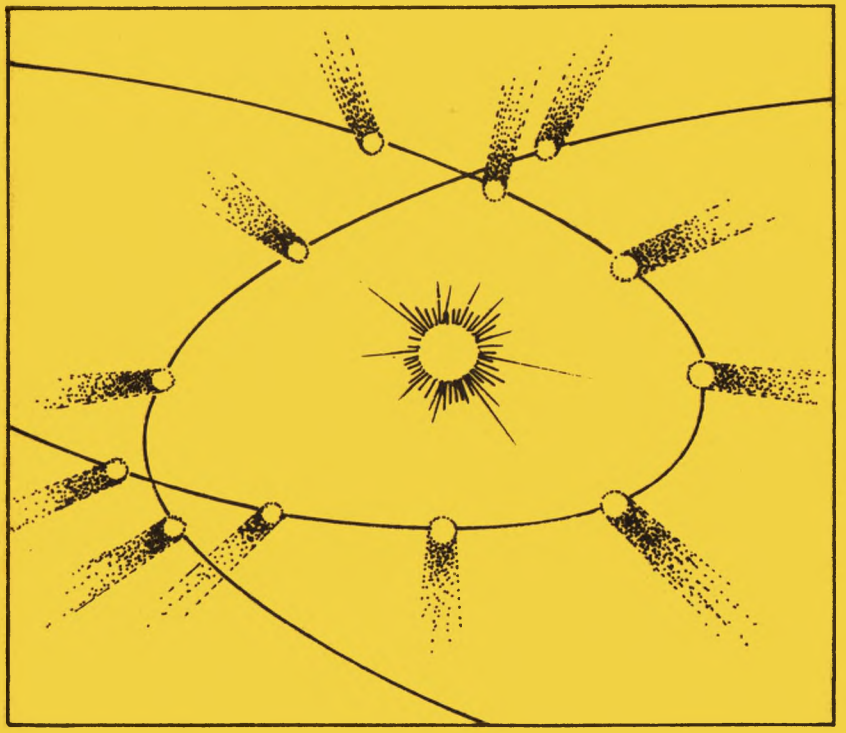
NOVA NOTES



BI-MONTHLY JOURNAL OF THE HALIFAX CENTRE

JAN - FEB 1983 VOL. 14, No 1

1983 HALIFAX CENTRE EXECUTIVE

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CENTRE MEETINGS

Bridgewater:

On 6 November about 20 people met at the DesBresay Museum for the first meeting of the Bridgewater section of the Halifax Centre. The organization was carried out by Wilf Morely who suggested that they meet the first Saturday of each month, alternating observing sessions and lectures. Randall Brooks presented a talk on recent discoveries on Mars, Jupiter and Saturn. Following questions, Wilf invited those who were not already members to join the Centre. As a result, Halifax gained half a dozen budding and eager astronomers.

Halifax:

The regular meeting of the Centre was held on 19 Nov. at the Nova Scotia Museum. Dr. Norman Scrimger had agreed to try something a bit different on this occasion. Instead of presenting a normal type of lecture, we turned the tables and had members pose questions. Therefore, instead of relating what Dr. Scrimger had to say, I'll list a few of the questions raised.

The three dozen members asked about as many questions - these ranged from how precession affects the Earth to how close we are to achieving a Unified Field Theory. Should we look for E.T.'s as suggested by Carl Sagan? Why don't stars collide? What's the speed of light in a Black Hole? How can a neutron star rotate 640 times a second, as does the newly discovered example? How do you detect gravity waves? Don't gravity waves affect the measuring systems? What is the state of the Very Long Baseline radio interferometer proposed to be built in Canada? What is the current concensus of the Age of the Universe? and is it open or closed?

As you can see, the questions were wide ranging and Norm must be applauded for his ability to field them with apparent ease. Norman was followed by Mike Edwards who briefly showed several of his photos taken earlier in the evening of the occultation of Mars by the moon. Finally, the results of the annual election for the Centre Executive were announced. The results can be seen on the inside of

the front cover. We would also like to thank those who allowed their names to stand and those members who took the time to cast a vote.

Halifax:

The December meeting of the Centre was held on 10 Dec. with Dr. Roy Bishop being the speaker. The topic was: SS433 - the extremely unusual object discovered in 1979. As usual, Roy presented a wonderfully lucid description and explaination with some help from Superman and Lois Lane. What makes SS433 so unusual? It is located near the centre of a 10,000 yr. old supernova remnant and exhibits two periodicities. The first to be discovered was a 164 day variation in the position of its spectral lines. The line positions in the spectra vary by 1000A in 50 days, shifting to the red then to the blue. The velocities associated with such red and blue shifts are 50,000km/s and -30,000km/s resp. with the mean velocity of 12,000km/s away from us - a velocity hundreds of times greater than any other body within our galaxy! The second period is 13 days and varys by $\pm$70km/s. This is the period caused by the orbital motion of one star about the other, ie. SS433 is a binary star.

SS433's total luminosity is a million times the Sun's! In the visible SS433 looks starlike but in the radio, it is $1\frac{1}{2}^{0}$ across and is somewhat lenticular in shape with a core only 6AU across superimposed on the visual object. With radio telescopes, knots of material appear to be moving outward at 0.009"/day! X-ray observations show a core with knots in jets on either side.

