NATIONAL NEWSLETTER

Fig. 1—This wooden yoke mounting easily supports the weight of an eight-foot long 12″ Newtonian telescope. See Richard Berry's article for more details concerning this type of mounting.

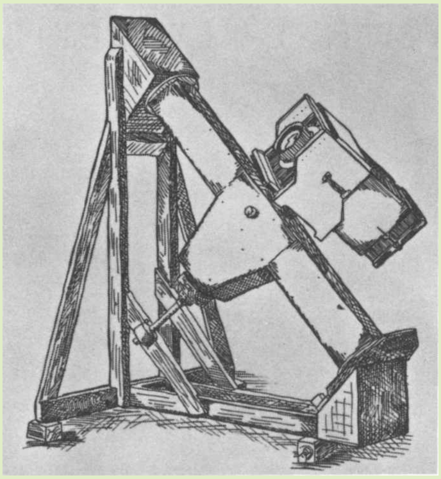


Fig. 2—This cross-axis mounting carries a 24″ focal length astrocamera. The mounting has been left on farms in areas where there are good skies outside of Toronto. The camera was brought to the site for observing nights during the dark of the moon.

Fig. 3—A 6″ reflector is easily carried by this yoke mounting. The extra long tube shields the optics for deep sky observation. The same mount carried an 8″ f/10 reflector for several years.

Mounting Design for Amateur Telescopes

Providing a satisfactory mounting for medium and large amateur telescopes is as important as making good quality optics, and often more difficult; for while the optics are literally made by hand, a good mounting may involve machine-shop work, close tolerances, and expensive materials. But by carefully designing to allow low tolerances, inexpensive materials, and fabrication by hand, I have constructed several mountings that perform very well and are adaptable to telescopes up to 20 inches or so.

In this article I shall discuss three "English" type telescope mountings, and some of their advantages and disadvantages, also describing ways in which mountings in general may be designed better. The three mountings, a small yoke mount, a cross-axis mounting, and a 12″ yoke mount, are "observatory" instruments, intended to be kept in one place for long periods of time. Two of them, the small yoke and the cross-axis, stay at the observing site, and the telescope is put on only when observing. When portability is needed the same telescopes are used on various pipe mountings. (By means of a standard base plate, all my portable telescopes have been made to fit all my mountings.) The 12″ telescope is too large for portability; hence, a roll-off observatory has been constructed for it.

The "English" mount forms (the yoke and cross-axis) have major advantages for the amateur in terms of ease of construction, load-carrying ability, materials required, and over-all performance. All of the largest telescopes (except the 120″ Lick) are carried in variants of the yoke/cross-axis design. The ability to work across the meridian without hitting the pier makes them ideal for photographic work involving long exposures. The yoke-mounted telescope cannot reach the pole (though it goes to +73° in mine), but the cross-axis can. The trade-off is in the need for counterweights. However, the outstanding feature of these designs from the amateur's point of view is their adaptability to larger telescopes without the need of sophisticated shop facilities and their outstanding freedom from vibration.

A telescope structure vibrates because energy is stored in it, both as potential (elastic deformation) energy and kinetic energy (energy of motion). The vibrational energy comes from various sources: the wind, the observer touching the telescope and shaking the ground, and sometimes a faulty clock drive. If we can restrict the amount of energy gained by the telescope and rapidly dissipate what energy it does gain, then our telescope will be stable. In what follows I suggest six design principles to generally increase stability.

The bearings should be separated by a large distance – within reason, the largest distance possible. This restricts angular play in the bearing alignment, hence the amount of kinetic energy the mount can acquire. This requirement need not restrict the mounting form, but in mine I have allowed it to: all three mounts are of the English (or long right ascension axle) variety with right ascension bearings from one to two metres apart. By supporting the axes at both ends, the bending of the axle structure is greatly reduced. In the yoke mounts, declination bearings are on opposite sides of the tube, which is as far apart as it is practical to space them. In the cross-axis the bearings are 50 cm apart, one at the inside edge of the axle, the other spaced back by a rigid box attachment to the axle.

It is desirable to have a large area of contact between moving parts since they transmit vibrational energy. In the cross-axis the inside declination bearing consists of two wooden surfaces 20 cm in diameter with felt between them pulled together by a moderate spring force. Any force on the telescope tube must also bend the polar axle because of the large area of contact in the declination bearings between them. If it were not for the large area of contact, the telescope could vibrate freely, limited only by energy loss down the relatively flexible declination shaft (a 2½″ heavy-wall pipe). Large contact areas also force the telescope to vibrate in a more complex way, a desirable feature I call "smush."

