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Roy + Phyllis

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JANUARY MEETINGS

Two meetings will be held in January--on the second and fourth Fridays of the month. On the 9th, Dr. Martin Clutton-Brock will speak about cosmology, a specialty of his which promises to be very exciting. Discoveries in this field are occurring every day.

The second meeting, on the 23rd, will feature Hans Thater with his delayed talk on the moons of Mars, and Don Hladiuk with an update of the Viking Mars mission. Both meetings will start at 8:00 pm in Room 110, Lockhart Hall at the University of Winnipeg.

NEWS

Nova Cygni: a Little Unusual---The characteristic rapid brightening which resulted in the many thousands of amateur "discoveries" of the nova in Cygnus this summer was followed by an uncharacteristic rapid decline in intensity. This decline was as much as 1 magnitude per day at one point and within 2 or 3 days the position of the nova was no longer apparent to the eye. The consensus of international opinion is that Nova Cygni may require some re-thinking of established theories.

The nova is estimated to have increased 19 magnitudes in its rapid rise to fame (40 million times). Spectra taken around the world show complicated changes not observed in previous exploding stars. Infrared observations at the University of Minnesota showed an initial spectrum characteristic of thermal radiation (radiation due to the temperature of the object) but this changed later to one characteristic of interacting ions. Some theoretical calculations explained the light curve and the spectral changes by assuming it was not a close binary star as is the case for other novas. However observers later found a small variation in the brightness of Nova Cygni which indicated it was a member of a double system. This object is likely to keep the mathematicians busy for some time yet.

Requiem---A star is dying in the constellation Perseus--or perhaps being born. An infrared source designated CRL-618 appears to be an invisible, hot (above 32,000 degrees), condensed object surrounded by a dense cloud of dust and gas which does the actual infrared emitting. The star and cloud cannot be seen directly, but instead are viewed by their reflection from two large dust clouds farther away. While it may be the last stages of the implosion of a dust cloud (birth), the majority of scientists believe it is the initial stages of the formation of a planetary nebula. If this is so, CRL-618 would be the first planetary nebula caught just at the beginning.

ANOTHER COMET BRADFIELD ?

Wm. A. Bradfield of Adelaide, South Australia, has put his name on a fourth comet in the last 5 years. The newest, 1975p, will become visible to northern observers after January 1, but since the magnitude will be 5 or less, some optical aid will be necessary. As seen in the chart on the next page, the comet will pass just west of Altair on January 7. The positions in the table below are the latest available at the end of December.

Date	RA	Declination	Magnitude
Dec. 14	16h52.7	-38d03.8	4.0
19	17h37.2	-28d40.3	2.6
24	18h13.6	-17d14.3	2.7
29	18h44.8	-06d51.5	4.2
Jan. 3	19h15.0	+02d12.2	5.5
8	19h46.1	+10d25.8	6.5
13	20h18.5	+17d52.3	7.3
18	20h52.3	+24d23.7	8.0
23	21h26.6	+29d52.2	8.6
28	22h00.8	+34d16.2	9.2
Feb. 2	22h34.1	+37d40.1	9.8
7	23h05.7	+40d12.6	10.3
12	23h35.3	+42d03.5	10.7

OH NO!! NOT KOHOUTEK AGAIN!!