How does one explain such unusual characteristics? By invoking time dilation (recall from Special Relativity that moving clocks tick slowly), Roy was able to show that each of the observations can be explained. SS433 is an eclipsing binary system (P=13d) with the visible star being normal. The other component is a neutron star surrounded by a disc (6AU diameter) of material stripped off the surface of the companion. However, the rotational axis of the neutron star is precessing (P=164d) at an angle of 20^{o} to the orbital plane. Because the jets of material are being ejected at high velocities from the poles of the neutron star and because this axis is tilted to our line of sight (82^{o}), time

dilation effects are observed. The combination of first order and second order Doppler effects result in a system appearing to be - but is not actually - receding at 12,000 km/s.

As usual the meeting recessed for coffee and goodies. All those who were there will want to join me in thanking Dr. Tindall's wife for baking a selection of Christmas treats. They were certainly appreciated.

Randall Brooks
Secretary

A.S.P. ASSAILS CREATIONISM

The Board of Directors of the Astronomical Society of the Pacific Unanimously passed a strong resolution condemning creationism at its summer 1982 meeting. The resolution starts:

"As scientists and educators, we are concerned that a religious doctrine called 'scientific creationism' or 'creation science' is being advanced as a scientific alternative to the evolution of the physical and biological world."

"Among its many dubious tenets , creationism proposes that the age of the universe is only a few thousand years, an idea that flatly contradicts both the physical evidence that has been accumulating for centuries and its logical interpretation. An examination of that evidence clearly indicates ages for the Earth, the Solar system, and the Milky Way Galaxy that are vastly older than a few thousand years."

"...Creationism is not a science, but rather an expression of the religious beliefs of a small minority. As such, it has no place in museums, science classes, or science text books."

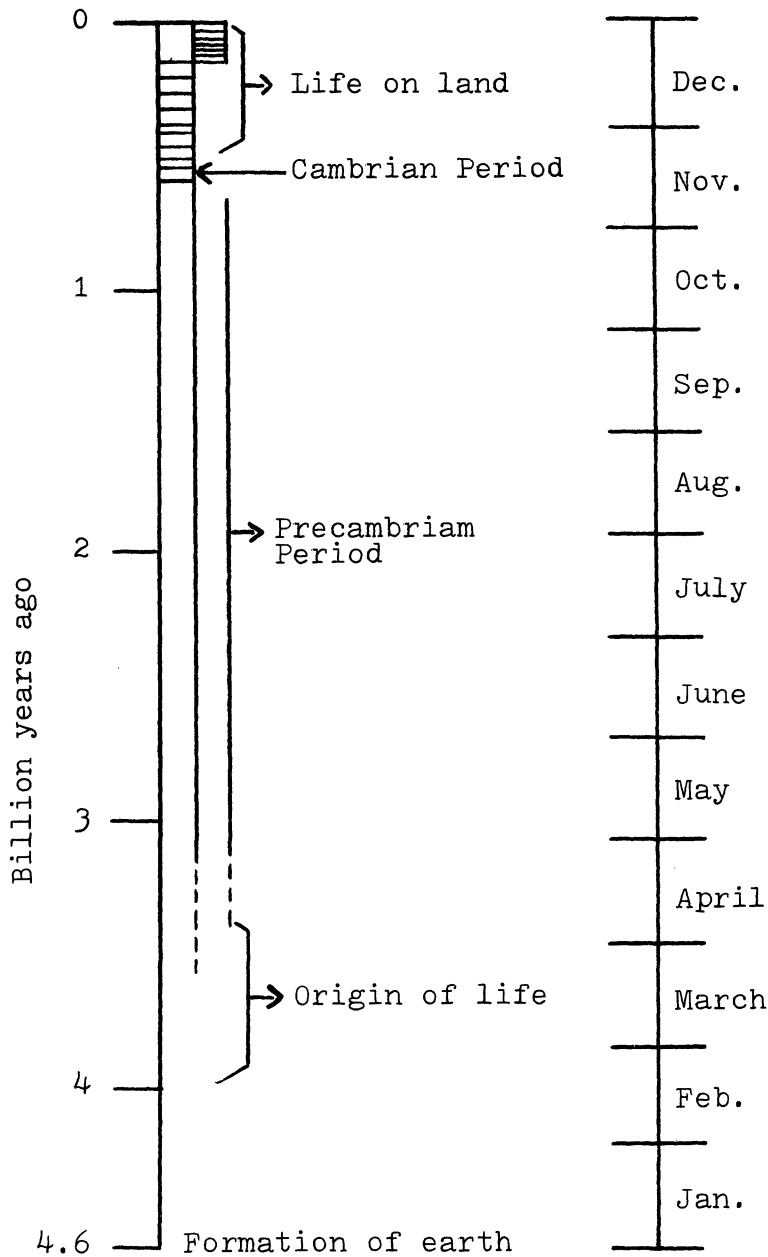
This is a reprint from the American Astronomical Society NEWSLETTER, No. 13, Oct. 1982

The following is abstracted from a paper by David Morrison of the University of Hawaii. Copies of the complete article can be obtained from the American Astronomical Society, 1816 Jefferson Place, N.W., Washington, D.C. 20036

"Scientists and educators tend to take for granted the principles of academic freedom and scientific peer judgement that are a cornerstone of scientific progress. Today these basic principles are under attack accross the United States from religious organizations that style themselves 'creation scientists' or proponents of 'scientific creationism.' These groups are seeking to mandate by law equal time in teaching, and equal government financial support, for their viewpoint in science classes, science books, science museums and scientific research. For example, a model bill being promoted within Congress calls for NSF and other federal funding agencies to award funds to 'creationist scientist research applicants' in the same amount as they do 'evolutionist scientist research applicants.' The area in which equal attention should be given to creationist alternatives include those that deal with 'the origin of the universe, the earth, life, or man.'

