

SASKATOON SKIES

Volume 23, Number 4

April 1993

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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 month's deadline is Friday, April 30, 1993. Please have any submissions in to Mike Wesolowski 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 some typing. Mail or bring your submissions to:

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 1813 Easthill,
 Saskatoon, Sask.
 S7J 3C2
 phone: 373-0137 (home)

OR

Saskatoon Centre RASC
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 931-3425 (work)



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

Minutes of the March Executive Meeting
 University Observatory
 March 15, 1993

Attendees: Jim Young, Ed Kennedy, Sandy Ferguson, Gordon Sarty, Mike Williams, Bill Hydomako

ITEM	DETAIL	ACTION
1.	Meeting called to order, 7:06 PM	B. Hydomako
2.	Note correction on Item No. 1 in the minutes of the executive meeting held on Feb. 15, 1993. Should read: "Term deposit for the telescope: free up \$1000.00, put additional \$3000.00 into another term <u>certificate</u> ."	M. Williams
3.	We will keep the telescope funds in short term certificates to maximize interest but keep it available for telescope construction.	M. Williams
4.	Congratulations to Sandy Ferguson for taking on the National Astronomy Day Coordinator position for 1994.	Jim Young
5.	Reading of a letter from D. Lemay on MIAC Reporting. [More info. about this on page 6 - Ed.]	S. Ferguson
6.	Some good response from Wanuskewin on working with them.	S. Ferguson
7.	Astronomy Day preparations are proceeding including a star night on May 1.	S. Ferguson
8.	Submissions for the May newsletter should be in early due to the absence of the editor at the end of April and beginning of May.	G. Sarty
9.	Saskatoon Centre may want to get "The Universe in the Classroom" to aid in our programs with the schools.	Ed Kennedy
10.	Meeting adjourned 7:40.	B. Hydomako

Minutes of the March General Meeting
 Room B-111, Health Sciences Building
 and
 Room 144 Kirk Hall
 March 15, 1993

ITEM	DETAIL	ACTION
1.	Called to order. 8:01 p.m.	R. Huziak
2.	Introduction to tonight's meeting and presentations.	R. Huziak
3.	Letter from National on not receiving the secretary's report and the list of officers for the Centre.	R. Huziak
4.	Received a letter from National on the G.A.	R. Huziak
5.	The Centre address has been changed again as noted in the newsletter.	R. Huziak
6.	First presentation by Sandy Ferguson: Astronomy for Beginners.	R. Huziak
7.	Second presentation by Mike Wesolowski: Slides on the Dec. Lunar Eclipse.	R. Huziak
8.	Meeting adjourned to Kirk Hall for the Saskatoon School Board's STARLAB.	R. Huziak

LETTER TO THE EDITOR

Mr. Editor,

I was very impressed with the March issue of "Saskatoon Skies". I found this issue to be very informative and especially useful with the large number of finder charts. There was an excellent mix of general interest, observing and information articles. I know that the extra pages make the issue more expensive in copying and mailing costs, but I think the extra information was worth it. In our current financial state however, it would not be feasible to issue such an extensive newsletter every time unless we can get some advertising or other income that can offset the newsletter costs.

Rick Huziak

EDITOR'S NOTES

Thanks for the letter Rick. I would certainly like more space to work with so any potential (paying) advertisers anyone can send my way will be welcomed.

I will be away at the end of April and beginning of May so Mike Wesolowski has agreed to do the newsletter for May. Thanks Mike! Please send your submissions to Mike (address on front of this newsletter) for May's newsletter.

The March General Meeting was very interesting with Sandy's presentation about Leo (among other things) for beginners, Mike Wesolowski's slides of the December total lunar eclipse and the STARLAB portable planetarium. Afterwards, Sandy got some charts for some variable stars for me, including R Leonis which she talked about in her presentation. I'm always looking out to expand my personal collection of variable stars — they're easy to watch from the middle of Saskatoon where I live!