In a "smushy" mounting the structure is very poorly tuned, that is, it can vibrate in many ways at different frequencies, but it doesn't vibrate well in any of them. As an example, imagine a simple steel pipe: struck, it vibrates for a long time. If the same wall thickness is built up by rolling layers of thin sheet metal into a cylinder, it will be very strong, but not vibrate at all. The enormous number of modes of vibration restrict the energy available to any single vibrational mode. One of the easiest ways to “smush” a structure is by adding cross-braces, which make it stronger as well as adding traps for vibrational energy. The ultimate cross-brace is a continuous plate, since it acts like a very large number of cross-braces. Note the north piers on the two yoke mounts: they are very smushy and hence quite solid. The cross-axis pier is more prone to vibration since it lacks bracing.

Energy-absorbing materials should be used whenever it is reasonable to do so. A steel pipe filled with concrete absorbs energy and makes a good telescope pier. Wood, because of its high internal friction, absorbs vibrational energy well, and is desirable from the standpoint of weight, cost, and workability. Wood cannot take high stresses, however, and care must be taken at points that bear heavy loads. All three mounts are made of wood, with steel ball bearings used at high-load-bearing points and greased-steel-on-plasticized-wood bearings used at low-load points.

If the elastic deformation of members is minimized, the vibrational energy stored by the mount is decreased. The cross-section of the members is the major determinant of stiffness. Most textbooks on the strength of materials give enough information for the amateur to compute some very stiff cross-sections. The main axle on the cross-axis is a hollow wood box 20 cm on a side, and it has the same stiffness as a 3″ × 5″ WF steel “I” beam!

Finally, one should exploit kinematic design principles whenever they are applicable. Everybody appreciates that a tripod is more stable than a four-legged table on an uneven floor, but kinematic design is useful only when the structure acts rigidly. Because the base bends, for instance, the 12″ mount is more stable resting on four feet. Each end of the mount acts as a tripod with one foot at the other end.

The “English” mount performs very well with respect to stability, but in some designs the eyepiece is difficult to reach at times. Whenever the tube can be rotated on its axis, as the 6″ in the small yoke can be, there is no problem; likewise, with the cross-axis mount the eyepiece always points away from the main axle. With the 12″ (eyepiece on east side) pointing at the western sky at high declinations, it is difficult to reach the eyepiece because the mount interferes with placing the observing ladder. Several years ago I used a light, adjustable scaffolding about three feet high, which was quite satisfactory but required some skill in balancing. A good solution would be to place eyepieces on both sides of the 12″ tube with a “flip” secondary.

When it is necessary to have one mounting able to carry several telescopes and astrocameras of different sizes, the cross-axis form, where the instrument is attached on only one side, is preferable to the yoke. The sketch shows my cross-axis with an Aerotessar astrocamera, but it was also used with a 6″ f8, 6″ RFT, and 8″ Cassegrain. For astrophotography as many as ten cameras have been run simultaneously, attached all over the axle, for exposures up to 90 minutes long. This mount was well painted and sealed and has survived four years exposed to the elements in farmers’ fields. The camera or telescope is brought out for observing sessions during the dark of the moon.

The 12″ telescope is protected by a light wooden roll-off building, 6 ft. wide, 10 ft. long, and 9 ft. high, running on tracks. Removing the entire building eliminates bad seeing originating from the walls and dome of a conventional observatory, and a roll-off observatory is much less expensive to build. The framing is 2″ × 3″ spruce covered with ¼″ Aspenite, painted white to reflect daytime heat. The building is large enough to do maintenance and work on the telescope inside during the winter. When rolled off, it can serve as a shelter where the observer can consult his charts. When in place, it is secured by four large hooks.

The use of friction damping gives a very stable telescope, but it requires a strong drive, which small worm gears are not. I use a belt drive with a complete disk. A lead screw (made of ordinary threaded rod stock), turned by a one rpm motor, pulls two steel strips that pull the disk around in one sidereal day. This form of drive is very easy to make, very powerful, and quite insensitive to temperature and misalignments. If the drive load is balanced, as it is in the 12″ drive, the amplitude of periodic error from the screw is only a few microns, and the pitch is constant. The preload is about 40 pounds for the drive shown.

