeared to be sullied only by a couple of yard lights and a moderate yellow glow to the Southeast. Suddenly a huge fertilizer truck came blazing past. When it was followed by another a few minutes later, we decided to investigate the source of both the light and the commotion. A few miles to the south this road ends at the huge Sherif Fertilizer Depot, well-lit, though not quite blazing with (thankfully!) yellow light. After we explained who we were and what we were doing, the foreman was quite friendly and invited us in for coffee, . He told us that this plant is busy from late April to early June, and for a briefer period every Fall. He also suggested we look at -interestingly - the very same SRC site, town of Blucher (in which he owns a lot), and the Bradwell signal tower hill which our site search committee have been examining.

After giving our thanks, we decided to take another look at these as well, especially as Sandy, an experienced observer, had never seen any of them. The Bradwell hill was only another 1 0 km, but we were given a bad fright by three young men who pulled up in a pickup truck and asked us what we were doing. They gave us no further trouble, but the fact that this happened at about 4 AM on a Saturday morning is not reassuring. The foreman had also told us that it was formerly the practice for kids to go out and shoot rats at a dump near this hill. The police stopped this after a stray shot caused major damage to a fiber-optic cable and the tower was fenced. However, the fact that the gate was wide open and that the tower lights have been out for a month made us wonder how safe any -especially female-member would feel at such a site. Utilities appear to be readily accessible, and a mutual security arrangement with SaskTel may be possible, but the abundance of bug-breeding water around this hill, and the length, steepness and poor condition of the access road are further concerns.

On the way back. we drove through Blucher, which turned out to have about half a dozen yard and other lights, and at the Saskatchewan Research Council's site just north of it. The amount of water in the SRC's pits and the length of dirt road to the more distant section which is the only one they are prepared to cede to us looked uninviting. Our conclusion, as we finally returned to Saskatoon, was that the ex-school site was certainly the best prospect of those we had examined that night. The heavy truck traffic occurs only for a short period each year and might be helped by a light fence, while the plant's lighting could be better shielded, and possibly possibly reduced.

One further completely new site possibility has been offered for our inspection through the Western Space Resource Network and the Separate School Board. Al Hartridge and I spent most of Wednesday May 15th looking over a 160 acre piece of virgin land which Ed and May Scissons bequeathed to the Board, with the condition that it not be exploited for financial gain, but be used for science education. This has become the site of the Saskatoon Catholic Schools Ed&May Scissons Environmental Center. The attractive stipulations on this property offer some degree of permanence. The promise of very dark skies, beautiful natural surroundings and the presence of utilities and an existing, winterized classroom building all make this a very attractive prospective site. However, it is located 80 or 90 kilometers (depending on the route taken), northwest of the centre of Saskatoon, and some of this is on secondary and gravel roads.

WHAT WE ARE LOOKING FOR:

As a newcomer to Saskatchewan and the site search process, I have learned of a number of important factors which we should bear in mind as we discuss prospects.

1. Winter access is a major consideration, especially with cutbacks in regional services. Thus, only sites near major paved or at least well-gravelled roads merit consideration. We want to be able to use our observatory year-round.

2. Any site should be close to power lines, and preferably close to a step-down transformer. The cost of installing such a transformer could be several thousand dollars. Proximity to telephone and gas lines is also desirable.

3. The skies should be much darker than at Rystrom, and likely to stay that way. Thus any site should be far away from planned or potential construction areas, as well as major roads and railroad lines and rural industrial plants. This makes sites on or near conservation or other legally restricted areas advantageous.

4. The horizon, especially to the South where the most star-rich area of

Membership Info

*Membership in the **Royal Astronomical Society of Canada** and the **Saskatoon** Centre is open to anyone and has many benefits.*

*Below are the prices for memberships. Should you require additional information please contact **Rick Huziak** at **665-3392**.*

Regular membership (21 & up).....$40.00
Youth Membership (21 & under)....$22.50
Club Newsletter (12 issues).....$10.00
Observer's Handbook.....$18.95

Note: Lifetime memberships are available on request for $900.00

our galaxy lies, should be as unobstructed as possible. Small hills and other barriers to errant lights are useful, especially in the direction of Saskatoon, but must not interfere with observing the circumpolar region, the high visibility of which is a major benefit of our northerly latitude. And this again means that any site must be some distance out, especially if it is located to the south of the city.