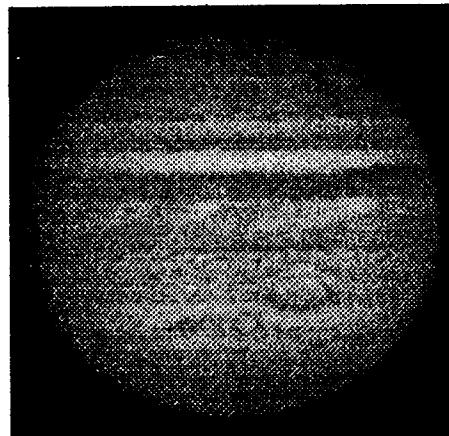
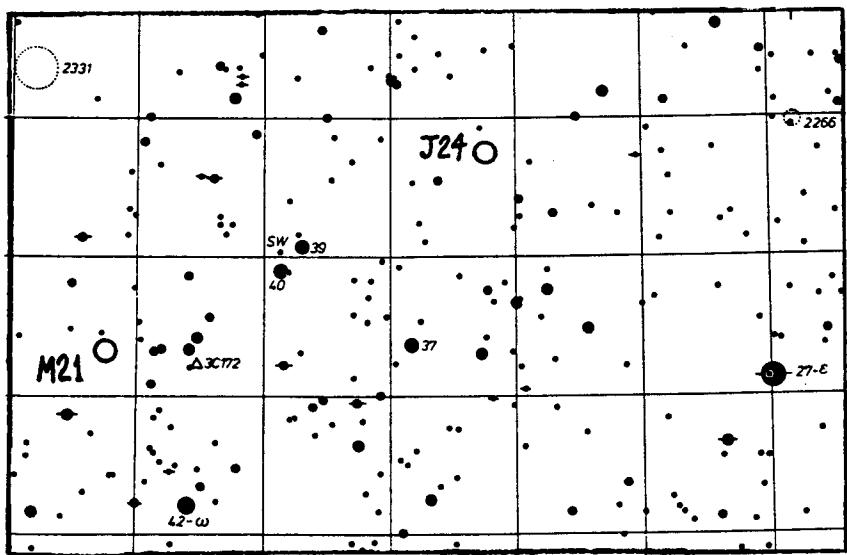
We also had a great turn-out at the March Observer's Group Meeting. Although the aurora became brighter as the evening progressed, we still managed to find some of the brighter galaxies in the spring sky via the Centre's 12.5 inch Eetook telescope and Scott Alexander's 14.5 inch telescope. We even managed to get a look at Comet Schaumasse. To all who came out; hope to see you again at future observing nights!

Speaking of the Observer's Group, Scott Alexander seems to continually find galaxies near Mars! He found one at the January 23/24 meeting and one again at the March 20/21 meeting. As I've said in the February newsletter, we thought that we were seeing 3C172. Well, I've done a little detective work and it seems that we saw 3C172 again at the March meeting! I've calculated the following positions for Mars: Jan. 24, 3:00 UT — RA $6^h 53^m$, Dec $26^\circ 52'$; Mar. 21, 3:00 UT — RA $7^h 5^m$, Dec $25^\circ 19'$ (1993 coordinates). These positions are plotted below on map 138 of *Uranometria 2000.0* which also shows the position of 3C172. Since each square on the map is a square degree, I'm tempted to believe that we saw 3C172 in March but not in January since the "galaxy" was in the same field of as Mars each time. What do you think Scott?

The star planet this month (bad pun) is Jupiter which now shines brightly in the evening sky. Jupiter normally has two brownish equatorial belts but one seems to be missing this year. You can check this out for yourself in almost any telescope. Venus has passed between the Sun and the Earth to become a morning star. I tried to find it in the daylight with my 8 inch telescope during the day on March 31 and April 1 but without luck. I guess there must still be a lot of volcanic ash high in our atmosphere to block the view. Mars is still in the evening sky and is trying to escape from Gemini (or just figures it's time to leave).