In designing a telescope mount, it is necessary to be aware what features make a satisfactory mount and to evaluate their relative importance for the particular observing programme and telescope. In developing the design for my cross-axis, I considered the following absolutely essential:

Great stability
Great load capacity
Ability to interchange telescopes
Right ascension and declination drives

To these might be added the following:

Auxiliary instrument carrying ability
Complete sky coverage
Accessibility of eyepiece
Portability

Since it is not possible to have all these attributes in one mounting, some must be optimized at the expense of others. Deciding which you must have and which you are willing to compromise is essential to achieve an unconfused design. The cross-axis design possesses the first five attributes; with the yoke, the ability to interchange telescopes is lessened, but load-carrying capacity is increased. In addition, both kinds of mounting are inexpensive and easy to build.

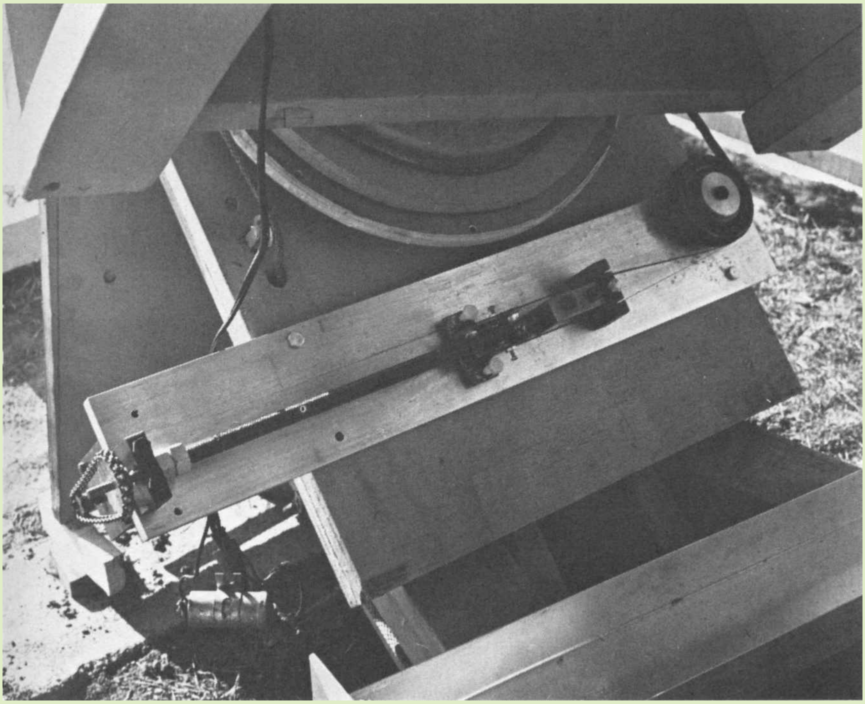


Fig. 4—Disk drive for the 12″ yoke mounting. A 1 rpm motor drives the lead screw through sprocket wheels. The lead screw draws the double nut assembly to the left. The load on the lead screw is balanced because two steel bands are used, one on each side of the nut assembly. They transfer the motion around the capstan to the 16″ diameter drive disk.

	Small Yoke	*Cross-Axis*	*12″ Yoke*
Date of Construction	1962	Winter 1970	Winter 1972
Telescopes used	6″, 8″ Reflector	Aerotessar Camera, Metrogon Camera, 6″, 8″ Reflector	12″ Reflector
Maximum Weight Used Routinely	40 lbs.	100 lbs.	240 lbs.
Length of Polar Axle Between Bearings	48″	64″	80″
Main Axis Construction	1″ × 6″ Pine ½″ × 1½″ Flange Open Yoke	2″ × 8″ Pine ¾″ × 8″ Plywood Box Girder	2″ × 10″ Spruce 2″ × 4″ Flange Open Yoke
South Polar Axis Bearing	½″ Brass on Bushing	¾″ Steel Single Ball Bearing	1¼″ Steel Thrust and Radial Ball Bearing
North Polar Axis Bearing	½″ Brass on Bushing	1½″ Pipe Radial Ball Bearing	2½″ Pipe Radial Ball Bearing
Length Between Declination Bearings	12″	18″	20″
Declination Axles	½″ Brass on Bushing	2½″ Pipe on Plasticized Wood	2″ Pipe on Radial Ball Bearing
North Pier Members	2″ × 3″ Pine A	2″ × 4″ Split A	2″ × 10″ A
Drive	None	10″ Disk, Copper Wire Drive, ³⁄₈″ Lead Screw	16″ Disk, Steel Belt Drive, ½″ Lead Screw, Balanced Load