"Astronomers may have looked on in bemused detachment as their life-science colleges have born the brunt of the creationist attack, but we are equally threatened. It is not only the evolution of life that creationists abhor, but all concepts of evolution; physical, geological and biological. It is their basic belief that the universe was fromed in essentially its present state within the last ten thousand years or so.

"...In an effort to place this threat in perspective, I asked myself what the effect would be on my elementary astronomy course if I were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Billion years ago
Life on land
Cambrian Period
Precambriam Period
Origin of life
Formation of earth
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constrained to give equal time to the concept that the universe was formed ten thousand years ago. Every lecture would be impacted. Indeed, almost every concept by which I try to give meaning to the scale and variety of the universe would be unacceptable to the creationist viewpoint..."

Morrison then continues with a list of examples that include comparative planetology, radioactive dating and impact cratering that are rendered meaningless. Other observed phenomena which are affected are the excess heat from Juliter, chemical patterns in the different planets, sunlight (it takes millions of years for energy to reach the surface from its core), and observations of all bodies more distant than 10,000 light years. Morrison concludes with, "In some cases astronomical arguments may be more effective than those drawn from biological evolution. We can invoke the quantatative aspects of physical science... We can also point out the problem of dealing with a universe much larger than the allowed light travel time. The creationist counter-argument — that the light from distant objects was created enroute to us doesn't really solve anything; it is logically indistinguishable from the argument that the universe was created last Tuesday together with all the evidence, artifacts, even human memory, of earlier times.

Finally, astronomical arguments are relatively free from the emotional pressures still generated for some people when the origin of humans is under discussion. I believe we should exploit these advantages and should stand more firmly with our biological collegues to defend science from the current creationist challenge."

A.A.S. NEWSLETTER, No. 13, October, 1982

ASTRONOMY RESOURCE GUIDE

The 1982 Guide to instructional materials for teaching astronomy, published by the Astronomy Education Materials Network, is available for $6.25 plus $1.25 for shipping and handling from the following address:

1982 Astronomy Resources Guide
West Virginia University Bookstores
College Ave.
Morgantown, VA 26506.

The Netwrok has been designed to inform shcool and non-school educators of the existance of non-commercially developed materials, and to provide an opportunity to contribute to the dissemination and exchange process.

(from Am. Astronomical Soc. Newsletter)

MOVIE: THE OBSERVATORIES

The National Science Foundation (US) has produced a color film, available on free loan for television and group showings, entitled "The Observatories". It presents a descriptive tour of six major astronomy centres in North and South America. Astronomers describe the functions of both optical and radio telescopes, descoveries being made, and what they hope to learn in the future with newly developed computerized equipment. The film explains in lay terms and animated visuals such phenmena as black holes, quasars and pulsars. The 16mm, 27 min. long motion picture was filmed by Dick Young Productions.

It is available from Modern Talking Picture Service, 5000 Park St. North, St. Petersburg, FL 33709.

(from Am. Astronomical Soc. Newsletter)

NOVA NOTES GET AROUND! Copies go to...

42 to Metro Halifax
16 to South Shore
11 to Valley
10 to Northern NS & CB
10 to N.B.
2 to P.E.I.
1 each to Ont., B.C., U.S.
and even one to China!

The above numbers are to members only. Copies are also sent to other organizations across Canada and a few to U.S.

CHINESE-WEST GERMAN VLBI

There is an article in the April issue of "Tian wen ai hao zhe" telling of the successful linking of the radio astronomy facility in Shainghai and that in Westerbork West Germany. This happened on November 28th, 1981.

Atomic clocks were used and tape recordings exchanged just like the Canadian Algonquin-Penticton equipment. I think the major work on this was done in China but my Chinese is very inadequate.

Is there any Chinese astronomer out there who can help with this article? These journals come from D. Bian at the Beijing Planetarium. He is a member of the Halifax Centre. (See the recent article by him on meteorite distribution in China in Nova Notes).

The accompaning diagrams are self explainatory.