From the Calgary newsletter, I've found dates for the following events: Texas Star Party, Prude Ranch Texas, May 16-23; Alberta Star Party, Little Fish Creek Prov. Park, Alta., Aug. 11-15; Mt. Kobau Star Party, Mt. Kobau, B.C., Aug. 18-22. Ask around the Centre if you want more information.

Don't forget the daytime occultation of Venus by the Moon on April 19. See page 5 of the January issue
for more information.
Gordon Sarty



Jupiter from the Hubble Space Telescope on May 28, 1991.

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ASTRONOMY DAY 1993

Mark this on your calendar! May 1st is Astronomy Day and, as always, the Saskatoon Centre will feature a display at a local mall. This year, Sandy Ferguson is the Astronomy Day Coordinator. She has chosen Market Mall as the site.

Astronomy Day is a great opportunity for new members to participate in a Centre activity and provides an excellent chance to talk to other members and the general public about astronomy. Volunteers are needed to attend the displays, so don't be shy about giving Sandy a call to tell her you will help out for at least a few hours. We will need help getting equipment from the Rystrom Observatory at about 8:00AM, setting up at the mall at 9:00AM, attending the displays until 5:00PM, then tearing down. Featured in the displays will be a good selection of astronomy books and atlases, a great slide show, and an amazing variety of telescopes, from 2 inches to 17 inches. Also featured, will be my 6" John Dobson Solar Telescope, set up in the parking lot, weather permitting. I will need help with this telescope for relief and crowd control.

We are also planning a Public Star Night the evening of May 1st in Diefenbaker Park. Members are also encouraged to participate in this if they can, and to let Sandy know ahead of time, so she can make provisions for the number of people participating. It will be held in the same location that we hold the July Public Star Night.

I will promote Astronomy Day and the Public Star Night on CFQC TV with Carol Blenkin on her 11:00AM show on April 30th (live from Market Mall), if you want to watch.

I hope to see a lot of members participating in this display. It is more fun than hard work, and it is important, as we usually attract a few new members through our presence. If you can't help out, I hope to see you drop by the display anyway to see what we're doing. Sandy will be away until about April 23rd. If you can help out with the display in any way, let me know at the next General Meeting, or call me at home (665-3392). After the 23rd, please call Sandy directly (382-0898).

Rick Huziak

UNIVERSITY OBSERVATORY HOURS FOR APRIL

The U of S Observatory will be open to the public on Saturday evenings from 9:30 to 11:30 p.m. during April. Visitors will be able to view Mars, Jupiter 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.

NOTICE OF OBSERVERS GROUP MEETING

The next Observer's Group meeting will be at the Rystrom Observatory at 9 P.M. on Saturday, April 24, 1993, weather permitting. To find the Observatory, drive south on hiway #11 to the Grasswood Esso station and drive-in, turn left past the KOA campground and head down the road approximately 1.5 miles to the last mailbox on the right before the railway tracks. The mailbox is the Rystrom's. Go down the driveway past two homes and around the large equipment building to the right. Be sure to dim your lights. In addition to the observers group meeting, members are welcome to visit the Rystrom site at any time provided you phone ahead. The number to call is 955-2370, ask for Nelson or Gloria. If you do not have a key, find a member who does and talk them into a trip to the dome. After you have been checked out on the equipment there you are entitled to a key of your own.

SOFTWARE DEMOS AT APRIL'S GENERAL MEETING

The March General Meeting will take place on Monday Evening, April 19, 1993 at 8:00 P.M. in Room B-111 of the Health Sciences Building. This month's presentation is a demonstration of **Planetarium Programs and other Astronomy Software** by Centre member Jim Young. The programs that he will be demonstrating include: *Skyglobe*; *Silicon Sky*; *Sky for DOS and Windows*; *Stargaze*; *Megastar* and; *Superstar*. We will be able to see these programs in action on a larger-than-life video projection system hooked directly to Jim's computer!

Executive members are also reminded to attend the Executive Meeting one hour before the General Meeting at 7:00 P.M. at the University Observatory.