RICHARD BERRY
Toronto Centre

Notes From Australia

While on sabbatical leave in Australia I had the opportunity to observe the progress on the 3.9 meter Anglo-Australian telescope (A.A.T.) which is located on Siding Spring mountain in New South Wales. It occurred to me (after some prodding from Mr. Harlan Creighton, Toronto Centre) that I might review very briefly in this newsletter the present status of this magnificent instrument.

As many of you know, the A.A.T. is a joint project between Britain and Australia, and was formally opened in October 1974 at a ceremony attended by Prince Charles. Now that preliminary observations and tests have been carried out, it is clear that the performance of this instrument is of exceedingly high quality, and in fact unprecedented in any large telescope built to date. The optical design is of the Ritchey-Chretien type with a primary mirror figured by Grubb Parsons from a solid disk of Cervit. According to Dr. B. Gascoigne, the commissioning astronomer, the surface accuracy of the hyperboloidal mirror is one-eighth of a wavelength, providing virtually diffraction limited optical performance. The prime focus correctors provide a field of view of one degree with stellar images less than one arc second diameter over this field. The corresponding field of view at the Cassegrain focus is 14 arc minutes with comparable performance.

Data acquisition and control of the telescope (and dome) are performed by two separate computers, and the setting accuracy while under computer control is a remarkable 2.5 arc seconds (r.m.s.). A significant portion of the setting error is in fact the one arc second resolution of the position encoders! This unprecedented accuracy achieved in the pointing of the telescope is due to two factors. First, the mechanical stability of the mounting and drives provide a setting accuracy of 10–15 arc seconds even without computer control. Second, the control program applies a correction to the telescope drives to correct this pointing error. Although the technique for the pointing correction is not new, the A.A.T. system employs a realistic physical model for the telescope which provides an accurate prediction of the error. The 2.5 arc second accuracy is attributable to the use of this eight parameter model, which is evidently a good representation of the actual sources of error.

An offset guider at the prime focus now provides automatic acquisition and guiding on a selected star (as faint as 15th magnitude). A similar guider will soon be available at the Cassegrain. The guiding operation, which is an integral part of the control system, is performed by scanning the guide star field using an image dissector tube. According to its designer, H. Kobler, the system is similar to that used in spacecraft star trackers, and the scheme permits a guiding accuracy of one tenth of a stellar image diameter. It also provides in principle a high degree of flexibility for use when variable tracking rates are required, (e.g. in tracking a star across the spectrograph slit).

Instrumentation currently available on the telescope includes a two channel photometer, a Boller and Chivens image tube spectrograph, and a spectrum scanner built by Joseph Wampler and Lloyd Robinson. Wampler, incidentally, is the director of the A.A.T. Although light is available at the Coudé focus, no Coudé instrumentation is yet available. Visiting observers are however invited to provide their own equipment at the Coudé. For example, one novel program proposed for the Coudé focus by a U.S. group employs a receiver for radio astronomy near 1 mm wavelength.

The A.A.T. will undoubtedly give a boost to optical astronomy in both Britain and Australia. In both countries, radio astronomy has until now played the dominant role in observational work. Keen competition for the A.A.T. is on the horizon, however. Two telescopes of similar size are coming into operation in Chile, which is undoubtedly a better observing site than Siding Spring. In any case, with instruments like the A.A.T. it seems certain that the focus of ground-based optical astronomy will shift to the southern hemisphere for the next one or two decades.

E. R. SEAQUIST

The Eclipse at Jarnac Pond

Buried deep in the Laurentians northwest of Montreal is a retreat that has always had a certain magic to it. Ten miles away by dirt road from the tiny village of Ripon, Quebec, this pond and its shore offer the finest observing that I have experienced in this province. It was here that, eight years ago, I completed my Messier hunt; it was here that last year the Montreal Centre enjoyed two flawless observing nights, and it was here that, on the night of May 24, I saw the surreal sight of a total eclipse of the moon.