R.M. Cunningham

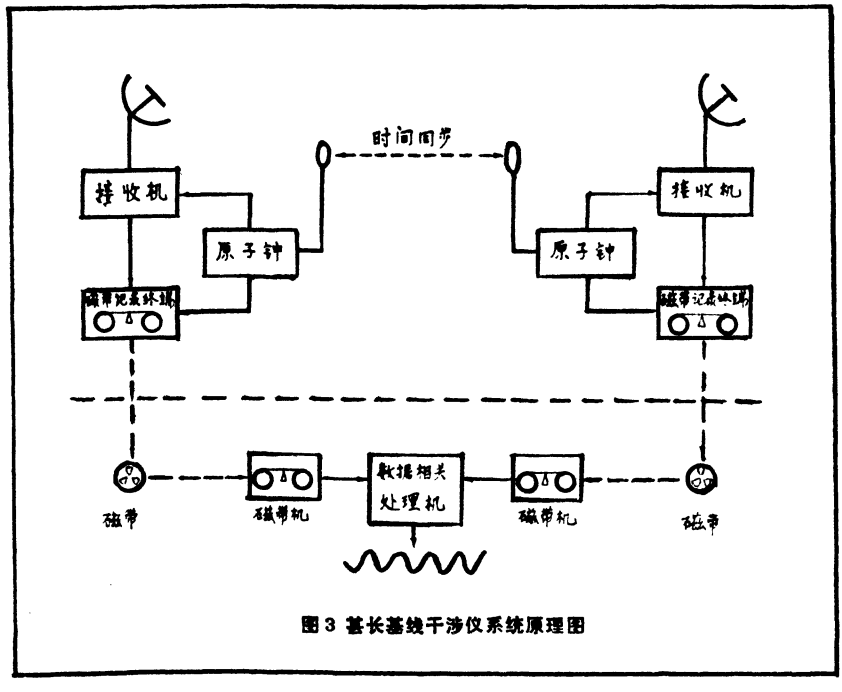
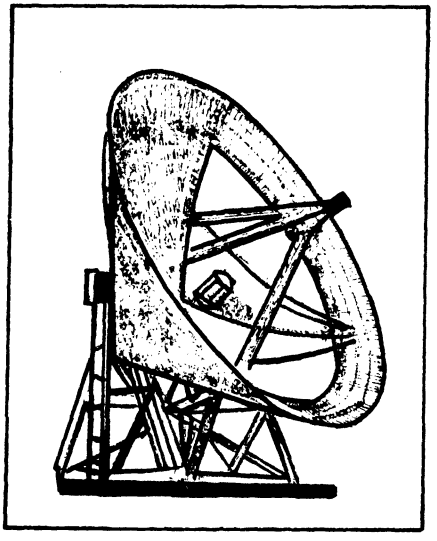
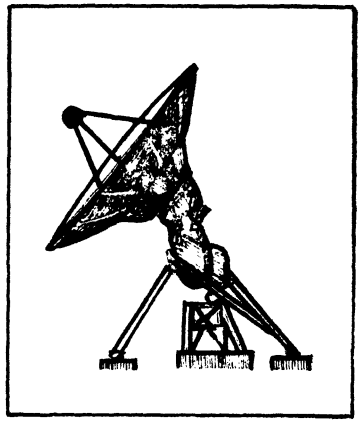
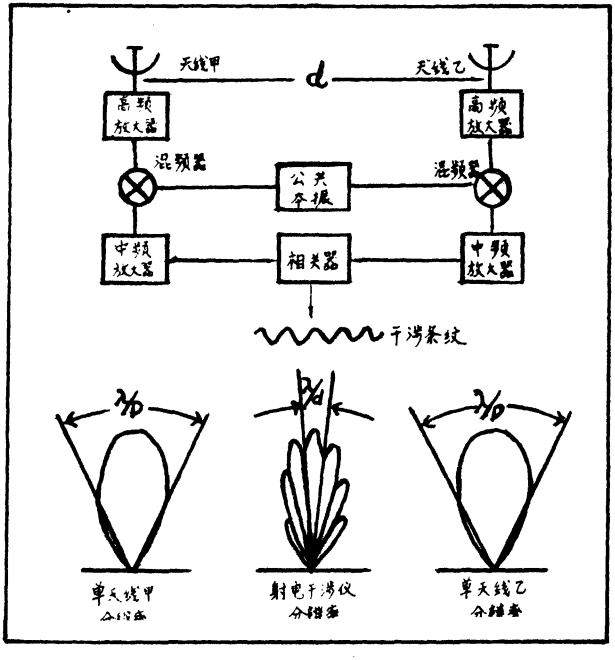