1993 GENERAL ASSEMBLY

Mary Lou Whitehorne, Chairman, 1993 GA Organizing Committee, writes:

"On behalf of the Halifax Centre RASC, I would like to extend an invitation to all members of the Society to come to our fair city for the 1993 General Assembly from Friday, July 2 to Monday, July 5, 1993.

"The location will be Mount Saint Vincent University on the shores of the beautiful Bedford Basin. The Mount offers a variety of accommodations (both single and double) in their student residences, all located in a relaxing, park-like setting. All facilities required for a successful GA are to be found at the Mount; meeting and assembly rooms, meals, banquet facilities, and accommodation. The Mount is located within minutes of Halifax's downtown core and is on local transit routes."

Many, many activities are planned for the GA but newsletter space is limited, so please contact Rick Huziak at 934-1676 (work) or Gord Sarty at 665-3392 for more information and registration forms. Mary especially wanted everyone to know about the *Ruth Northcott Memorial Lecture 1993* by David H. Levy on "**THE ART OF COMET HUNTING**" to be presented on Sunday, July 4, 1993 at 9:00 pm in the Seton Academic Centre, Auditorium B, MOUNT SAINT VINCENT UNIVERSITY, Halifax, Nova Scotia. Other activities include displays, local site-seeing tours and a Murphy Slide Show / Song Contest / Astrocomical Joke Telling session.

Also, there is a **Call for Papers** for the GA. If you are interested in doing a presentation at the GA, send your name, address, and an abstract of your talk, with a short biography of yourself, to the address listed below. Also, please indicate if you require any special presentation equipment. Papers should be limited to ten minutes in length and, schedule permitting, there will be a five minute question period after each speaker. There may be a limited number of twenty minute time slots available for longer presentations but these will be allotted on a first come, first serve basis. Send your response to: **RASC 1993 GA Paper Session, c/o David Chapman, 8 Lakeview Avenue, Dartmouth, Nova Scotia, B3A 3S7**. Or via E-MAIL to CHAPMAN@MAGGIE.DREA.DND.CA

ATTEMPTING VENUS DURING INFERIOR CONJUNCTION

On April 1st, Venus was at inferior conjunction. Since this was a work day, I took my telescopes to work, hoping to observe this interesting phenomenon at noon as I did two years previously. On the way to work, I had a thought (this in itself is rare). Since there are 5 RASC members at SED Systems (where I work), I thought it might be a good idea to solicit their help and throw a mini "sun-Venus day". After consulting with Mike Wesolowski, Bill Hydomako and the others, I decided to post a message on E-mail and invite everyone in the company to view Venus and the sun at noon. I was, however, smart enough to throw in the disclaimer "weather permitting".

At noon, Mike and I set up my 4.25" reflector for Venus, and my 6" JD solar telescope for the sun. Unfortunately, thin cloud around the sun made finding Venus impossible, but the people that did come out got a reasonable view of the sun. Some wondered what that dust on the eyepiece was. I told them it was sunspots (which was true). Unfortunately, a few people thought my E-mail message was an April Fool's joke and didn't come out, but all in all the impromptu sun-Venus day worked out quite well. I may end up doing it again in the future.

Anyhow, I hope to find Venus in the next few days, still only a few percent illuminated. It's a wonderful sight, but be careful with the sun so close by!

Rick Huziak

THE BEGINNER'S OBSERVING GUIDE - STILL AVAILABLE

1992 edition, 116 pages, softcover, spiral bound comes complete with 1993 supplement

This publication by long-time RASC member, Leo Enright, is just what the beginning observer needs. It has clear and concise descriptions of what to look for, how to see it and what instruments to use. It emphasizes using your eyes, binoculars and small telescopes. The BOG is a great value and excellent resource for the beginning amateur astronomer. And, at \$5.35 (G.S.T. included) you can afford to buy one for a friend.

The BOG will be available at General Meetings, or call Rick at 665-3392 to receive your copy. Please include an additional \$1.60 postage if you want the book mailed to you. Make cheques or money orders payable to "Saskatoon Centre, RASC".