5. Nearness to at least one visibly inhabited other structure would have its advantages, both in terms of site security, and in case of emergencies.

6. Still-standing abandoned structures could save us a great deal of work in building a warm-up shelter, clubhouse, and so forth.

There are a few further factors to consider, based on my personal experiences and the experiences of others.

1. Any site should be within 30 minutes driving distance. The Sudbury site, at 48 km out of town, is much less used than was anticipated and even Regina's 41 km distant highway-side site appears to involve something of an expedition.

Remember, we'll have to shut down and pack up and drive back, and most of us have to get up to work the next day! Problems with security, maintenance and insurance also increase with every kilometer we move further out of town.

2. Nearness of swamps or ponds can be a real downer, as I found out at both the 'gravel pit' and SRC sites. On one particularly bad night last Fall, there were at least a dozens mosquitoes on my corrector plate when I finally gave up, and I nearly went off the road, driving too fast on a gravel road with all windows open, to blow the swarms of bugs out of my car. And this was at the 'gravel pit' site; the SRC one would likely have been worse. There are preventative measures possible here, but these have their limits. Some members are bound to have allergies and chemical sensitivities. Then too,our environmental consciousness should make us think twice about counting on chemical warfare to make such sites usable.

3. Murphy's law applies to our observatory search, as it does to any human endeavor. When Sandy Ferguson and I decided to check the Meadow Lark schoolsite at 2:3 0 AM on a Saturday morning, we were just extoling its virtues as the first of several blazing fertilizer trucks drove by. This recalls an anecdote by Terrence Dickinson. He once built himself a dream observatory at his north of Toronto home- within a year a brightly-lit shopping centre sprang up a mile away. This experience made such an impression that Terry long refrained from building another observatory, even at his much more remote Yarker, Ontario home.

The need for a new observatory site is becoming critical. Please help in any way that you can. Any prospect should be checked out by as many people as possible, in as many ways as possible. No site will ever be perfect, but persistent footwork will find a decent one and some research can avoid disappointment 'down the road'. There are many ways you can participate. You can find or suggest potential sites, or come out to inspect them, either with us or by yourself (call Rick Huziak for directions). You can also help in less obvious ways. For example, some legal research and chatting with planners and area residents and businesses could well have saved Dickinson some grief. members could certainly help in this area as well. And just talking to people, and letting them know what we are looking for -even fertilizer depot foremen at 3AMmay gain us more useful information, and perhaps even new possibilities.

A larger committee of all who have expressed an interest, including our University liaison people, will be examining and discussing all the possibilities within the next weeks. Please call Rick Huziak or Erich Keser (374-4262) if you are interested.

Important Info

The Rystrom Observatory

Members are welcome to use the observatory at any time but ***please phone ahead.*** *Call Nelson or Gloria Rystrom at 955-2370* ***before 9:00 p.m.*** *if you intend on going out. This lets them know that someone will be roaming around their yard. If they do not answer go anyway. Drive through the yard slowly, and dim your lights as a courtesy to others who may be observing.*

Astronomy Day
by Sandy Ferguson

This year's Astronomy Day was held on Saturday, April 20th, when we set up our display panels at Lawson Heights Mall. Again this year, the weather refused to co-operate, which prevented both solar observing in the parking lot during the day and a successful starnight at Diefenbaker Park in the evening. On the day before, former member Carol Blenkin helped us publicize the event by interviewing Erich Keser and myself on her morning show "Eye on Saskatchewan".

We set up our display panels, telescopes and other equipment between 9:00 a.m. and 5:00 p.m. in the Mall, with our theme being "Canadian Discoverers". We also offered a slide presentation on general astronomy that drew a fair audience from shoppers throughout the day. There was also a good deal of interest in Comet Hyakutake and our display of Al Hartridge's excellent photos of the comet. Many made inquiries about our Centre and six or seven temporary members signed up. In addition to the usual items we had on display, Dan Kulak contributed information on meteorology and eye protection from UV radiation, which was part of his Earth Day material. We held draws for two copies of Peterson's "Field Guide to the Stars and Planets", which were won by Lesley Cook and Gord Jacobs, both of Saskatoon. After packing up everything at the end of the day, a large number of those helping at the Mall regrouped at the Genesis Restaurant for the first of our Centre's "Gastronomy Nights", and to wait out the period until dusk, to see if skies would be good enough for the starnight.