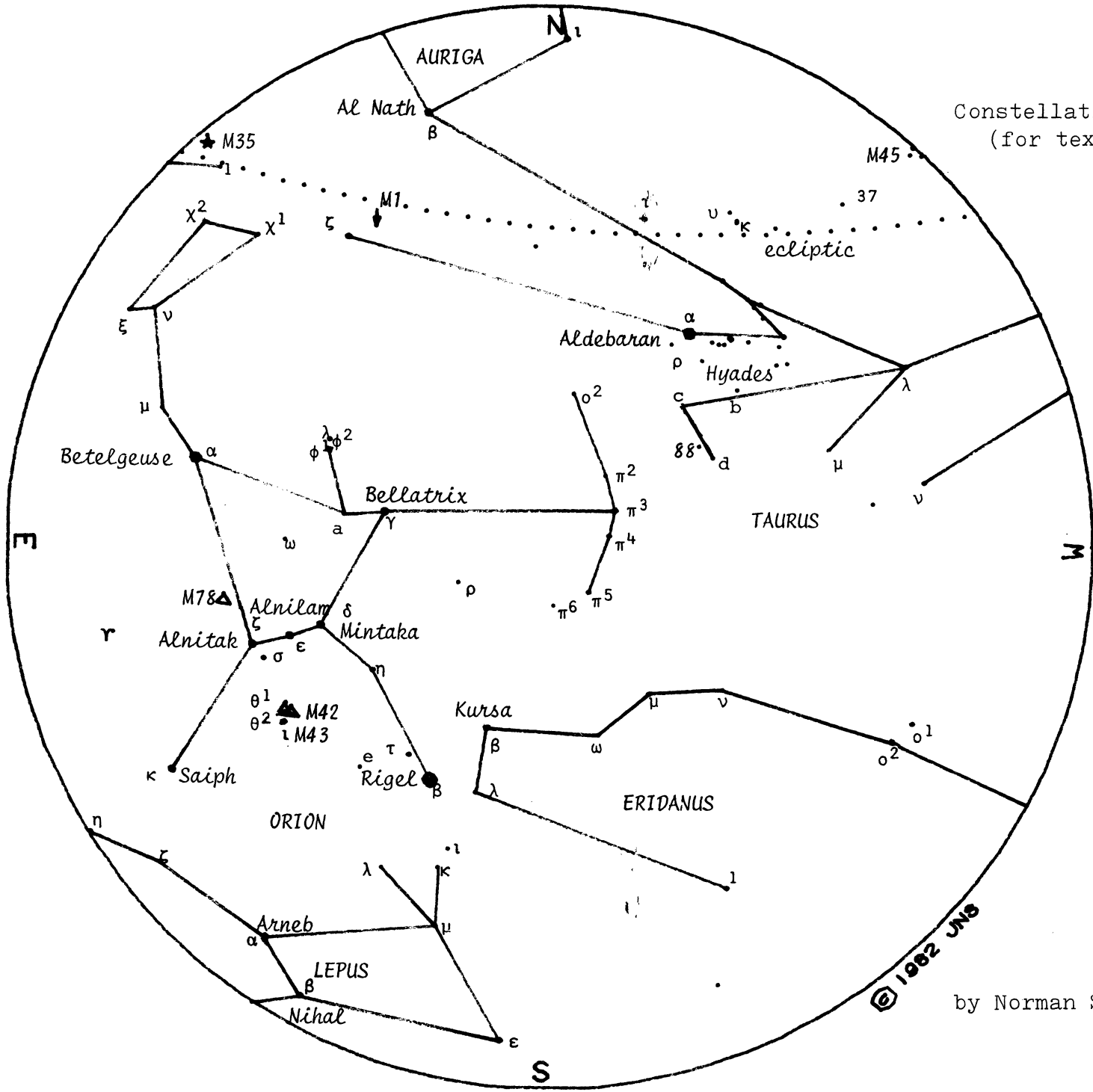
图3 甚长基线干涉仪系统原理图







The Chinese-West German VLBI



Constellation of the Month
(for text see next page)

by Norman Scrimger/SMU

FOCUSING ON CONSTELLATIONS

Orion

In past issues of Nova Notes, we have skirted around Orion, featuring Taurus, Auriga, Gemini, and Monoceros. Orion is perhaps the easiest to find of the winter constellations, and is thought by many to be the most spectacular constellation in the sky. Certainly, Orion holds a large number of interesting objects for whatever equipment an observer chooses, from binoculars to a large telescope with a spectroscope.

Orion, visible from all parts of earth, has been linked in many writings with a "warrior", an "armed king", and national heroes. Orion is even a part of Hobbit folk-lore, being *Menelvagor*, the swordsman of the sky.

We have all inspected M42 and M43, and perhaps even M78. Some have even found the horsehead nebula near Alnitak. Most know Betelgeuse is an irregular variable red supergiant with a radius larger than the earth's orbit. Enjoy all the spectacular views in Orion, but also try for some of the more difficult finds in Orion. Orion is full of variable stars, and is crossed by bright reflection nebulosity. Have you found the 6.7 magnitude companion to the white supergiant, Rigel? Have you seen the white-pale blue-grape red triple, iota?

Most of the Orion complex (which lies pretty well in the Milky Way) is at a distance of between 500 and 1000 light years. Some fainter stars, which are foreground objects like pi-3 (at only 26 light years) are much smaller and less luminous than the two bright supergiants, alpha and beta. Rigel, the seventh brightest star in the sky is about 900 light years away. If it were at the distance of Sirius (8.9 light years), it would be a dazzling -10 in magnitude, near the brightness of the full moon! Being so bright and also very massive, Rigel will have a very short life of less than a few million years from beginning to end.

GUCK IN THE ATMOSPHERE

OBSERVING WITH IT

"Guck" is what I call any cirrus type cloud and other related matter. The question is; how does it affect observing?

Well, for those who are not familiar with this, it might be of benefit to know more about it. Especially since both, thin high cloud and dust (moisture too), are very helpful in observing the planets and some double stars because all of this material has a steadying influence on the atmosphere. Right now, even as this article appears, there is a lot of dust up there from the volcanic eruption of El Chichon in Mexico that occurred in April of last year and that is why you are getting those spectacular sunsets.

The major problem with this dust is the fact that it has cut star light by a substantial amount (up to 40%). So it is no wonder that I can't see Eta Ursa Minoris from my backyard and it is 5.5 magnitude. The people at NASA also mention that a drop of a degree or two Celsius may be caused by this dust in the upper atmosphere and this may account for our unusual weather.