METEORITES AND IMPACTS ADVISORY COMMITTEE - MIAC

We want Fireball reports! Damien Lemay and Dr. Robert L. Hawkes are collecting fireball data on behalf the "Meteorites and Impacts Advisory Committee" (MIAC) of the Canadian Space Agency (CSA). Fireballs are very bright meteors which have a chance of making it to the ground before completely vaporizing in the Earth's atmosphere. YOU can help if you or anyone you know of has seen a fireball recently. Simply interview the person who has seen the fireball, collecting the information required to fill out the *MIAC Reporting Form* printed below and forward the information to me (374-8803) or Kim Mysyk (374-2485). If you do not feel you can conduct such an interview, let us know and we will interview the fireball observer. We are especially interested to know if anyone saw the fireball of last December 16.

Also call Kim if you are interested in actually looking for fallen meteorites (see his article on page 11 of the March *Saskatoon Skies*). Below is the *MIAC Reporting Form*:

MIAC FIREBALL REPORT FORM

FIREBALL REPORT FORM (fill in as much as possible)

Observer's name:
Street:
City: Province:
Postal Code:
Phone, home: work:
Fax: Others:

CIRCUMSTANCES OF OBSERVATION

Year: Month: Day:
Time (0-24 hours) Hour: .. Min: .. Time zone: ...
Cloud conditions (* one): none[.] 25%[.] 50%[.] 75%[.]

If possible, provide coordinates from a topographic map.
Latitude: ... degrees, .. min, .. seconds
Longitude: ... degrees, .. min, .. seconds
If not, describe location in relation to roads, building, etc.:

FIREBALL PARAMETERS

Beginning point of fireball (complete a or b or both)
a) elevation: .., bearing (0 =north; 90 =east): ...
b) right ascension: .., declination: ...

Ending point of fireball
a) elevation: .., bearing (0 =north; 90 =east): ...
b) right ascension: .., declination: ...
Alternatively provide description of trail position relative to stars

Ending point of fireball was visible [.] or obstructed by horizon [.]
If possible, provide apparent magnitude estimate:
If not, estimate distance (in m) away from "100 W" incandescent bulb for

comparable luminosity?

Or comparison with full moon (* one)
much less bright[.], less bright[.], about the same[.], much brighter[.]

Approximate duration in seconds: ...

Apparent speed (compared to others meteors, * one)
slow [.] medium [.] fast [.]

Form of trail (* one) smooth light trail [.] flare [.]

Description of fragmentation:

Colour:

Persistent train (* one) Yes [.] No [.]

If a persistent train, approximate duration of persistence: ... sec.

Sound (* one) Yes [.] No [.]

If yes, time delay from appearance of fireball: ... sec

If yes, type of sound (* one) sharp [.] smooth [.] staccato [.]

Report collected by:

Email: telephone: home

..... work, fax:

Address:

Notes:

Use whatever space you need to further describe what you saw.

Gordon Sarty

FOR SALE: 10" f/5.6 Dobsonian reflector with Coulter optics. This telescope breaks down into easy to carry components that will fit in a compact car. It is a closed tube design with teak veneer panels, hand made with care and next to new. A Novak 2" helical focuser and a one-power fiber-optic finder included. Purchaser will have the choice of a 1.25" eyepiece at an excellent price. The optical parts and other materials cost over \$600. Yours for \$750.

6" f/7 reflector and German Equatorial mount with sealed bearings on 1" shafts. This is a homemade instrument with a mirror ground from an Edmund Scientific kit. It could use some paint and a better diagonal holder. It has a good Meade rack-and-pinion focuser and gives sharp planetary images. Body by Sonotube. \$250 or without the mount for \$175. German Equatorial mount with sealed bearings and 1 9/16" shafts. This would hold at least a 14" scope with no problem. No legs or pedestal included, mount head only, but it weighs sixty pounds as it is, \$150.