Unfortunately, the skies turned out to be poor and the decision was made to cancel

the starnight. Erich kindly volunteered to drive over to Diefenbaker Park to put up a 'cancelled' sign for the public, while the rest of us went home to put our feet up. We later discovered that Paul Ferguson, unaware of the cancellation, turned up at the park and ended up conducting his own ministarnight on the top of the hill, where a few park visitors waited out the clouds with him. They were successful in observing a few objects, even with the poor skies. Thanks, Paul, for such dedication!

As usual, our Centre is very fortunate in having a lot of great members who put the day together. Thanks to Rick and Amy Huziak, Erich and Ariel Keser, Al Hartridge, Jim Young, Scott Alexander, Bob Christie, Kim and Heather Mysyk, Bill Hydomako, Gord Sarty, Paul Ferguson and Dan Kulak for staffing tables and providing equipment. Thanks, also, to Don MacKinnon for the loan of his Comet Hyakutake slides for Carol's show and to Brenna Wright, who helped by drawing the names for the prizes. Finally, many thanks to Carol Blenkin for her continuing support year after year.

A Regina Centre Meeting
by Erich Keser

The other RASC Centre in Saskatchewan, which was originally founded half a century before ours, is alive and well, has great presentations at its meetings,and is organizing a Cypress Hills Star Party they very much want us to participate in. On Friday 24th May Sandy Ferguson and I joined a dozen Regina RASC members at their monthly meeting in the Imax Boardroom of the Saskatchewan Science Centre. The brief business part of the meeting included a couple of items which are quite relevant to us.

There was a discussion of the construction of a "light fence" to shield Regina Centre's Davin Observatory from car headlights. Apparently this 40 km distant site, which was bought for $1 in 1969, has the problem of being too near Highway 48. We wondered aloud whether such measures could help us with lights near the horizon from Rystrom, and especially from any future observatory site

Past President Ross Parker reported on plans for the July 12-14th Cypress Hills Star Party. For our benefit, he outlined the history of this event, which **Looking Up** describes as Regina's annual Star Party. It started in 1988, when Parker noted the pristine skies, the absence of bugs, and the wonderful setting and facilities this Park provided. The following year 15 people occupied an RASC group campsite, which allowed for such luxuries as a 3AM after-observing barbecue. Since then, the event has been smaller, but "Absorbent Sponge" Parker welcomes Saskatoon (and Sarles!) participation, and will investigate the possible use of a park hall for presentations. Ross feels that a good response this Summer could pave the way for a larger event with prearranged program, formal registration and a group camping area in 1997.

The meeting then featured a presentation by former National Research Council associate John Orht on "Scattered Light", that is, on the many ways in which stray light can degrade observing, and on how to fight it. Like any serious engineer, John emphasized that perfection is unattainable, but nevertheless described a number of ingenious ways of approaches to diagnose and deal with light leaks. A simple way of testing a telescope, for example, is to attach a camera, cap it, surround it with bright light, and then take a long bulb exposure. The turn off all lights and make a second exposure. A comparison of the fog levels of the resulting negatives, either visually or, better, with a darkroom densitometer, will quickly reveal any light leaks.

Ohrt went on to solutions. First of all, he stressed the importance and simplicity of attaching a front light baffle at least twice as long as the diameter of the tube to any telescope. Then he explained vow the edges of the primary mirrors in Newtonian reflectors can be blackened with a drafting pen as the mirror is rotated on a turntable and how finder mounting holes can be sealed against light leaks with a combination of carpet tape and black felt. Also, the tubes of such telescopes should be tightly fitted into a U-shaped flange to present one of the most common sources of stray light. Ohrt also discussed such factors as light-scattering imperfections in glass, the proper baffling of telescope tubes and easy ways to construct labyrinth seals.