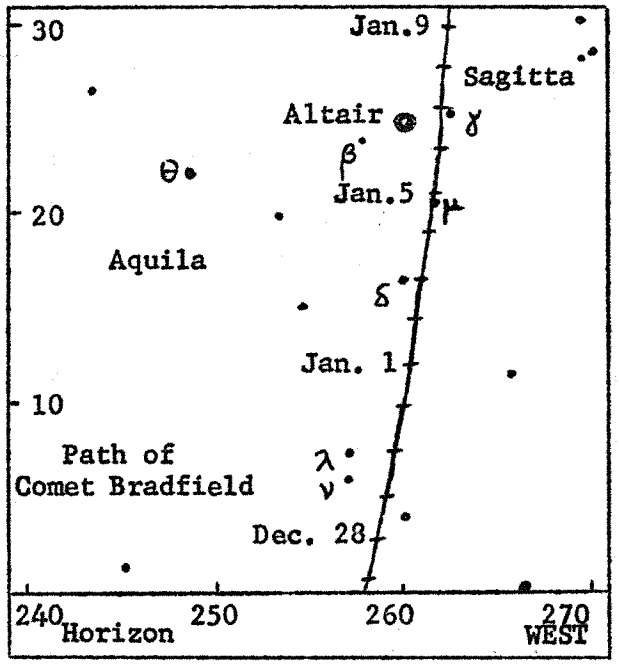
A comet discovered by Dr. Richard West in August is still out near the orbit of Mars at the New Year, and is not due to reach perihelion until March. Since the comet is so far away (as was Kohoutek when discovered), magnitude estimates are risky. Current guesses put it just below magnitude 1 on March 1. Comet West will be seen in the early morning and should develop a tail around the first two weeks of March.

A RASC CHRISTMAS

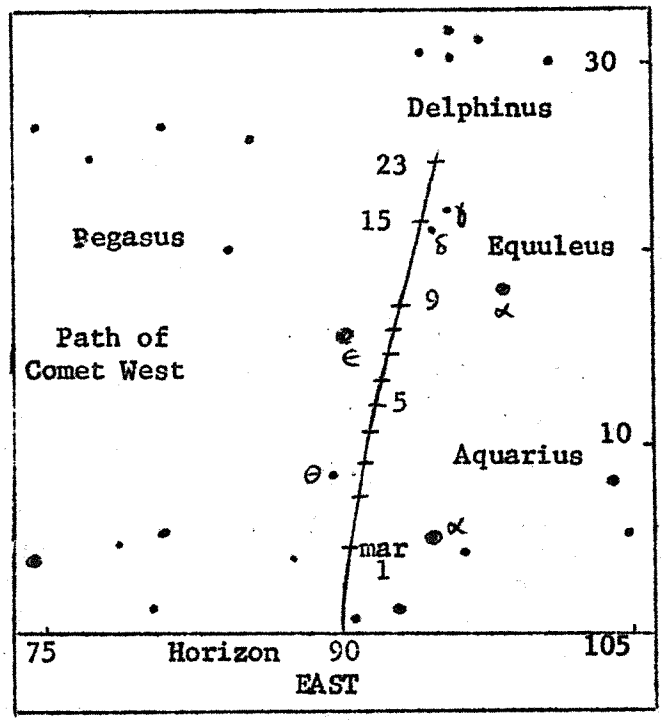
On the evening of December 19th, the astronomy Christmas Social was held at the planetarium. To music recorded by Ed Dyer, and goodies arranged by Phyllis Belfield and Judy Anderson, many man/woman hours of cheerful chatter passed. Notable were Ed's live but sit-down jokes as well as the Christmas tree, well underlaid with books donated by members for the Winnipeg RASC library. Bill Krosney found the punch recipe quite notable as well. All in all, a good time was passed by those in attendance at the merry beginning to the holidays. Thanks are given again to Phyllis, and to those who stayed late to help clean and pack up the leftovers.

--Judy Anderson

The position of Comet Bradfield is drawn for the end of nautical twilight. Each tick shows its position for 6 pm CST. The faintest stars are magnitude 4.5.



Comet West rising in the morning sky. The ticks indicate the comet's position at about dawn. Look for Comet West low in the east about ½ hour before sunrise beginning March 1.



Condensed Minutes

December's meeting of the Winnipeg RASC brought some twenty members and visitors to the university through a snow-clogged city. Despite a late start, interest was directed to the newly re-modelled 4" refractor which had been worked on by Paul Moffat. Thanks went out to those involved in the Bonnycastle and Woodhaven star-nights, which were very well attended by the public.