Two Coulter 10" f/5.6 mirrors unopened in shipping boxes, \$140 each. New Coulter diagonal 1.83" for 10" mirror, \$16. 2.00" diagonal, used, \$25. 2.60" diagonal, used, \$40. New Novak 1.83" diagonal holder, \$18. 1.83" diagonal holder, used, \$10. 2.60" Novak diagonal holder, used, \$20. 2.60" diagonal holder, used, \$10. New Novak straight vane spider for 10" mirror, \$18. 32 mm. plossl eyepiece kit consisting of two 1" diameter doublet lenses, \$25.

Allen Walker, Box 88, Plato, Sask. 1-378-2731.

THREE SPACECRAFT TO CONDUCT 3-WEEK GRAVITATIONAL WAVE SEARCH

Three interplanetary spacecraft, now headed quietly toward Mars, Jupiter and over the poles of the sun, soon may prove the existence of elusive waves in the universe's gravitational field by bobbing on ripples in space like corks bobbing on ripples in a pond.

Such waves of gravity have never been directly detected, although their existence was predicted decades ago in Einstein's theory of relativity and there is indirect evidence that they exist. The waves are believed to be produced by supernova explosions, collapsing black holes and other catastrophic events. Past searches with ground-based equipment and single spacecraft have failed to discover them.

Astrophysicists are hoping to make this major discovery by spending the next few weeks "listening" for passing gravitational waves with three "borrowed" spacecraft at the same time in the most sensitive detection system yet assembled to search for very low frequency gravitational waves.

The spacecraft, now on their way to separate destinations in the solar system, are NASA's Mars Observer, Galileo and the European Space Agency (ESA) Ulysses spacecraft.

The joint NASA-ESA experiment will run from March 21 to April 11, marking the first time three spacecraft will make observations simultaneously, greatly increasing the reliability of any detection.

"If this experiment succeeds in detecting gravitational waves it may answer fundamental questions about the nature of gravity as well as give further support for Einstein's theory of general relativity," said Dr. Robert Stachnik, Gravitational Wave Program Scientist in NASA's Astrophysics Div., Office of Space Science, Washington, D.C.

"We're also very excited about the possibility of making a major discovery with such a cost-effective experiment. We were able to take advantage of three spacecraft already in space which soon will be in the correct relative positions and distances we need to do this experiment. We can just borrow them for a few weeks, without any added cost for equipment and no change to their missions. It's big science on a small budget," Stachnik said.

"Einstein predicted the existence of gravitational waves in his theory of general relativity, and radio astronomy observations of pulsars have suggested they indeed exist – but no one has ever detected a gravitational wave directly," said Dr. John W. Armstrong of NASA's Jet Propulsion Laboratory, Pasadena, Calif., who will work with the Mars Observer and Galileo spacecraft.

The experiment is built around a simple concept. During the 3-week experiment, the antennas of NASA's Deep Space Network (DSN) on Earth will beam radio signals to the three spacecraft at precisely known frequencies. Each spacecraft will send signals back to Earth at the same frequency it receives. If no gravitational waves are passing through the Solar System, the signals returned to Earth should have exactly the same frequencies as the original signals sent from the DSN, shifted only by the Doppler effect of spacecraft motion.

However, if a strong enough gravitational wave passes – produced perhaps from collapsing masses of stars in the hearts of galaxies or from the spiraling together and collision of two black holes – both the Earth and the spacecraft will experience a slight "bobbing" from the ripple-like passage of the gravitational wave. This interaction cannot be directly detected at either the Earth or the spacecraft alone, but would show up as a slight change in the frequency of the radio signal finally received back at Earth.

The hydrogen maser clocks that control the DSN transmitters and receivers are so accurate that scientists will be able to detect a change in radio frequency of as little as a few parts in a quadrillion (a quadrillion is 1 followed by 15 zeroes).

"This should allow us to detect gravitational waves from objects such as massive pairs of black holes hidden in the hearts of other galaxies," said Hugo D. Wahlquist of JPL, who will work on the Ulysses spacecraft with Sami W. Asmar of JPL, Prof. Bruno Bertotti of the University of Pavia, Italy, and Prof. Luciano Iess of the University of Rome La Sapienza.