In closing, Mr. Ohrt discussed the many problems associated with stray light from dust and the resulting never-ending debate over how and how often to clean optics. He stressed the importance of doing this very carefully, using medical grade alcohol and distilled water, and avoiding such uncontrolled substances as cans of compressed air, which often contains compressor oil. This was certainly an informative presentation, which suffered from only one major omission'. our esteemed President's brilliant stratagem for recycling used gym shorts (which I refrained from "leaking" for fear that there may be a patent pending). I suggest we invite John to do a similar talk for us, at which time Rick could introduce him to his own low-budget solution to "scattered light"!

After the meeting, Regina president Robert Klein and Newsletter Editor Steve Szuta took us to the Science Centre's observatory, the most visible part of which is a dome the club contributed, in return for free access to the building. It houses a 6" Unitron refractor, whose wonderfully classic appearance belies such problems as a nonfunctional clock drive and the wear and tear caused by occasional sloppiness by Science Centre staff. The hunt for misplaced eyepiece sleeves and the attempts to properly shut a dome slit which had been left ajar recalled problems the Sudbury Club encountered in its joint projects with Laurentian University and Science North. Such experiences suggest that any shared venture we engage in, such as a joint observatory site with the University, must be based on a very clear definition of the rights and responsibilities of each party and, especially, carefully controlled access..

Finally, Glenn Gunther (a hapless weatherman like our own Dan Kulak),

Steve, Ross and former Treasurer Dave Kozoriz joined us at Smitty's (a definite improvement over donut shops-the coffee refills are free!). After a late supper and many assurances of better contact in the future, we were off for Saskatoon.

The Regina Centre has a long and proud history. President Robert Klein claimed that Regina was the site of the first RASC center in the West. **LOOKING UP: A History of the Royal Astronomical Society of Canada** says even more: "On October 1 1, 1910, twenty-seven members from Saskatchewan were elected to membership, and the Regina Centre was born, the first outside Ontario" (P.201) That first Centre folded in 1920. However, there has been a **Regina Astronomical Society** since the 1940's, and although it only formally joined the RASC Centre in 1989, it has carried on an active observing program, and even maintained its own observatory since 1955. It is high time that we get to know our colleagues only two and a half hours away, and to exchange notes and experiences with them. They could likely give us a great deal of advice as we plan and build a new observatory, and we could likely help them with such exciting projects like their Cypress Hills Star Party as well.

Hyakutake's Close Encounter With The Sun

NASA, the European Space Agency (ESA) and the Naval Research Laboratory (NRL) have released a set of unprecedented images representing a time lapse movie of Comet Hyakutake making its close approach to the Sun.

The observations were made during April 29 - May 6, 1996 with the NRL-built Large Angle Spectrometric Coronagraph (LASCO) instrument on the Solar and Heliospheric Observatory (SOHO) spacecraft. The comet, estimated to have an orbital period of 10,000 years, came within about 20 million miles of the Sun and is seen in the images against the background of the million-degree hot outer atmosphere of the Sun, the corona.

"Such observations require a special instrument in space to suppress the glare of the Sun and reveal the comet and its tails," said Dr. Guenter Brueckner, NRL's principal investigator for LASCO. Scattering of sunlight in the Earth's atmosphere prevented good views from the ground during the comet's "perihelion passage," when it was closest to the Sun.

When the comet enters the outer atmosphere of the Sun, it begins to react with the Sun's environment and can be used as a "probe" of the solar corona. The LASCO images show the head of the comet, and clearly visible are three separate tails that behave differently as Hyakutake swings around the Sun. These tails are made of different materials which react differently with their environment. Heavy particles follow the comet in its orbit without being redirected by an outside force while the light dust particles are lining up away from the Sun and are driven by the sun's intensive radiation. Finally, atomic particles are repelled from the comet by the solar wind and presumably line up with the magnetic field of the solar corona. The comet's tails could clearly be seen changing their relative direction over the seven day observation period as the Sun's forces acted upon them. Hyakutake's orbit carries it back into the so-called "Oort Cloud," a vast collection of billions of comets that is located 1.4 light years away from the solar system.