As stated earlier, a thin or medium thin veil of cirrus cloud will help in observing the planets and double stars. This has been noted in some astronomy books and observed by both professional and amateur astronomers. The only disadvantage is for the deep sky observers and comet hunters since it really reduces their effectiveness. Using a 6 cm refractor (who says they are too small for anything) I observed M13 on a clear night and it was fainter than before the dust. So good luck with the "guck".

Michael Boschat

A LOOK AT M42

Orion is a very bright constellation, easy to find and identifiable by the belt stars zeta, epsilon and delta Orion. In January it is in a good position to view around 8:30 pm (local time).

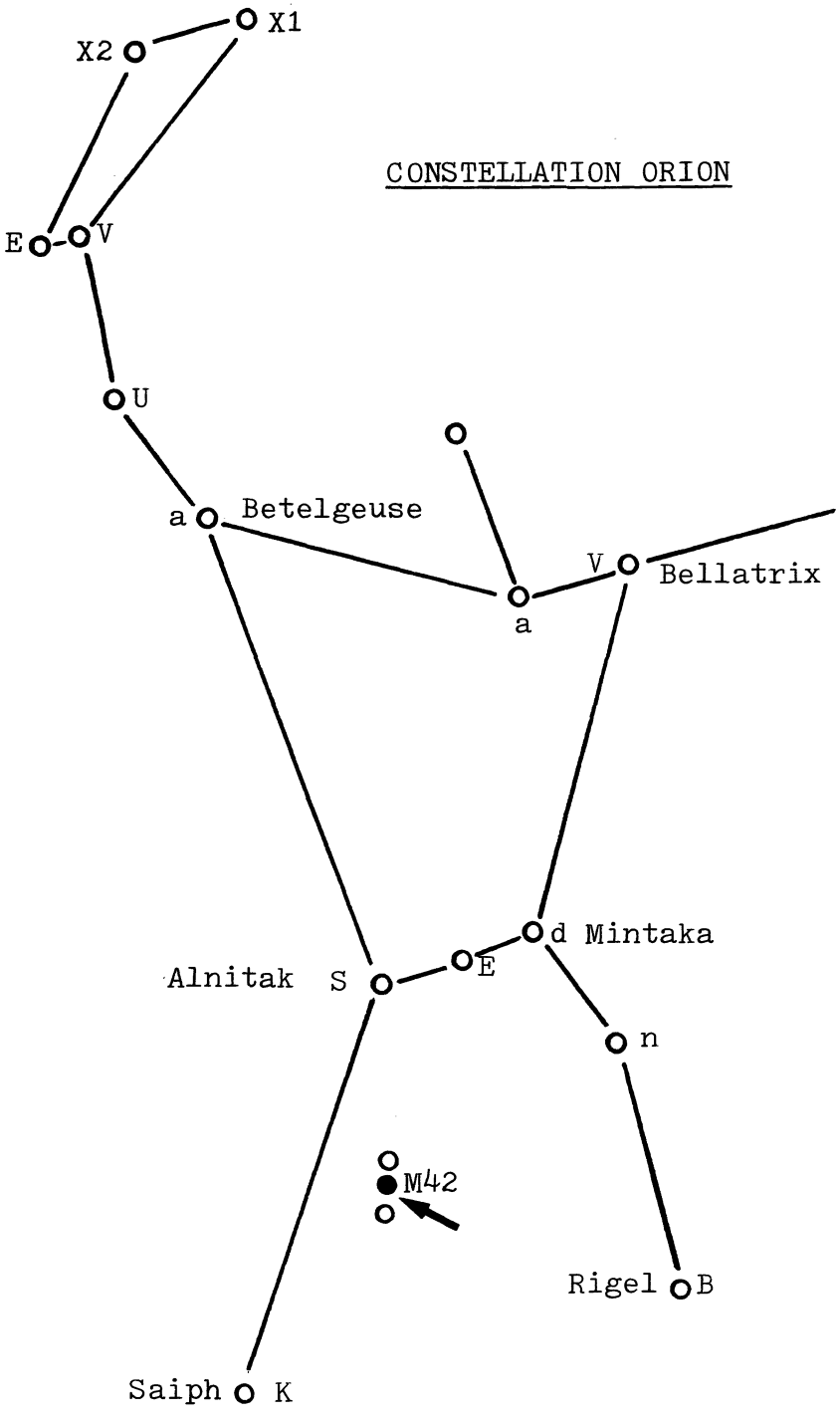
The Orion Nebula (M42) is visible with the unaided eye and is the brightest Nebula visible from the earth. It was discovered by N. Peiresc in 1611, with a telescope given to him by his friend Galileo. It was catalogueg as M42. In the norhterly part of the same complex is M43 and this was discovered by Mairan in 1731.

The Orion Nebula is about 1300 light years away and is a strong radio source. It is a meeting ground for optical, radio, infrared and x-ray astronomers. The Orion cluster is faintly seen on red-filtered photographs. This cluster lies a little behind the Nebula which seems to be in front of the large dark cloud of gas and dust molecules. It is the largest dark cloud in our galaxy.

The Trapezium stars, formed deep within the cloud, were born about 100,000 years ago. These are very young and hot stars and being very hot they are burning a hole in the dark cloud, ionizing the gas and blowing away the obscuring dust.

The Orion Nebula is also known to astronomers as the broken bubble because the hot stars broke through our side and we can see the hollow interior of the bubble allowing us to see the Trapezium stars. If you look at a picture of the Orion Nebula you can see the extend of the dark obscuring cloud.