Scientists emphasize, however, that snaring a gravitational wave during the 3-week experiment will depend on a good bit of luck – whether a suitable astronomical event happens to occur during the relatively brief opportunity when data can be taken. All three spacecraft will be in the Earth's night sky at that time, so interference with their radio signals due to charged particles in the solar wind will be at a minimum.

Successful detection of gravitational waves could open up an entirely new kind of astronomy. Because the gravitational waves do not readily interact with matter, detecting them may open a window to the interiors of powerful – and sometimes catastrophic – events such as supernova explosions and collapsing black holes.

"Gravitational wave research is now in the hands of physicists. Once signals are detected, the astronomers will be beating down the doors," said Stachnik.

Sensitive ground-based interferometer antennas now are being built in both the United States and Europe to search for gravitational waves with wavelengths of thousands of kilometers.

"In addition to searching for the shorter waves that can affect antennas here on Earth, we now will be using radio signals sent to spacecraft hundreds of millions of kilometers away to search for waves of much longer wavelength," said Dr. Frank B. Estabrook of JPL, who will work with the Galileo spacecraft.

Detection of the gravitational waves, even if they occur, will still take at least several months of patient data analysis. "The spacecraft systems can detect large enough gravitational waves, if they exist," said Dr. Bevan M. French, Program Scientist for the Mars Observer. "But it won't be one of those sudden 'Eureka!' situations. We'll be looking for a few small wiggles in a huge amount of radio data. It will take time."

To identify the unique signals of gravitational waves, the scientists also will have to eliminate such mundane effects as planned changes in the orientation of the spacecraft, interference from charged particles (plasmas) in space and even atmospheric changes, rain and snow on Earth.

Mars Observer, launched in September 1992, will reach the Red Planet Aug. 24 of this year. Launched in 1989, NASA's Galileo spacecraft will arrive at Jupiter in 1995. The ESA Ulysses spacecraft was launched in 1990, and it will fly over the sun's poles in 1994 and 1995.

Gravitational wave research is supported by the Astrophysics Division of NASA's Office of Space Science and by each of the three spacecraft projects, which scheduled the radio searches during their interplanetary cruise periods.

- From: yee@atlas.arc.nasa.gov (Peter Yee).

SPRING CLEANING OPTICAL SURFACES

The one thing astronomers dread the most is finding that it is necessary to clean optical surfaces on their telescopes. Optics can be permanently scratched and aluminizing removed by the most well intentioned cleaning process. Telescope surfaces should be cleaned only when very necessary, and then with the greatest caution! Moderate amounts of dust, lint, etc., don't affect the observed image. Preventative measures can help avoid frequent cleanings.

When storing your scope make sure to keep the dust covers in place on both ends including your eyepieces. Shower caps can be used but must fit tightly, green garbage bags also work well. A small plastic bag secured with a rubber band will work for the eyepiece opening on your telescope; any unused holes in the telescope can be filled with silicone.

When setting up your telescope leave the dust covers on until you are ready to use it. Use your red flashlight in dim starlight to remove and replace them. Oils from fingers and eyelashes can become a problem. When showing your guests where the eyepiece is, point with the back of your finger. If you touch the eyepiece with your fingernail, you won't leave a finger print on the surface and guests won't touch the eyepiece while asking where to look!

If there is dust stirring up in your viewing area such as cars approaching on dirt roads, apply the dust covers until the dust settles. When finished viewing for the night, aim the scope downwards with the dust covers in place. Finally, don't leave your scope aimed towards the east. If the dust covers were to become dislodged overnight, the morning sunlight may come streaming through your optical system, melting seals, fracturing optics and possibly starting a prairie fire!

Most standard reflective surfaces are now coated with aluminum rather than silver which tarnished. Hard overcoatings of Beral or Silicone Monoxide are applied to protect the surfaces from damage. To check for the presence of an overcoating a pencil eraser may be rubbed on the edge of the reflective surface. If the surface is not overcoated, the aluminum will be removed by the eraser. Then you will know that you should use extra care not to scratch the surface when cleaning.

