SASKATOON SKIES

Volume 22, Number 5 May, 1992

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Saskatoon Skies Information

Next month's deadline is Friday, May 29, 1992. Please have any submissions in to me by then in order to be included in the next issue. Saskatoon Skies is a monthly publication of the Saskatoon Centre of the Royal Astronomical Society of Canada. Submissions may be sent to one of the following:

Mike Wesolowski
1813 Easthill
Saskatoon, Sask.
S7J 3C2
373–0137 (home)
931–3425 (work)

OR

Saskatoon Centre RASC
Box 317, Sub P.O. #6
Saskatoon, Sask.
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Submissions mailed to the Centre's address may not be retrieved in time for inclusion unless you tell me it's there.

NOTICE OF OBSERVER'S GROUP MEETING

The date of the next Observer's Group meeting has not been set but I suspect it will be either Saturday, May 23 or May 30. The date will be set at the next General Meeting. New members are especially encouraged to attend. Note that the new eyepieces have arrived and will be available for test drives. They are located in the warmup shelter on the south shelf near the sign–in book. Richard Huziak says the 32mm Konig II will "blow your mind with both eyes open!" For information about the date or how to find the observatory, you may contact the editor at 373–0137 or 931–3425.

NOTICE OF MAY'S GENERAL MEETING

This notice is intended to inform you that ***there will not be a meeting on the third Monday in May (May 18) as would normally be expected. The meeting date has been moved to Monday, May 11 in order to avoid the holiday long weekend.*** The meeting will be held in Room B–111 of the Health Sciences Building at 8 P.M. as usual. The program has not been set but will likely include a videotape.

EDITOR'S NOTES

1) Observant readers will notice that there are no meeting minutes this month. The reason for this is that there was no General Meeting in the usual sense last month, nor was there an executive meeting due to a lack of a quorum. The regular General Meeting was replaced by the lecture about meteorite impacts by Dr. Richard Grieve at the Biology/Geology lecture theatre.

2) As noted elsewhere in this issue, the May General Meeting has been moved up to May 11, due to the holiday long weekend. Note that this is 2 days after Astronomy Day, information for which is available elsewhere in this issue.

3) It's hard to believe, but the Hubble Space Telescope has been in orbit for just over two years. Following the initial horror (not to mention disgust!) of discovering that the main mirror of the telescope had not been figured correctly, users have managed to obtain data nearly as good as expected, due to some very clever image processing techniques. Observations of extremely faint objects are still not feasible, but the telescope is not nearly as bad as first expected. Hopefully the scheduled rescue mission will restore the telescope to nearly 100% usefulness.

GENERAL ASSEMBLY REMINDER

The next General Assembly of the Royal Astronomical Society of Canada will be in Calgary, Alberta, from July 1–5, 1992. For information, refer to the January issue of *Saskatoon Skies*, or contact RASC– Calgary Centre, c/o Ms. Dennis Goodman, 28 Southland Crescent S.W., Calgary, Alberta, Canada, T2W 0K3. Phone (403) 252–7095. Information is also available from the editor.

If you are at all interested in going, don't delay and don't make plans in isolation. It is likely that other members of the Centre will be planning to go too, so ask around!

ASTRONOMY DAY 1992

Astronomy Day 1992 has been set for Saturday, May 9. Sandy Ferguson has planned a full slate of activities for this day, including:

- a mall display at Lawson Heights Mall. This will include poster boards and a slide show, with a theme based upon light pollution. Of course, promoting our Centre is also a goal.
- viewing of the Sun using Rick Huziaks solar telescope. This will be set up outside of the mall, weather permitting.
- a star night at Diefenbaker Park.

Not unexpectedly, volunteers are needed for all three activities. No one is required to commit themselves for the entire day. Please give Sandy a call at 382–0898, or you can call the editor of *Saskatoon Skies* at the numbers given on the first page.

NEW PLANETS DISCOVERED!

In July of 1991, a group of astronomers reported that they had discovered what appeared to be a planet orbiting a pulsar (a pulsar is a star which has collapsed to a radius of 10 km or so, spins extremely rapidly and emits radio energy in lighthouse–like beams). This group subsequently reported that they had made a mistake; in their analysis of the data, they had neglected to remove the effects of the Earth's orbital motion, which resulted in the apparent presence of a planet in a six month orbit around the pulsar.

Subsequently, another team reported the discovery of *two* planets orbiting a different pulsar. In this case, the suspected planets are calculated to have masses of 3.4 and 2.8 Earths, and lie at distances of 0.36 and 0.47 astronomical units (a.u.) from the pulsar, respectively. The respective orbital periods are 66.6 and 98.2 days.

How did these astronomers discover the planets in the first place? How are the astronomers so confident of their results this time? The answers are really quite simple.

As noted above, a pulsar emits radio energy in a fairly narrow beam, which we would observe as bursts of radio energy as the beam sweeps across the Earth. It turns out that the period of the radio bursts is very nearly constant, being dependent upon how fast the pulsar is spinning. In the case of the pulsar with the two planets (PSR 1257+12 by name), the pulses arrive every 6.2 milliseconds, on the average. Observations over a period of time showed that these pulses sometimes arrived late and sometimes early. The trick was to explain how this could happen.