Gordon Hawkins


CONSTELLATION ORION
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OCCULTATION OF MARS

R. C. Brooks

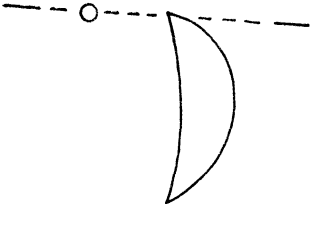
Under the organization of Kathy Oakley, Observing Chairperson of the Halifax Centre, more than 30 members of the Centre ventured out to observe the 19th November graze and occultation of Mars by the Moon. The nearly perfect skies, moderate temperatures (7°C) and the fact that the event occurred just prior to our monthly meeting were also contributing factors. The primary site in Dartmouth was chosen to lie as close to the predicted line as feasible while maintaining a clear, unobstructed view of the Moon and Mars. They were only 8 or 9 degrees above the horizon at the time of the event yet the seeing was 1-1½" and the disc of Mars was clearly discerned. The only problem with the site was that the street was so new and the contours altered to such an extent that it was difficult to determine the exact location of the site from the topographical maps.

I think some of the observers were surprized at how rapidly the gap between Mars and the Moon closed. Nonetheless, the 20 telescopes at the primary site were all pointing westward as Mars began to slip behind the Moon at 20:28 UT. A very clear darkening and then brightening occurred between first contact and 22:29. Some flickering continued until second contact at 22:31. Although our site was 500 m. northwest and outside the predicted graze line, Mars was occulted for just over 2 minutes. From this site Mars was observed to disappear behind the sunlit side of the lunar cusp. At 22:33:15 Mars reappeared followed by forth contact at 22:36. Again some slight flickering was observed during the reappearance. The above times, accurate to about 15 seconds, were obtained by Roy Bishop and Sherman Williams using a 3" Unitron refractor at 96x. These were confirmed by times obtained by William Holden (Honourary President of the Centre) and Bill Thurlow who had travelled from New Albany and Digby for the event and meeting. They used a 3½" Questar at 45x. They noted that the flickering after first contact lasted 45 seconds.

At Bedford, 4.1 km. north of the graze line, Michael and Peter Edwards observing at 400x with a C8 observed a maximum of 2/3rds of the disc of Mars disappear at 22:31. First and forth contacts for them were at 22:27:10 and 22:36:30. They also photographed the event and Michael had the slides ready for showing at the meeting a bit later in the evening. South of the graze line (3.5 km.) Michael Boschat, using a 60 mm. refractor at 89x observed Mars disappear at the lunar cusp. During the disappearing phase, he observed the same scintillation caused by the lunar terrain. At his location in Halifax, first and fouth contacts were at 22:28:53.2 and 22:37: 22.9. David Tindall and Walter Zukauskas were viewing the occultation from the roof of the Dunn Science Building at Dalhousie Univ. some 6.25 km. south of the graze line. They observed Mars to be occulted for about 3 minutes while Norman Scrimger 3.6 km. south of the graze line, observed Mars occulted for about 2 minutes.

Dale Ellis was 4 km. south of the graze line in Dartmouth and using a C8 at 80x recorded the following times for second and third contacts: 22:29:02 and 22:35:55. From his vantage point Mars was occulted behind the sunlit side of the lunar cusp. He noted that timing the second and third contacts was made easier because of the distinct difference in colour between the two bodies. In Bridgewater, Wilf and Steven Morely were clouded out just minutes before the graze was to occur there. At the primary site I was able to obtain a series of photos of the disappearance and reappearance of Mars with a new and, until, then untried Meade 8". These will be shown at a later Centre meeting.

All in all, this was one of our most successful observing ventures. I think it has piqued the interest of some members to watch for some of the upcoming grazes of stars by the Moon or asteroids. If you are one of those, we would like to hear about your observations in Nova Notes or at a meeting.



HALLEY'S COMET

Prospects for Viewing in 1985/6

Available through the cooperation of:

The Royal Astronomical Society of Canada
The Herzberg Institute of Astrophysics
The National Museum of Science and Technology
National Research Council Canada

October 1982

Halley's Comet - the very name brings images of a great spectacle with fiery streamers crossing the sky or recalls stories by a parent or grandparent of an apparition many years ago. Since this most famous of all comets returns near the sun once every 75 years, it is normally a "once-in-a-lifetime" event and relatively few people alive today can recall the last appearance in 1910. Our chance is coming soon, in 1985-86, but the event may be regarded as a huge success or a complete disappointment, depending on what the viewer has been conditioned to expect.

Why is Halley's Comet so important? After all, there have been several hundred comets observed since the invention of the telescope. The history of Halley's Comet can be traced for more than 2,000 years and this was the first comet for which a future appearance was correctly predicted, by Sir Edmond Halley in 1705 for the return of 1758-59, but these facts alone would not make astronomers choose it for special study. It is because this is the only bright comet that exhibits a complete range of activity - solid nucleus, gaseous coma, dust emissions and enormous tail composed of both dust and electrified gas (plasma) and whose return can be predicted with sufficient confidence to plan observing programs and space missions years in advance.