Eyepieces and some other refracting lenses also have protective overcoatings of antireflective compounds. If your eyepiece lenses apart easily, fine, if not, don't force them. Do the best cleaning you can with the lenses intact.

After carefully removing the optics to be cleaned from the scope the first procedure is to remove dirt and grit; this is what scratches the surface. Dust can be blown off using canned air available at photo shops. Dust can also be brushed off using an uncut camel hair brush available at art or photo shops. Lightly flick the dust off from the surface of the optics. Blowing with your mouth should be avoided since you can get drops of saliva on the surface.

Often just dusting off the optics will be enough and any additional cleaning can be avoided. You will want to assemble your cleaning materials before you start so you won't have to set objects down when they could be scratched, roll away or have someone else interfere with them. Jewelry may be removed to avoid accidental contact and scratching of a surface.

For eyepieces A professional lens cleaning fluid from a photo shop or a homemade mixture of:

- 1) 1/3 Isopropyl (rubbing) alcohol - cleans oils and grease
- 2) 2/3 Distilled water - to dissolve inorganic residue
- 3) A few drops dishwashing liquid - cuts surface tension that causes beading
- 4) A new or very clean spray bottle to apply the solution
- 5) Surgical cotton

White unscented tissue is used by some brave astronomers but caution is advised since many tissues contain abrasive fibers.

The homemade solution works well and if, after blowing or brushing dust off, it is still necessary to wash, spray the solution onto the surgical cotton. Don't spray it directly on the eyepiece since they may not be sealed or waterproof. Now wipe lightly across the lens with the dampened cotton. Large lenses or corrector plates should be cleaned in small pie-shaped areas to avoid letting sections dry before you're finished. Use fresh cotton for each section. Any streaks that appear can be polished off by "haa-ing" the surface with your breath and then gently wiping it off. Any cotton fibers lingering on the surface can be blown off when it's dry. Slight streaking will not hamper the image and it's better to leave them on than to over polish and risk rubbing off the finish.

For reflective surfaces 1) Canned air or uncut camel hair brush

- 2) Sink for tap water rinse
- 3) 1 or 2 gallons of distilled water
- 4) The home made cleaning solution
- 5) Surgical cotton
- 6) A pan for the sloshing process
- 7) 3 towels or old clothes to line the pan, sink and to set the mirror on to dry

First, carefully remove the mirror from its mounting cell. Then remove the dust with a blast of air or with the uncut camel hair brush. Next, place the mirror on a towel in the sink under running room temperature tap water to wash off stubborn debris. Now place the mirror in the towel lined pan and fill the pan with the home made solution. Slosh over the surface lightly with wet cotton. Don't rub! Then rinse the mirror under tap water. If you're not satisfied, repeat the process. Finally, rinse with distilled water and set the mirror on edge on a towel to drain. You can chase any water droplets off using canned air. Small spots will not bother the image and it may be best to leave them until the next cleaning. Don't attempt to frost the mirror with your breath unless it is overcoated. During the process be very careful not to bump the mirror or touch the finish. When you're satisfied, remount the mirror on its cell and replace it in your telescope.

Do not use 1) Scented facial tissue (they contain oils)

- 2) Lens paper (the fibers may scratch)
- 3) Synthetic cotton (the fiber shafts are not smooth)
- 4) Cut camel hair brush (the squared off ends have corners that can scratch)

Astronomers realuminize their mirrors when they lose about 20% of their reflecting ability. The time this takes varies with conditions such as air moisture and air pollution. Generally it takes one or two years. Telescopes that remain in storage most of the time will need to be realuminized less frequently; perhaps every five or more years. When you think it's time realuminize, get recommendations from other astronomers who've had it done.

On the return of your mirror, check for a good coating by holding it up in front of a light or the Sun and looking for pinholes in the aluminum. If the realuminizer did not remove all the previous coating, the new aluminum will come off with water and will have to be redone. Good luck and happy spring telescope cleaning!

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(Adapted from an article by Roger Tuthill.)