The guest speaker, Professor G.S. Clarke of the U of M's Earth Sciences Division, spoke about the 'Geological Interpretation of Martian Topography'. The talk was well illustrated and presented, using comparisons between terrestrial, lunar and Martian surface features to explore the topography of Mars in more detail than any of us have seen.

As one consequence of the Apollo flights, scientists have set the age of the Earth and Moon at about 4.6 billion years. The Mariner flights have attempted to establish the age of Mars from observations of the geological features, without the helpful addition of rock samples. A series of slides of terrestrial features contrasted impact craters in Arizona caused by meteorites with those in Hawaii of volcanic origin. Similar features on Mars were shown, with the audience speculating to their origin. The existance of conelike features, prominent faults, canyons, and areas seemingly affected by liquid action indicate that Mars may have been geologically dormant for some time. It is now thought to be actively evolving, although still some 3 billion years younger than Earth.

Details of the Unicity display on Decenber 15,16, and 17 were then discussed, and voulunteers were requested to man the displays.

Notice was given that membership fees were well past due, and those members unpaid by the January meeting would be removed from the mailing lists.

To end, a letter from Dr. Duckworth, President of the U of M, was read. He is pleased to continue as our honorary President for the ensuing year.

-Ella Dack

President's Message

The center's display at Unicity was a great success despite initial misgivings when we first started the project. In retrospect however, with all the hard work that went into the program, it could not help but turn out as well as it did. Thank you, all who took part.

Another highlight of the same week was our Christmas party, which was enjoyed by all who attended.

Many thanks to Ed Dyer for his donation of a display board, which will be put to good use by the Centre.

Best wishes, and good observing for 1976.

- Roy Belfield

Expectations for the Coming Year

Now that the mails are going and the handbook has arrived,a quick look for the months ahead shows some interesting events for 1976. January is still the month for Mars, but February belongs to Saturn and the Orion Nebula. This means a new crop of tiresome photos of M42 will be ready for summer.

March is unexciting, but April has an interesting occultation of a 3.2 magnitude star by Mars. This should occur just before sunset in Winnipeg, but the five minute eclipse will be visible even in daylight. Mercury will also be well placed in April.

May brings summer and two close planetary conjunctions - Venus and Jupiter, and mars and Saturn. Jupiter is also close to the Moon this month, but a better close approach will occur in June. Mercury and Venus will have a close approach in July, though Mercury will have its most favorable appearance of the year in August.

From July through August, Comet d'Arrest is expected to brighten from magnitude 8.9 to 6.4. If these predictions are correct, it will be easily visible in binoculars, though it will be fairly far south in Aquarius at its brightest point. Since the comet will be approaching from the northwest, it will be better seen from Manitoba before its closest point, when it moves from Vulpecula toward the ecliptic. This also means that it can be seen before midnight instead of after.

September has nothing spectacular, but in October a stellar occultation by the asteroid Pallas may occur. This could be a very important event, if we can see it. Uranus will also pass very close to the Moon in November, though the Moon will be almost new. A poor eclipse of the moon this month will probably not get much attention. December has little to offer, but it will probably be cloudy anyway.

January's Happenings

Event	Date	Time
New Moon	1	
Algol at minimum	2	4:50 am
Quadrantic meteors	4	
Algol at minimum	5	1:40 am
Mercury low after sunset	6	
Algol at minimum	7	10:30 pm
Algol at minimum	10	7:20 pm
Venus 0.4 degrees north of Moon	11	10:00 pm
Ceres 0.3 degrees north of Moon	12	8:00 pm
Occultation of 6.0 mag star by Moon	14	8:01.4 pm
Occultation of 5.9 mag star by Moon	15	9:26.8 pm

Event	Date	Time
Occultation of 5.2 mag star by Moon	15	2:20.7 am
Full Moon	16	
Algol at minimum	22	6:40 am
Last quarter Moon	23	
Algol at minimum	25	3:30 am
Algol at minimum	28	12:20 am
Algol at minimum	30	9:00 pm
New Moon	31	
Occultation of 4.6 mag star by Moon	3	6:37.2 pm