The night was very clear, warm, and the insects did not bother our small group. We could see the whole eclipse as the moon traced its southern arc across the pond.

Ever so imperceptibly the penumbra began to darken the moon's east edge; then suddenly, at the stroke of midnight, the earth's main shadow took its first bite. During the next hour the sky darkened as the umbra made its advance; the Milky Way got brighter and we knew that tonight, of all nights, the darkness of the night sky would be extra special since this should not happen at full moon.

And the eclipse was a dark one; at mid-eclipse I estimated its luminosity at about 1½ on the Danjon scale. The way to view such an eclipse is through a rich-field reflector; the darkened full moon hung like an apple in the dark, surrounded by many stars in the same field of view.

At 2:01 a.m. I saw the moon approach a faint (10th magnitude) star. I waited for the occultation; the star might have disappeared and moved away. It seemed like a close graze. About a minute later the moon, moving swiftly towards the east, occulted another star.

The quiet was as total as was the eclipse. The moon was supposed to have left the penumbra at 4:38 a.m.; at 4:40 am. the moon disappeared over the tree tops in the west.

DAVID H. LEVY
Reprinted from *Skyward*
Montreal Centre

Astronomy Update

Recent Results of Research in Astronomy

Of much interest in recent years is the observation that some galaxies and galaxy-like objects (or at least their nuclei) are variable in light intensity. These objects include N-galaxies, Seyfert galaxies, and QSO's. Usually, one assumes that the time scale of the variation is indicative of the light travel time across the varying object. That is to say, if significant light variations occur in a period of X days, the diameter must be no larger than X light days. Even for time scales on the order of several months it is difficult to imagine a single object varying in a coherent manner as is observed. This is a particular difficulty for an object such as 3C371 which is a N-galaxy varying on a time scale of only 40 minutes. The possibility that several objects within the nucleus of a galaxy may interact to produce the light variations is suggested by a partial light curve of 3C371 which was recently obtained: the variations in brightness are similar to those of an eclipsing binary. Clearly, two ordinary stars are not involved. The suggestion is that two very large (10^{12} – 10^{13} cm.) and massive (5×10^{10} solar masses) bodies are in orbit about one another. (*Nature* 254, 124, March 13, 1975) The Soviet astrophysicist V.A. Ambartsumian had previously suggested the existence of such objects. No clear picture of the structure and evolution of such bodies is yet available, nor is there any direct evidence for their existence.

* * *

The oldest lunar rock sample returned during the Apollo program has been dated at 4,260 (± 20) × 10^6 years. (*Nature* 254, 292, March 27, 1975)

* * *

One of the classical tests of General Relativity is the deflection of electromagnetic radiation in a gravitational field. This effect was first observed in the visible spectrum during a total solar eclipse about 55 years ago. One need not wait for an eclipse, however, if use is made of longer wavelength radiation in the microwave or radio region. A recent observation in the microwave region during the occultation by the Sun of a background source gave a result equal to 0.99 (± 0.03) times the value predicted by General Relativity. Its chief competitor, the Brans-Dicke theory, predicts a substantially smaller value, namely 0.94. Brans-Dicke cosmology is, therefore, virtually disproved. (*Physical Review Letters* 23, 1621, 1974)

* * *

Approximately 10% of the rest mass of material falling onto a neutron star is converted into energy. This is a far more efficient energy releasing mechanism than any subsequent thermonuclear burning involving the same matter.

* * *

The observational tests of General Relativity (see above) with one particular exception involve phenomena occurring within the Solar System. The one exception involves the first discovered, and so far only, binary pulsar, PSR1913+16. Careful timing of pulses and their analysis in terms of orbital motion should permit the first direct determination of the mass of a system containing a neutron star, and an additional test of General Relativistic and Brans-Dicke cosmologies. These two theories predict quite different variations in orbital parameters due to gravitational radiation. (*Astrophysical Journal 196*, 159, 1975, and two following papers)