Visually, Halley's Comet will be difficult to see at the coming return, especially from the latitude of Canada and from city locations. When closest to the sun and performing most actively, about February 9, 1986, the comet will be roughly behind the sun as seen from Earth. On its approach to the sun it will pass 93 million kilometres from Earth late in November 1985 when it will be a faint object well placed

in the southern part of our sky for much of the night. The comet will still be more distant from the sun than the Earth at this time, however, and the level of activity is likely to be low, without a well developed tail.

The best time to observe Halley's Comet from Canada will probably be late December 1985 or early January 1986, although our weather conditions are not normally favorable at this season. As the comet approaches the sun it should brighten enough to be visible without binoculars if seen in a dark sky, but it moves steadily westward in the evening sky until it will become difficult to detect in evening twilight by mid-January.

Shortly after closest approach to the sun, mid-way between the distance of Mercury and Venus some 88 million km from the sun, Halley's Comet should be intrinsically active. The location in the sky is too close to the sun until early March and then it quickly moves deep into the southern sky. North of latitude 40° it will not be possible to see the comet more than 10° above the horizon (low in the southeast before sunrise) during March. By late April it has moved to the evening sky and is better placed for northern observers but it is already out to the orbit of Mars and the spectacular phases are likely to be over.

Observations of Halley's Comet from Canada will be a challenge, then, but one that many keen observers will surely meet. At most times it will certainly help to use binoculars or a small telescope and this may be essential for those with less than ideal observing sites.

What do astronomers expect to learn from studying Halley's Comet in 1985 and 1986? Let us consider our present picture of what a comet is and how it behaves. The accepted model for a comet is often called the "dirty snowball" model and its essential features have survived observational tests for 30 years. The nucleus of a comet is a small object, in most cases between 1 and 10 km in diameter. It is composed mainly of frozen volatile material which could include water ice, frozen carbon dioxide, methane and a few other substances. Opinions differ as to whether the innermost portions may form a sort of core or whether the nucleus is homogeneous throughout. There is now considerable evidence that the dominant component is ordinary ice but the relative abundances of the

ices and the dusty materials mixed with them are uncertain. When a comet is far from the sun (beyond the orbits of Jupiter or Saturn) there is sufficient heat to vaporize the ices so there is no cloud of gas surrounding the nucleus and the characteristic tail simply does not exist at such distances. As the comet approaches the inner part of the solar system in its elongated orbit, the ices are warmed sufficiently to begin vaporizing (sublimation directly from solid to gas). Observations of this gas tell something of the chemical composition but the original molecules in the gas are usually broken up quickly by solar radiation and the dense coma which soon surrounds the nucleus is composed mainly of these secondary fragments. It becomes a detective problem to determine the original chemistry.

Along with the gas, a comet releases particles of dust, some of which we may eventually encounter as meteor particles. The nucleus is spinning, like most objects in the Universe, with typical periods of many hours. The "afternoon" side becomes the warmer side with more intense emissions of gas and dust from this side, leading to a rocket effect on the nucleus which is sufficient to affect the orbit. The fine dust particles are blown away from the coma by radiation pressure and form one part of a comet's tail. The other, more irregular tail, is a plasma tail formed of electrically charged gas particles whose motions are controlled by the solar wind with its appreciable and variable magnetic fields. All of this activity reaches a peak when the comet is closest to the sun and it is not rare for a comet nucleus to fracture into several pieces due to the stresses on it at this time. By observing the variation in all aspects of this activity as Halley's Comet approaches and then recedes from the sun, astronomers expect to find answers to some old questions about comets.

The most exciting discoveries during the coming apparition may well come from three space missions, sponsored by the European Space Agency, by the U.S.S.R. and by Japan. Attempts will be made to fly past the comet early in March 1986, when its distance from the sun is somewhat greater than that of the planet Venus. We may get pictures of the nucleus, estimated to be 5 or 6 km in diameter for Halley. Various instruments on board should return a multitude of data on the composition and other properties of the dust and gas

leaving the nucleus. Other observations will be made from satellites in orbit about the Earth. An army of ground-based observers is already being organized by the International Halley Watch, with worldwide networks of observers in each of several specialties ready to cooperate in an all-out attack on the mysteries of these elusive visitors. Observing the comet from the backyard may prove difficult but this apparition of Halley's Comet will provide us with new insight into the earliest history of our solar system which should help our understanding of our place in the Universe.

R. C. Brooks

VENUS AND MIKHAIL V. LOMONSOV

In the 18th. century Russia was backward and the Copernican theory was generally rejected, both on scientific grounds and religious dogma. As late as 1750 most Russian professors held to the idea that the sun went around the earth, but Lomonsov believed otherwise.

One of Lomonsov's most interesting discoveries was made in 1761 when the planet Venus transited across the solar disc. Lomonsov watched the 1761 transit from his home in St. Petersburg where he had erected a refracting telescope of $4\frac{1}{2}$ feet focal length. The one thing that interested him the most was just before the transit began. The sun's limb seemed to become smudgy and the same thing happened after the transit. As we now know, this is the so-called black drop due to the atmosphere of the planet.

Lomonsov, an astronomer and poet was born in 1711 and died in 1765. His was the oldest observatory in Russia and it is now a museum called the "Chamber of Curiosities" situated in Leningrad.

Thus ends a short story on a Russian astronomer and poet.

Michael Boschat

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