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LIBRARY NEWS

The Centre's first Christmas party on Dec. 19 was a pleasant event for those who managed to get there. One idea that went over very well was the placing of gifts under the tree for the Centre's library. I would like to see this continued in the future, as it seemed to meet with general approval at the party. A BIG thank you to the following people for their contributions:

'The Solar System and Back' - Isaac Asimov - from Don Hladiuk

'Griffith Observer', bound copies for 1973 - from Ella Dack

'Pioneer Odyssey' - Ames Research Center - from J and J Anderson

'The UFO Experience' - J. A. Hynek and

'UFO's Past, Present and Future' - R. Emenegger - both from Ballantine Books

'Carrying the Fire' - Michael Collins, 'View from a Height' - Asimov,

'Man's Reach for the Stars' - R.A. Gallant - all from the Belfields

In addition, the Centre purchased the following books last month:

'A Short History of Astronomy' - A. Berry
'Amateur Astronomy' - Patrick Moore
'The Neutrino' - Asimov
'Direct Use of the Sun's Energy' - Farrington Daniels

And now a Happy New Year to all. May 1976 be a wonderful and exciting year.

– Phyllis Belfield

THROUGH THE LOOKING GLASS

In the late stages of a star's evolution, the hydrogen in its core is exhausted and the star expands into the familiar red giant portion of the Hertzsprung-Russell diagram. Its energy during this time is derived primarily from the conversion of helium into carbon and oxygen, and in even later stages, of carbon into heavier elements. Eventually, however, all the possible energy-creating reactions are used up and the star collapses rapidly.

During this sudden contraction, the atoms in the interior of the star are squeezed to such an extent that their electrons are stripped from them. The pressure caused by the interaction of these free electrons is sufficient to stop the contraction of the star, provided it has a mass less than 1¼ times that of our sun. It becomes a white dwarf.

Heavier stars cannot resist the collapse however, and eventually the atoms themselves break up into neutrons. Again, the repulsive force of these neutrons may be enough to stop any further collapse of the star. This leads to the creation of a neutron star, which is most visible as a pulsar, such as that in the Crab nebula.

But it is the stars heavier than two solar masses which concern us here. For these stellar remnants, the neutron pressure cannot stop the collapse and the ultimate result seems to be the black hole. In this final collapse, the gravitational field around the star becomes so intense that even light photons are unable to escape into space. Passing light rays will be deflected by the strong gravity field, and if the photons are close enough, will be drawn into the black hole.

An astronaut standing on a collapsing neutron star is able to shine a searchlight up into space, though the gravitational force will cause the beam to lose energy as it fights its way upward. If the beam is shone off at an angle instead of straight up, it will be pulled toward the star's surface by the gravity. As the collapse proceeds, and the gravitational field at the surface becomes stronger, the angled light beam will be bent so much that it curves back to strike the surface; only those beams pointing directly upward, or close to directly upward, will be able to escape from the star. Even this is only temporary, as the collapse soon proceeds to the point where even the vertical searchlight beam cannot leave the star, and the astronomer is cut off from the rest of the universe. He is said to have passed his "event horizon." To outsiders he will have disappeared from the universe.

Shortly after Einstein published the General Theory of Relativity in 1916, Karl Schwartzschild solved the mathematical equations that described the physical characteristics of space and time around a massive collapsed

star. His solutions applied only to non-rotating black holes, and described the sequence of events as we approach one of these stars.

First we encounter a "photon sphere", which is a very thin layer of light photons in orbit around the black hole. Further inward, we pass the event horizon and can no longer communicate with outsiders. Eventually we reach the center of the stellar remnant--the singularity where the gravitational force crushes our atoms into nothingness, though we would have been destroyed long before this point is reached.