Coronal mass ejections also were observed by LASCO, in which hot gases were expelled and accelerated by the corona's magnetic field to travel through the interplanetary medium. A strong reaction between such a solar high-speed cloud and the portion of the comet's tails made of atomic particles are expected when Hyakutake crosses the equatorial plane of the Sun. The comet was out of LASCO's field-of-view during this crossing, but the scientists will have another opportunity when Hyakutake reappears from behind the Sun and can be seen later in the southern hemisphere's night sky with ordinary telescopes. Researchers expect to learn more about the tails of the comet and the surrounding solar corona with more detailed analysis.

LASCO is a joint project between NRL, the Max Planck Institut fur Aeronomie (Germany), the Laboratoire d'Astronomie Spatiale (France), and the School of Physics and Space Research at the University of Birmingham (UK). SOHO is a project of international cooperation between ESA and NASA.

Come Out & Observe
by Erich Keser

Don't miss the last Observing Sessions of the Spring! It's been a disappointing season, but the nights are finally more warmer. Sunset is becoming ever later, but since Stargazing is what we are really all about, we should make one last try! If you are interested in the sky, you are welcome to come out and view a variety of celestial wonders for yourself.

Ursa Major (the Big Dipper) and its half dozen bright Messier Galaxies will be ideal viewing position, as will the more challenging clusters of galaxies in Virgo. The asteroid Vesta is plainly visible in Libra and we should be able to catch our first glimpses of Comet Hale-Boppandtosee Comet **Kopff.** Even such old friends a M 3 1, the double cluster in Perseus, and of course **Jupiter.** are once again visible.

You don't have to have your own telescope, but Observing Sessions are an excellent place to choose or learn to use one. Most of us welcome the chance to demonstrate our own 'scopes and to help you with yours. **Binoculars very useful, so please bring them if you** have them.

You are welcome to arrive at almost any time of evening. Come at dusk if you have to set up a telescope, or want to watch others do so. Come at nightfall to participate in a discussion of good "targets" for the night, and to do as much observing as possible. Come after the kids are in bed and after other activities are over for a peaceful and spiritually rewarding end to your day. Please be sure to dim your lights and drive in slowly if you arrive after nightfall. You will quickly make friends by bringing something warm to drink and some extra

bug repellent. Come out and look at the stars:

DATE Time of Nightfall PLACE:
Fri. June 14 10:00 PM Pitt Road Dark Site* *Alternate Date:* Sat. June 15

* *Alternate date will be used in case Fri. date is "clouded out".* Pitt Road dark site will be used only if safely accessible. Please confirm with Erich Keser 374-4262 or Rick Huziak and the RASC message machine at 665-3392 if in doubt. We will decide by whether we are going out by 8PM on the relevant day.

Search For a Mirror Finish by Gordon Sarty

As an amateur telescope maker, I have had to apply a shiny surface to my homemade mirror. I've tried two methods: (1) silvering the mirror myself and (2) sending it away for aluminumizing. Since the silver coating tarnishes after a couple of years, my mirror is currently aluminumized. I sent it by courier to California and ended up paying an unreasonable amount of money to a broker to get my mirror back across the border. But, thanks to the rasc listserver I now know of two Canadian places that aluminumize homemade mirrors.

On Wed, 15 May 1996, John Adlington <jon@islandnet.com> wrote to the listserver: "Can any body recommend a good Canadian source for mirror recoating? I've got a 12.5" mirror to do and I'd like to avoid the hassles of sending it to the States."

Replies came from Patrick Kelly <pkelly@tuns.ca>, MK <santryl@cadvision.com>, and Doug Hube <dhube@phys.ualberta.ca>.

These guys recommended two possibilities:

1. Barry Arnold, Department of Electrical Engineering, University of Alberta, Edmonton, Alberta, T6G 2E1
e-mail: arnold@ee.ualberta.ca

2. Moonward Vacuum Coatings, Suite 250, 800 Lasalle Blvd., Sudbury, Ontario P3A 4V4 Phone: Alan Ward (705) 566-7924 FAX: (705) 566-1833
e-mail: moonward@osiris.isys.ca

Moonward Vacuum Coatings sounds like a commercial venture as opposed to Barry Arnold who seems to offer the service as a favor. However, MK mentioned that Barry may be willing to refigure a bad mirror as well!