* * *

The variable star RU Lupi is familiar to most students of astronomy and to most professional astronomers solely because of its odd name. However, the star is of intrinsic interest and should become more widely known as a result of recent simultaneous spectroscopic and photometric observations made in Chile by a team of Swedish astronomers. RU Lupi is a T Tauri type variable, an example of a class of stars believed to have relatively small masses and to be in the final stage of contraction onto the main-sequence. As evidence of their youth is the fact that all are somewhat irregular variables found in close association with interstellar gas and dust clouds. The observations which have now been published suggest that the variability of RU Lupi, and presumably of other members of the T Tauri class, is due to the presence of circumstellar clouds of dust whose orbits cause them to regularly pass across our line-of-sight to the star. The time scale of the variations is on the order of a few days suggesting that the dust clouds orbit the parent star at planetary distances. The implication is that in RU Lupi we are seeing material which may be developing into a proto-planetary system. (*Icarus 24*, 327, 1975)

Dr. Doug Hube
Reprinted from *Stardust*
Edmonton Centre

Astronomy Downdate

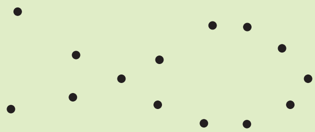
A similar article to this presents the most recent advances in astronomy. However, astronomy is not progressing entirely without an occasional giant step backwards. A few of these reversals in the forward march of astronomy were evidenced in a recent examination given to the Astronomy 353 class at the University of Alberta. From a few of the choicer answers we learn:

(a) About solar eclipses.
–"The Saros was first recognized in Georgia on May 28, 1900."
–"There are several types of solar eclipses – lunar, solar, ullitpical (sic), and binary."
–"The moon must be full for a solar eclipse to occur."

(b) About the solar system.
–"The atmosphere of the earth help regulate the hydrolic cycle."
–"The rock samples returned by the astronauts from the moon showed conclusively that the moon was not made of green cheeze."
–"One of the moons of Venus doesn't only travel at different speeds from the other but also goes through many phases while still in the sky."
–"The north star helps to direct people in which direction a certain thing is in relation to the north star."

(c)About instrumentation and light.
–"Radiation comes in several wave lengths and thus travels at different speeds. The long waves (eg. radio waves) take longer to travel than the short waves (eg. γ rays)."
–"The mass spectrometer is one of the more useful attachments that is used in modern day astronomy. The ages of stars can be determined roughly by mass spectometer readings."

(d) About stars, constellations and such.
- –"O and B stars will probably become neutral stars."
- –"Blue shifted stars are brighter and red shifted stars are duller."
- –"The spectra of stars are plotted on the Hertzlem Brussel diagram."
- –"The constellation of Pisces was so named by the ancient Greeks because of its diagramatical resemblance to a fish." (Sketch of constellation)



(e) Anyone who can explain what the following means will be automatically awarded a Ph.D. in astronomy.
- –"If the Hydra cluster is a very large association with a small velocity deficit, then it is a differential mechanism for elongated distribution."

(f) "Stevensons quintet – irregular galaxy with four quasars." This may require a bit of explanation. What was meant by Stevensons quintet was actually Stefan's quintet which is an unstable cluster of 5 galaxies. However, the irregular galaxy with four quasars is actually NGC 520. All of this is actually irrelevant as the question originally asked for 3 important objects in our galaxy.

For anyone who does not follow the above discussion, or disagrees with any of the above answers, it is suggested that you enroll in astronomy 353 next year to learn what the universe is really all about

DR. J. WINZER
Reprinted from *Stardust*
Edmonton Centre

Preliminary Report on the University of Alberta's 20-inch Reflector

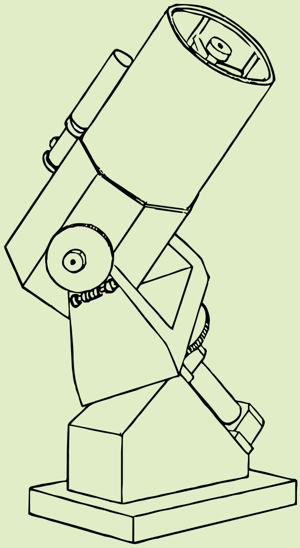
The 20-inch reflector designed for Devon Observatory is starting to take shape. The primary mirror, 20 inches in diameter and 4 inches thick arrived on March 7 and is presently being ground to an F/3 curve. Secondary mirror blanks for the F/8 and F/18 Cassegrain systems, and a corrector plate blank for a prime focus reflector have also arrived. The optics will take up to a year to complete.

The tube is currently being assembled. The bottom end of the tube – the 'bucket' – is virtually completed as are the declination axes and the bearings. The main drive gear and motors are on order. The mechanical parts of the telescope should be completed by the end of the summer.