In the 1930's, Einstein and Rosen re-examined Schwartzschild's solution and noticed some remarkable properties. As a star collapses, the region of space-time around it becomes very warped. To an outsider, it would resemble the vortex created when water runs down a sink, or the funnel of a tornado seen from above. However Einstein and Rosen found that this "funnel"did not converge down to a point, but began to open out again as it passed the event horizon (where it is invisible to us). Mathematically, it resembled an hourglass seen from above, rather than any of the previous funnels. The event horizon would lie at the narrowest part of the hourglass. Moreover, where one end of the hourglass opens toward our universe, the 'other'side openen either to another universe or to another time and place in our universe! This hole joining the two universes is referred to as an Einstein-Rosen bridge, or a wormhole.

Since an outside observer can never see past the event horizon, it was necessary to use the Schwartz-schild solutions to describe what happens between the event horizon and the singularity. The necessary work was done by Dr. M.D. Kruskal in 1960, but to understand his results, we require a description of the three kinds of space-time.

In our universe we require considerable time to move from one point to another, since we are unable to move at anything but a small fraction of the speed of light. Because time is the overiding feature of any long distance motion, we are said to live in a time-like environment, and to move along time-like paths.

Consider the case of a universe in which the opposite is true. In this world, travel would occur at speeds much faster than that of light, but distances would be so huge, that, despite the speed, space would be the domina-ting factor. This type of universe is called space-like.

The dividing line between these two worlds is the speed of light. The third universe becomes the one in which objects move at this velocity, and is called, naturally, light-like. In our own experience we can never travel along a space-like path or even a light-like path, though the possibility remains of getting close to the speed of light at some time in the future.

Once a spaceship crosses the event horizon of a non-rotating black hole, it cannot escape. This would require travel faster than the speed of light---in other words, along a space-like path. So there is no avoiding being crushed by the singularity at the center of the black hole, nor is there a chance of escaping through the wormhole since this would also require a speed greater than that of light.

But is a non-rotating black hole a reasonable expectation? Everything in our astronomical experience has some amount of rotation, especially stars. The equations which could describe the space-time conditions around a rotating black hole remained unsolved until 1963, when Dr. R.P. Kerr published a solution.

Dr. Kerr showed that if the collapsed star were rotating, two event horizons were formed instead of just one. Moreover the geometry of space-time universes inside the event horizon changed in a very significant way. Instead of joining just two time-like worlds, the rrotating singularity connected an infinite number of other universes. As well, the singularity itself changed from space-like to time-like in character--and astronauts can travel in a time-like universe! By choosing his path correctly he can cross first one event horizon and then the other, without going "through" the singularity. This allows him to pass into another universe unscathed, and he doesn't have to achieve high velocities. It becomes possible for an astronaut to leave our universe, travelling along a time-like path, and reemerge in either another universe, or in another time and place in our universe. Some scientists even speculate that quasars are the "opposite ends" of black holes in other universes.

The prospects of this type of time and space travel also brings some problems. How, for instance, do you navigate through a black hole? If there are an infinite number of choices and times to pick from, how do you find the one that brings you home? And then there is a more immediate problem: how do we get to the black hole in the first place?

---Jay Anderson

A VIKING PROBLEM SOLVED

Problems to the #2 Viking Lander en route to Mars were overcome by the Jet Propulsion Lab in California by switching to the backup system. The primary system was not charging the four batteries which are used to power the spacecraft while it is switching from solar to radio-isotope electrical supplies. Controllers were at first reluctant to use the backup circuitry since it might also fail. The #1 Viking is proceeding normally.

COORDINATING CHAIRMEN

For information on the following observing activities, or events in the following categories, please contact the following people:

Observing Recorder:	Miss Ella Dack	943-3173
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Aurora & Solar:	Dr. John Scatliff	453-0514
Grazes:	Mr. Frank Shinn	233-4384
Librarian:	Mrs. Phyllis Belfield	256-4295
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