The answer lies in how two bodies actually orbit each other. Conventionally, one thinks of a planet like the Earth as orbiting the Sun, which is essentially fixed in position. In reality however, both bodies orbit a common center of gravity which lies somewhere on the line joining the centers of the two bodies. When applied to the pulsar system, this means that sometimes the pulsar is approaching the Earth and sometimes moving away from the Earth. This causes the frequency of the radio bursts (i.e., how often they arrive) to increase or decrease respectively. Measuring these changes in arrival times from the expected value, and performing some esoteric calculations, allowed the astronomers to conclude that there are actually planets orbiting the pulsar. In this case, because the data could not be satisfied by the simple sinusoidal curve one would expect if there were a single planet, calculations were made assuming the presence of two planets, which matched the data extremely well.

The story is not over yet. The astronomers reporting the discovery have made some predictions about how the radio signal from the pulsar will behave over a period of time. More observations will be required to determine whether or not the pulsar is behaving as expected. We'll know for sure in a few years.

For additional details, refer to the May, 1992 issue of *Sky and Telescope* magazine.

JUNE 15 PARTIAL LUNAR ECLIPSE

On the evening of Monday, June 15, observers in Saskatoon will be able to observe a partial lunar eclipse. This eclipse, with a magnitude of 69% will not only be more spectacular than the last partial eclipse visible from Saskatoon, the weather will probably be a lot more pleasant (the last eclipse had less than 10% of the moon covered, and maximum eclipse was at 4:30 AM on December 21!). Unfortunately, the eclipse will already be in progress when the moon rises for observers in Saskatoon; on the brighter side, it should make for an interesting moonrise.

The circumstances of the eclipse are as follows:

- Partial (Umbral) Phase Starts– 21:27 CST
- Moonrise – 22:06 CST
- Mid–Eclipse – 22:57 CST
- Partial (Umbral) Phase Ends – 00:27 CST (June 16)
- Penumbral Phase Ends – 01:45 CST (June 16)

The moon will be fairly low in the sky throughout the eclipse, as it will be located in the constellation of Ophiuchus. A low power telescope or binoculars is ideal for observing the eclipse. Some observing suggestions are given in the *Observer's Handbook 1992*, pp. 98–99.

You may also wish to attempt to take pictures of this eclipse. At the very least, a telephoto lens is recommended; a normal 50mm lens will result in a very small, 0.5mm image of the moon. There is no one solution for the exposure time to be used. From the *Handbook of Astrophotography for Amateur Astronomers* by G. N. Patterson, the equation for determining exposure times is

$$T\ (\text{sec}) = f^2/SB$$

where

T = exposure time in seconds
f = focal ratio of system
S = ASA/ISO rating of film
B = brightness of object being photographed.

A suggested value of B is 220 for a full moon, and 0.005 for the umbra. What proportions you use are up to you; one suggestion is .69(0.005) + .31(220) = 68 for maximum eclipse. You must also take into account the low elevation of the moon, about 15–20 degrees above the horizon at best. When the moon is just rising, it will be about 20 times dimmer than it would be if it were straight up. Even at its best, the moon will only be about 2/3 as bright as is indicated by the figures given here. The bottom line is that you should vary your exposure times by up to a factor of 2 in either direction in order to have a reasonable chance of getting a usable picture.

Good luck!

Mysteries of the Universe Explained !?!

Nasa announced on Thursday April 23, the Cosmic Background Explorer Satellite has discovered ripples of matter in the early universe that show how the Big Bang explosion expanded into the Galaxies, Stars and Planets that exist now.

Two years of data from the COBE satellite (pronounced COHBEE) shows the universe as it looked when it was only 300,000 years old. Cobe was launched by NASA on November 18, 1989 to search for early remnants of the Big Bang.

Images show huge clouds of matter more than 500 Million light years long that are beginning to condense. These structures are the largest and oldest objects ever seen.

Edward Wright of the University of California - Los Angeles exclaimed, "The Big Bang model is alive and well, very well!"

The new data seems to confirm the Big Bang theory - that a single point of infinitely hot matter exploded 15 to 20 Billion years ago and evolved into the entire universe that exists today.

Research team leader and Astrophysicist George Smoot of the Lawrence Berkeley Lab and the University of California - Berkeley said, "If you're religious, it's like looking at God!"

This new discovery was called the "Holy Grail of Cosmology" and a "triumph for Space Exploration" by other scientists.

Fluctuations Found in Background Microwave Radiation

The COBE data is the best evidence found so far to support the Big Bang theory. It shows small fluctuations (less than 1 in 10,000) in background radiation caused by ripples of matter when the universe was 300,000 years old. These structures somehow evolved from a younger, equally smooth universe.

Whole sky data from the COBE Satellite with the Milky Way taken away, shows ripples and lumps in the Microwave background radiation. After 15 to 20 Billion years the Big Bang has cooled down to ~2.735 degrees Kelvin. This is roughly 100,000,000 times cooler than the heat of a small pocket lighter!