In any case, Moonward Vacuum Coatings can supply the following services. They provide four levels of aluminum: bare aluminum; protected (caoted with SiO); semi-enhanced (coated with MgF2) and enhanced (MgF2/Zns). The price for a 12.5", for each of these levels respectively, are $75, $75, $87 and $100. Turn around time is 1-2 weeks for the first three, 2-3 for the last one. Secondaries are done free if sent with the primary. Applicable taxes and shipping are extra.

On Friday, May 17, Peter Ceravolo <ceravolo@fox.nstn.ca> wrote to thelistserver with another source of aluminizing for larger mirrors:

"For the big stuff I recomend my old workplace, the National Research Council Of Canada's Optical Components lab. They can handle mirrors up to about 30" and will put on an overcoat. They are expensive, about $450 for a coating.

"Call Glen Fraser (supervisor) or Tom Cassidy (coating Tech) at (613) 993-2850. Don't tell them I sent you--they might hang up on you!"

Measurements From Ulysses Gives New Clues To Dark Matter

Measurements from the joint NASA/European Space Agency Ulysses mission found a surprisingly small increase in the amount of helium-3 since the formation of the solar system, allowing a more precise estimate of the amount of dark matter in the universe, two scientists announced today. Their findings, from measurements of the Solar Wind Ion Composition Experiment aboard Ulysses, were published today in Nature magazine

Drs. George Gloeckler, professor of physics at the University of Maryland, and Johannes Geiss, director at the International Space Sciences Institute in Bern, Switzerland, reported the first measurements of helium-3 in the interstellar cloud surrounding our solar system. They said their findings of this lighter isotope of helium give additional clues to the amount of dark, or invisible matter, that was produced at the beginning of the universe -- the Big Bang -- 15 billion years ago.

The exact nature of dark matter is one of the most intriguing mysteries in astronomy. Although scientists do not know what it is, their best estimates indicate most of the Universe -- perhaps as much as 90 per cent -- is composed of dark matter. This estimate is based partly on observations showing stronger gravitational attraction between galaxies than should be the case with the amount of matter they can see. The dark matter may be 'ordinary' matter such as planets and burned-out stars too dim to detect, or perhaps exotic objects such as black holes or as-yet undetected particles which pervade the Universe.

"Basically, our measurements indicate the amount of dark matter in the early universe was fairly high," Gloeckler said. "Visible matter is a small fraction of the total. By measuring the relative portions of the lightest elements and their isotopes, one can infer the amount of ordinary matter in the universe."

"Since current theories of the earliest stages of the universe predict a much larger amount of matter coming out of the Big Bang, the difference is surmised to consist of an entirely different and unfamiliar kind of matter, commonly called dark matter," Geiss said. "The precise nature of this dark matter is not known at this time, because it has eluded so far all efforts of detecting it directly. It could very well have survived to this day, filing the whole universe and dominating its dynamics, yet be invisible to us."

The light elements of helium-3, hydrogen, deuterium -- a heavy isotope of hydrogen -- and helium-4 were created in the Big Bang, the scientists said. The abundance of helium-3 has been changing ever since because it is both produced and
destroyed in stars.

The direction and amount of this change have until now remained undetermined, they said. They found, however, that the reported amount of helium-3 indicates a surprisingly small increase -- about 50 percent -- since the time of the formation of the solar system 4.6 billion years ago.

Since the change was smaller than earlier models indicated, Gloeckler and Geiss said, the density of dark, or unseen, matter relative to that matter which we can see must be greater.

"What is so exciting is that we have good numbers for the helium-3 abundance during three time epoch's spanning the life of the universe," Gloeckler said. "This gives a firm handle on how matter is processed or 'cooked' in stars."

He said current models that predict large amounts of helium-3 are not consistent with the new findings.

The measurements were made over the south pole of the Sun at distances several times the distance of the Sun to Earth. They detected the interstellar gas that made its way deep into the inner solar system and determined the composition of helium-3 in that gas.

