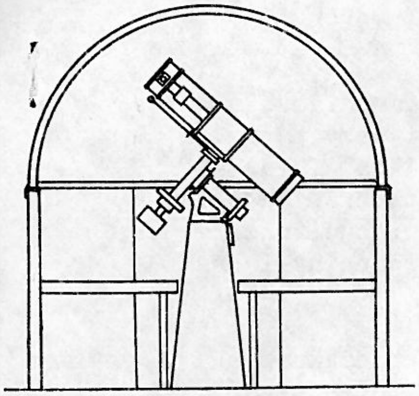

THE SPECTRUM

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BUFFALO ASTRONOMICAL ASSOCIATION INC.
BUFFALO MUSEUM OF SCIENCE
HUMBOLDT PARKWAY
BUFFALO NEW YORK 14211

MARCH MEETING: Our speaker for the March 8, 1968 meeting will be our own ORRIN CHRISTY: "Solar Influence on the Lower Ionospheric Transmission of High Frequency Radio Waves." Orrin is studying physics at Canisius College. He has constructed a 16 ft. Radio Telescope which he used to gather data for his March talk. To our knowledge, he is the first member of the B.A.A. to have built a Radio Telescope and to have actually used it. This promises to be a very interesting meeting and we hope that everybody will be there. Meeting starts as usual (?) at 8:00 PM, EST, at the Museum. Welcome, ORRIN CHRISTY!

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OUR APPRECIATION goes to Mrs. Margaret Rabe for her many years of service to our B.A.A. as THE refreshment hostess - Margaret resigned because she wants to devote more time to meeting people at our meetings and to listen to our speakers, unimpeded by the sounds of that infernal machine - our coffee maker. Seriously, though, I know that I speak for everyone when I say: We really appreciate all you have done, Margaret, and thank you for the many cups of coffee you so expertly brewed! eeb.

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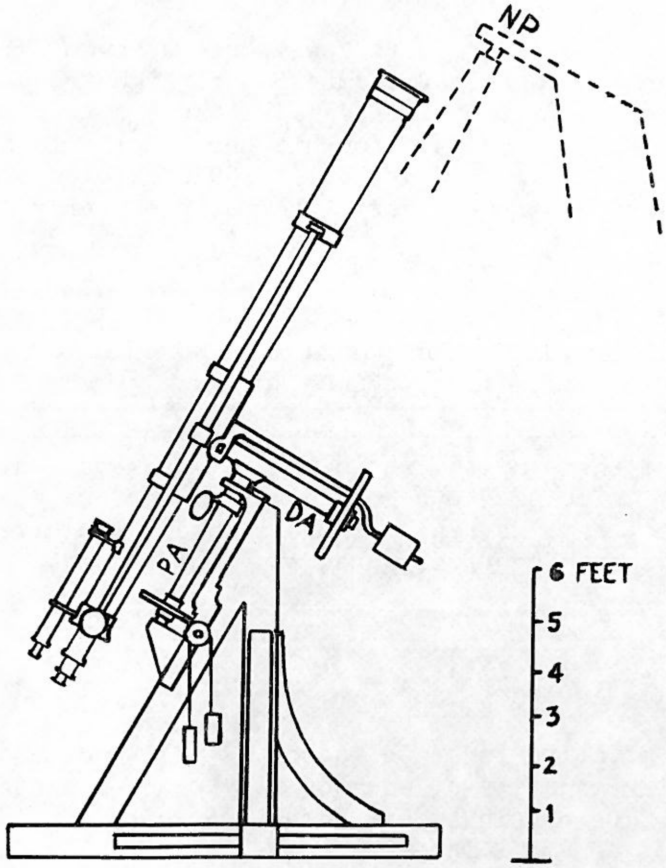
* THE <u>GERMAN</u> MOUNTING. * By Ronald C. Clippinger.

The "German" form of equatorial mounting for a telescope is well-known to amateur astronomers. By far the greater majority of equatorially mounted amateur telescopes use this type of mounting. The original development of this mounting and the reasons for its success are of no small interest.

Equatorially mounted telescopes were little known in the early part of the last century. Most amateur telescopes were mounted, like William Herschel's, on some form of alt-azimuth system. Indeed, even most professional observatories lacked equatorial instruments, the transit instrument and its variations being the rule of the day. It is true that in England, the "English" form of equatorial mounting (1) was being developed, but its application was limited to instruments of rather small size, such as the famous Shuckburgh Equatorial by Ramsden. These "English" equatorials of the 1800-1825 period were, however, of six feet or less focal length. This is an important consideration, as we shall see, because in the "English" form the polar axis must be longer than the tube of the telescope, if it is to have access to all areas of the sky. Telescopes of this time were limited to the smaller sizes, not because of the lack of adequate forms of mounting, but because reflectors were using speculum metal mirrors which were not very successful in the larger sizes and refractors were limited by the lack of larger disks of optical quality glass for their objectives. The first breakthrough on the road to larger telescopes came with the work of Pierre Louis Guinand, who in the first decade of the 19th century discovered a process for producing large disks of optical glass.