Paul Willa of Georgia State University declared, "When you have these fluctuations, it means matter is not completely expanding with the flow of the universe, but pieces of it are able to turn around and recollapse and then make galaxies and eventually stars."

Astronomers still do not know how the Big Bang became the structures in the 300,000 year old universe. COBE data should tell us how this happened when it has been analyzed further.

Earlier COBE Data and Findings

Specific data from the two year COBE mission is not yet available to Amateur Astronomers. For comparison I have included information on COBE's sensors and their findings from the first six months of data that was made available in May 1990. Compare this information with the generalized findings from two years of data released on April 23.

Far Infrared Absolute Spectrophotometer - FIRAS measured the background radiation in the 60 to 600 Gigahertz range.

Early testing confirmed that the early universe's temperature closely follows the spectrum of a black body. A black body is an opaque object that absorbs all the energy that reaches it, and radiates exactly as much energy back into space.

Early FIRAS data shows early matter and energy had the same amount of energy and provides no clues to galaxy formation.

Differential Microwave Radiometer - DMR searched for differences in the magnitude of the cosmic background radiation.

Early studies at 31, 53 and 90 Gigahertz showed the early universe to be a smooth sphere of energy without variation.

DMR's data showed no evidence of early explosions that might have stirred up the universe, causing the galaxies to form.

Diffuse Infrared Background Experiment - DIRBE is a wide band instrument that looked for the infrared radiation of luminous primeval stars and galaxies that might have existed in the early universe.

Early tests at 1.2, 12 and 240 microns showed strong radiation but only from interplanetary dust grains in our solar system, interstellar dust and Stars; no early background structures were found in the initial data.

How Did The Galaxies Form?

Astronomers are now armed with new data to explain how the Galaxies, Quasars, Nebulae, Stars and Planets we see around us formed from the early uniformly smooth Universe.

Some Astronomers theorize that early objects exploded and caused shockwaves that created the galaxies we now see. These explosions would have caused structures in early COBE data.

Another possible explanation for the initial formation of the galaxies is Dark Matter; which is comprised of cold and hot dark matter. Dark matter is not visible on current astronomical instruments and it's existence is heavily debated.

Cold dark matter is a group of hypothetical large, heavy and slow moving particles (e.g. gravitons), that can bind together easily. Hot dark matter is different group of particles that has little or no mass, more energy per particle, travels near or at the speed of light (e.g. neutrinos), and are harder to bind together than cold dark matter.

Many Astronomers, including J. Richard Gott of Princeton University believe that the gravitational effects of dark matter are responsible for the initial ripples or structures of matter in the early universe. Gravity can move matter around without leaving residual thermal radiation that would show on COBE data.

How will COBE's data stir up this area of Astronomical research and our current theories on the amount and distribution of cold and hot dark matter in the universe?

Will we have to recalculate the gravitational effects of dark matter on galaxy formation and evolution?

Some scientists wonder if this new data will lend more weight to the Big Crunch - Big Bang theory. This theory predicts an infinite cycle of Big Bangs followed by Big Crunches.

Imagine an universe that starts with a Big Bang explosion that expands until gravitational forces cause it to stop. The Universe then collapses back until it is smaller than the period at the end of this sentence. At this point, the cycle starts again as another Big Bang explodes. COBE data may provide the information that proves or disproves this theory.

What Will Happen In The Future?

NASA promises that higher resolution images of the universe are on the way. The COBE satellite observed the early universe and as the data is manipulated and studied more information will become available.

New ground based microwave instruments are gathering data in conjunction with COBE. Scientists will continually refine all of this data into more detailed pictures as time continues.

George Smoot sums up the importance new COBE data, "This is really important; not only Scientifically, but Culturally! I mean this is, this is going to change our view of the universe and our place in it!"

A discovery of this magnitude, if found to be correct, is strong candidate for the Nobel Prize.

Daryl J. Rybotycki
Saskatoon Center, RASC
April 29, 1992

The 6th Annual

ALBERTA STAR PARTY 1992

The Tradition Continues

Journey to the land of the dinosaurs and view the mysteries of our universe from a dark site.

DATE: July 30-August 3, 1992
LOCATION: Kinbrook Island Provincial Park (South of Brooks, Alta.)
COST: $15.00 per Vehicle (no GST)

This year the Alberta Star Party will be held on our own private island located just south of Brooks, Alberta (one accesses this island by driving through Kinbrook Island Provincial Park). Facilities include the basics like water, toilets, and a group meeting area, but you are responsible for cooking your own meals. The island has been reserved from July 30-August 3, 1992. The $15.00 registration fee includes camping privileges for 1 or all 5 nights. Limited motel space is also available in Brooks. There will be evening lectures by local amateur astronomers on August 1 and August 2. You can also take day trips to Dinosaur Provincial Park which is north of Brooks. If you are interested in attending the 1992 Alberta Star Party please write to the address below.

Alberta Star Party 1992
c/o Murray Paulson
11 Gladstone Crescent
St. Albert, Alberta,
T8N 0W6

or phone (403) 459-1168 (Res.)