The Ulysses mission is managed jointly by NASA and the European Space Agency (ESA). The Jet Propulsion Laboratory manages the U.S. portion of the mission for NASA's Office of Space Science, Washington, DC.

Tethered Satellite Mission Revamping Space Physics Theories

Numerous space physics and plasma theories are being revised or overturned by data gathered during the Tethered Satellite System Reflight (TSS-1R) experiments on Space Shuttle Columbia's STS-75 mission last March.

Models, accepted by scientists for more than 30 years, are incorrect and must be rewritten. This assessment follows analysis by a joint U.S.-Italian Tethered Satellite investigating team of the information gathered during the mission.

During STS-75, a tether system was being unreeled to nearly 13 miles above Columbia's payload bay. Just short of the full distance, its tether broke. Nevertheless, the science instruments on the satellite and Shuttle, which had been operating during the five hours of deployment operations, sent a flood of readings that were received and recorded by scientists on the ground. "Even the quick-look made to date reveals that this data harvest is rich in content," said Dr. Nobie Stone, NASA TSS-1R mission scientist at the Marshall Space Flight Center, Huntsville, AL.

"Perhaps the most significant finding," Stone said, "is that tether currents proved to be up to three times greater than existing theoretical models predicted prior to the mission. With the amount of power generated being directly proportional to the current, this bodes well for technological applications."

"Reversing the direction of current flow puts the system into an electric-motor mode," Stone explained. This harnessed energy could furnish thrust for reboosting a space station, satellite or Shuttle in a decaying orbit.

"Traditionally, the primary source of power for long-term space platforms has been solar arrays," Stone said. "Those cells can only produce power when exposed to sunlight during the two-thirds of each 90-minute orbit when a space station, for instance, is not on Earth's dark side. However, a tether system might provide a constant source of energy," he noted. "It is very efficient and might serve as an effective back up power system."

Other important revelations from the STS-75 mission include observations of the satellite's thrusters interacting with the ionosphere while moving rapidly in Earth orbit. Stone said that, when the thrusters were fired to adjust the satellite's spin rate, the neutral gas emitted became ionized.

The tethered satellite researchers noted that, at that point, "a sudden jump" took place in the level of current flow, while the satellite's potential (voltage) dropped several hundred volts. They traced this effect to the small amount of gas, released from the thrusters, becoming ionized in the vicinity of the satellite. A greater, more efficient current flow was observed. "The effect of neutral-gas ionizationis not taken into consideration by existing theoretical modelsof current collection in the ionosphere," Stone said.

Also, for the first time ever, the high voltage plasma sheath and wake of a high-voltage satellite moving rapidly in the ionosphere was measured. "This is virtually impossible to study in a laboratory and is difficult to model mathematically," Stone said.

Tethered Satellite System investigators have just begun to scrutinize the data from STS-75. They expect that it will reveal more answers to questions about the workings of the Earth's upper atmosphere, its physics and the electrodynamic applications of tethered systems in space.

Crab Nebula.....The Movie

Fascinating new motion images from NASA's Hubble Space Telescope showing glowing, eerie shifting patterns of light and sharp wisp-like features streaming away from the center of the Crab nebula at half the speed of light will be the topic of the next Space Science Update. The briefing will be held at 2 p.m. EDT, on Thursday, May 30, from the NASA Headquarters Auditorium, 300 E St., S.W., Washington, DC.

Entitled "Crab Nebula: The Movie," astronomers will explain that being able to see the rapidly changing and dynamic activity in the Crab reveal that these processes are similar to those in the centers of distant active galaxies and quasars -- processes which Hubble is now revealing in great detail for the first time.

Panelists will be:

* Dr. Jeffrey Hester, Arizona State University,Tempe, AZ
* Dr. Paul Scowen, Arizona State University, Tempe, AZ
* Dr. Bruce Margon, University of

Washington, Seattle

* Dr. Anne L. Kinney, Space Telescope Science Institute, Baltimore, MD

* Dr. Steve Maran, Goddard Space Flight Center, Greenbelt, MD

The Space Science Update will be carried live on NASA TV with two-way question-and-answer capability for reporters covering the event from participating NASA centers.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz. Audio of the broadcast will be available on voice circuit from the Kennedy Space Center on 407/867-1260.