Among the first of the telescope makers to utilize these larger disks was Joseph von Fraunhofer (1787-1826) of Munich, Germany. In 1825 Fraunhofer began construction of a 9.5 inch aperture refractor for the Dorpat (=Tartu) Observatory. This instrument was to become famous not only for its excellent optics and the fact that it was used for many years by Wilhelm Struve, founder of the Struve "dynasty" of famous astronomers, but also because of its original form of mounting. Here then is the prototype of the "German" form of mounting, and although Fraunhofer died shortly after completing this instrument, his successors in Munich, Merz and Mahler, continued to supply most of the leading observatories of the world with copies of this Dorpat equatorial in various apertures. The well-known and still active 15 inch refractor mounted at Harvard Observatory in 1847 was one of these "German" instruments and it in turn was to become the model copied by the most famous American telescope makers of the last century, Alvan Clark & Sons.



What led Fraunhofer to develop this form of mounting is difficlt to say, but if we consider the problems he faced in making the Dorpat instrument we may gain some insights. The focal length of this telescope was 14 feet and the latitude of Dorpat Observatory is 58° N. Both of these factors undoubtedly contributed to the development of the "German" form of mounting.

The diagram shows a profile of the Dorpat instrument (2). PA indicates the relatively short polar axis, DA the declination axis and NP the required height of the North pier of the only other practical form of equatorial mounting known at that time, the "English" type. As can be seen, the "English" form does not lend itself easily to longer focal length instruments mounted in high latitudes. This is further proved by the fact that in England itself, the "English" form of mounting was soon abandoned in favor of the "German" mounting, for the larger refractors that came into the possession of both amateur and professional observers in England after 1825.

This failure of the "English" form was not only due to the awkward size of the mounting required for these larger telescopes but also and more importantly due to the structural failure of the long polar axis to have the stability required of a telescope mounting. This structural weakness was due, in turn, to the fact that the polar axis had to be constructed of wood or, if of metal, it had to be built up of many smaller sections so that the joints would constitute a major source of weakness. This stability failure was not to be overcome until later in the century, when full length steel pieces could be substituted for the previous construction forms and this substitution only became possible when much larger metal working machine tools were produced by advances in technology. Such large machine tools simply did not exist in Fraunhofer's time and this limited his choice of design to much smaller one piece axes than were required for the "English" form.

When it became possible to construct large "English" type mountings, the "German" form had already become almost universally adopted as the standard type of equatorial mounting. The "German" form was to continue its pre-eminence until the advent of photography at the end of the 19th century. For photographic telescopes, the "German" form had some important limitations and this brought about a revival of the "English" form, especially for the large aperture reflectors made possible when speculum metal was replaced by silver on glass mirrors. But the "German" form has continued to this day to be highly popular with instruments intended primarily for visual use and especially for portable equatorial instruments, both these requirements of course being important ones to most amateur astronomers. *

(1) For a discussion of the "English" form, see Owen Gingerich, "What is an English Mounting?" Sky and Telescope 34: 293-295, November 1967.
(2) For a photograph of this telescope as well as a photograph of the Shuckburgh refractor see Sky and Telescope 34: 294, November 1967.

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* NEW QUASAR PUZZLE.* Reported by Kurt Erland.

One of the many problems which quasars pose to the astronomer is the fact that their distances cannot be determined unambiguously. If they were relatively close objects, there would be no problem, for then their distances could be found from the relation D=Hz, where H is Hubble's constant (about 100 km/sec per million parsecs), and z is the redshift (that is, the shifted wavelength minus the laboratory wavelength divided by the laboratory wavelength). Unfortunately, for greater distances this relation depends on the physical structure of the universe and hence it is not possible to derive meaningful distances without knowing the shape of the universe. All that one could say with certainty is that quasars appear to be enormously distant - only, of course, if their redshifts are Doppler shifts indicating recession. And this is the big IF at the moment (IF they are Doppler shifts, then the velocity V=cz, but this relation, too, breaks down when z becomes large, i.e. when the velocity becomes a sizeable fraction of c, the speed of light). Most astronomers have tended to believe that quasars are, indeed very distant, although many have argued for closeness on the basis that the red-may be due to some, as yet unknown, cause.

At the 125th meeting of the American Astronomical Society, Dr. Thomas A. Matthews (University of Maryland) reported that he had derived a tentative distance of between 100,000 and one million light years for quasar 3C-287 (R.A. 13h 28m 16.12s, Decl. +25° 24' 37.1", Epoch 1950.0. The apparent visual magnitude is 17.67 and z=1.055). His distance measurement is based on the following observation: 3 C-287 consists of two components, a brighter blue object and a fainter reddish object, both connected by a bridge-like nebulosity. Photographs taken in 1966 showed that the red object had been replaced by a distinct nebulosity and that the bridge had become larger, i.e. that the separation between components had increased. Dr. Mathhews argued that since the apparent separation between the objects was measureable and that since the gap between them could not have been bridged at a speed greater than that of light, one could determine at least a limit to the linear size of the "bridge." Knowing that and its angular size, he determined that 3C-287 cannot be farther than 1,000,000 light years. It is planned to take new photographs this spring to determine if the gap is increasing. . . So, a new puzzle has been added to one of the greatest astronomical mysteries of today. If 3C-287 is really as close as Dr. Matthews has found, why does it have such an enormous redshift? What is it?

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