The major components of the telescope are described briefly below:

1. *Polar Axis*: It will be approximately 6 inches in diameter and move in tapered roller bearings spaced approximately 18 inches apart. At the upper end of the shaft is mounted the 20-inch, 480 tooth worm wheel which will drive the telescope at sidereal rate. Also at the upper end of the polar axis is a 12-inch, 72 tooth gear to be used for slewing the telescope in right ascension.
2. *Fork*: The telescope is supported on a short wide fork (4 inches thick, about 20 inches deep by 24 inches wide on the inside) and is made of cast aluminum.
3. *Declination axis*: The declination shafts for either side of the telescope are approximately 2 inches in diameter and move on double ball bearings. A 12-inch, 72 tooth gear is used for driving the telescope in declination.
4. *Tube*: The tube consists of a) an octogonal "bucket" made of ½-inch thick aluminum plate which is attached to the declination axis and which will house the mirror and serve as a mount for any instrumentation; and b) a circular tube holding the secondary mirror. There are several separate upper ends that can be interchanged to provide different optical systems (F/8, F/18 or reflector-corrector).

DR. JACK WINZER
Reprinted from *Stardust*
Edmonton Centre



A sketch of the University of Alberta's 20 inch telescope. This telescope is presently being constructed by U of A's Physics Department for use at its observatory near Devon, Alberta.

Ed. Note: In a recent telephone conservation, Dr. Winzer provided some further details about this ambitious project.

The observatory site is about 3 miles north of the town of Devon, Alberta. Devon is 15 miles southwest of Edmonton. Presently there is a 12-inch telescope at the site. This will be moved to the University of Alberta's campus in Edmonton before the new telescope is installed.

Mr. Barry Arnold is presently machine grinding the mirror blanks. In addition to the telescope primary, a 20-inch F/1.5 spherical mirror is being prepared to test secondaries for the telescope. Later the test mirror may be used in a Schmidt camera of 14 inch aperture.

Work on the mounting is progressing well, the polar axis assembly is complete and the fork casting should be delivered before mid-August. (W.T.P.)

News Briefs

Honorary Degree Given to Dr. A. W. Carrie

In May, the University of Saskatchewan conferred an honorary doctor of laws degree on Dr. B. W. Currie, of Saskatoon, the Saskatoon Centre's Honorary President. Dr. Currie is research advisor to the president of the University and an internationally recognized authority on the upper atmosphere.

Solar Eclipse – S.E. Australia – 23 Ocober 1976
October Average Weather Summary Along Eclipse Path

The following is a description of average weather conditions in October along the path of the 1976 eclipse.

The weather in October is often very changeable, with large variations from day to day. It ranges from warm and clear days with a temperature over 25°C to cold, overcast, windy and showery days with a temperature below 15°C.

The average daily maximum temperature in October is between 18°C and 20°C on the lowlands, but only 11°C on mountains of elevation 1500 metres.

Some rain falls on about one day in two in southern Victoria in October, but only one day in three north of the Dividing Range and on the south coast of New South Wales. Mean cloudiness at 3 p.m. is also least over these latter two areas, but throughout the path, on average, the sky is more than half covered with cloud on October afternoons.

The following table gives the means of some meteorological elements for several places in the path of the eclipse.

	Mean Max. Temp (°C)	*Mean Monthly Rainfall (mm)*	*Mean No. of Days of Rain*	*Mean Cloudiness - 3 p.m. (percent of sky covered)*
Mt. Gambier	18.3	64	16	67.5
Hamilton	17.6	66	17	75
Warrambool	17.2	62	16	62.5
Ballarat	16.6	69	17	76.3
Ararat	18.0	61	15	65
Bendigo	20.4	52	12	67.5
Melbourne	19.6	67	14	67.5
Geelong	19.3	52	14	65
Euroa	20.4	62	10	—
Alexandra	20.3	72	12	—
Mt. Buffalo	10.9	193	—	—
Mt. Beauty	18.6	135	—	60
Omeo	18.5	72	13	61.3
Bairnsdale	19.6	68	14	60
Orbost	19.5	79	12	66.3
Bombala	19.0	55	11	—
Bega	—	66	9	55
Cooma	19.7	49	10	60
Moruya Heads	19.6	72	10	57.5

D. J. LINFORTH
Australian Bureau of Meteorology

NATIONAL NEWSLETTER

AUGUST 1975

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