Letter from the Editor

I wanted to go over the rules of submission for the newsletter to save any and all article submitters and myself some work. Lately I have had to do a lot of editing and resizing etc. to make things fit properly in the newsletter. Here are some simple rules that will make things easier for all concerned.

First of all the deadline for submissions for the next newsletter will be June 25/96. The purpose of the deadline is so that I am not rushing around trying to get the newsletter done. As I explained awhile back I have become very busy and have to schedule when I can work on the newsletter. Anything received after the deadline will appear in the next newsletter. The deadline for this newsletter was the 27th of May so if you submitted something later than that it will appear in the next newsletter.

Secondly, when submitting an article please write it in 10 pt. type Arial or any standard font. Although it is tempting to submit fancy letters etc. it makes my life tough because I have to redo everything to get it to fit into the newsletter format. Keep it as simple and straight forward as possible as I also scan most submissions that are typed and the simple font makes this process quicker. The font that I use for the newsletter is a 10 pt. Times New Roman.

Number 3: Keep the articles that you submit to a maximum of 400-500 words. Lengthy articles of three and four pages are to long for the type of format that the Saskatoon Skies has. I like to put as many different articles into the newsletter as possible and lengthy articles eat up valuable space that could be used for other articles or announcements. Try to keep all submissions within these guidelines. The articles are greatly appreciated but keeping them down to a managable level is in order. For future newsletters lengthy articles may be edited to fit space availability.

Number 4: I always put what I want to have in the newsletter together by the 20th of each month. This month I had to redo the entire newsletter due to the submission of articles arriving right on the last day. I love to have these problems but it does create alot of work for me. For the next newsletter I will appreciate a call around the 20th of the month from anyone submitting any articles as to how many and how big the articles will be (approx.). This way I will know approx. how much space to leave for submissions. Please let me know by the 20th of each month. By leaving the approx. amount of space needed for your articles I can get about 75% of the newsletter out of the way by the time I receive your articles, thus saving me a great deal of much needed time.

Number 5: If you want to submit you articles on disk please do so on a 3.50" DD or HD Disk. Please save the file as a .doc file. This should allow me to drop it into my program and edit from there. If you do not have a computer please type it out and I will scan it in.

Number 6: When you submit an article please do not double space it. Also please do not leave lines between paragraphs as I have to delete these out when I am editing.

Number 7: If you have charts or sketches to submit with an article please try to get the article to me before the deadline so that I will have time to scan and edit it.

Enough of that. I hope that these tips will make it easier for all submitters of articles. I am hoping to change the design of the newsletter next month so watch for it. I was very surprised and disappointed in the flop that our swap meet turned out to be. Only four people actually brought things to trade. The lack of participation was a real surprise for me as I published the time for the swap meet for two issues of the newsletter. I was one of those there and I had lots of goodies to swap. I could have brought a lot more but I am glad that I did not.The turnout was terrible!

Speaking of another idea that took a real nose dive was my idea about getting members to send in a photo of their scope along with a couple of notes about your scope and what you like to observe. This would have been a great way for members to get to know each other better and to learn what type of equipment other members are using. The Spider that has built a web in the newsletter mailbox is getting lonely.

We have lost the printer who was doing up the newsletter for free. They were a small outfit and it turns out that they were actually sending out the newsletter and getting it copied at a copier place and paying for it. I am currently getting it printed at Staples which is not bad. It takes about half an hour to get the finished copies. I am looking around for a company who will do it for free but so far no response. Ideally the company should have access to a high speed copier so that the newsletter does not ties up their copier all day. If anyone nows of a copier place who would give us a heck of a deal (like free) let me know.

Gordon Sarty sent in an update with prices for silvering a mirror but as I had already redone the newsletter and had no room left I did not include the price list. I will republish the article complete with price list next newsletter.

Articles for Sale

For sale: One 60 m.m. refractor on an equitorial mount. $100.00. Two light weight plastic tubes approx. 65" long suitable for mirrors up to 8". These tubes would be idea for lightweight scopes. Take both for $30.00. Call 384-3127 for details.