Cerro Tololo Inter-American Observatory  
La Serena, Chile

This report covers the period 1 October 1979–30 September 1980.

I. VISITOR RESEARCH HIGHLIGHTS

In FY 1980, 166 different visiting investigators, including 19 graduate students, carried out 132 observational programs at CTIO. Among the institutions represented by these investigators 55 are in the United States, 6 in Latin America, and 9 in other countries.

The subject matter of the research programs has been arbitrarily divided by the writer into the following groups:

A. Extragalactic Astronomy
   1. Magellanic Clouds
   2. QSO's and Seyferts
   3. Other Galaxies

B. Galactic Astronomy
   1. Globular Clusters
   2. Open Clusters and Associations
   3. Stars and Binaries
   4. Emission Nebulae, Circumstellar Shells, Interstellar Material
   5. X- and Gamma-Ray Sources
   6. Galactic Structure

C. Solar System
   1. Planets, Satellites, and Asteroids

As of the date of this report, it is too early to summarize the final results obtained by CTIO visiting investigators. One can only list some highlights of the observational programs and some preliminary results in each of these areas. The writer is grateful to the CTIO visitors whose early comments about their work made this report possible, and assumes responsibility for the way these comments have been presented here.

A. Extragalactic Astronomy

1. Magellanic Clouds. A study of the wavelength dependence of polarization of LMC stars was carried out by S. Tapia and G. Coyne (Arizona). The results suggest that when strong (＞2%) polarization is observed, it is due in part to the interstellar medium and in part to circumstellar shells. A. Moffat (Montreal) finds that nearly all bright WR stars in the Magellanic Clouds are spectroscopic binaries; among the exceptions one finds luminous WN7/WN8 stars. A. P. Cowley (Michigan) finds that the old red LMC globular clusters are extremely metal poor. R. Dufour (Rice) found that the LMC SNR’s N49 and N63A show an amazingly chaotic structure when compared to the galactic Puppis A and Vela X SNR’s. The observations show evidence of [O III] being formed in a region preionized by a shock front. Star formation rates in the Clouds are being investigated by L. Stryker (Yale) who has collected deep plates in regions where faint sequences are available to determine luminosity and initial mass functions. H. Richer (Vancouver) has investigated two of the complete samples of LMC and SMC carbon stars found at CTIO by V. M. Blanco and collaborators. A preliminary result is that possibly all red giants in the Magellanic Clouds go through a carbon star stage. P. Hodge (Washington) is carrying out a detailed photometric study of the Magellanic Clouds blue globular clusters NGC 152 and NGC 1831, and E. W. Olszewski (Washington) is determining the age and metal abundance of the old LMC cluster NGC 1978.

2. QSO’s and Seyferts. J. Grindlay, W. L. Forman and J. Steiner (Harvard-Smithsonian), and MIT’s C. R. Canizares and J. E. McClintock searched high-galactic latitude fields where the Einstein Observatory has shown weak x-ray sources. In four of the fields all the x-ray sources turned out to be low-redshift (z < 1) QSO’s with relatively faint magnitudes, and these are similar in numbers to what would be expected from counts of optically discovered (radio quiet) QSO’s. This suggests that all low-redshift radio-quiet QSO’s may be x-ray emitters. B. Margon (UCLA) identified 10 previously unreported x-ray emitting QSO’s found with the Einstein Observatory. These appear subluminous for their redshifts. J. Huchra (Harvard-Smithsonian) is studying the energy output of x-ray emitting Seyfert galaxies and QSO’s, which in general radiate the major portion of their flux in the infrared. A strong correlation between x-ray and 3.6-μm luminosities appears to exist for Seyfert 1 galaxies. L. Campusano and H. Moreno (Chile) are following up searches of QSO candidates near the South Galactic pole with 4-m telescope grism plates.

3. Other galaxies. V. C. Rubin (Carnegie) continued her studies of the relationship between the dynamics and morphological classification of galaxies. So far, results suggest that spirals of all classes have rotational velocities which remain high all across the galaxy, as if a very significant mass exists at large nuclear distances. R. Davies (California-Santa Cruz) is following up findings suggesting that nuclear bulges in disk galaxies, although photometrically similar to elliptical galaxies, are different in that they possess substantially larger rotation velocities. A complete survey to z = 15 and one based on sample areas to z = 16.2 of the clustering properties of galaxies in Horologium is being carried out by G. Chincarini (Oklahoma), and P. Crane and M. Tarenghi (ESO). The Horologium region is particularly interesting because it is relatively free of nearby clusters. B. Newell, and W. J. Couch (Mt. Stromlo) have observed distant galaxy clusters (z = 0.2 to 0.4) to study the Butcher-Oemler claim that significant evolution of galaxies has occurred in the past 5×10^9 years.

B. Galactic Astronomy

1. Globular Clusters. The pioneer work at CTIO by J. Hesser (DAO) and G. Harris (Waterloo) has shown appreciable differences in the CN band strengths of stars in globular clusters down to their main sequences. R. D. Cannon (Edinburgh) has obtained low-dispersion spectra of faint subgiants and upper-main-sequence stars in four globular clusters. The spectra suggest primordial abundance variations within a given cluster or at least early differential enrichment of the proto-cluster. C. Pilachowski (Washington and KPNO) obtained C,
N, and \(^{12}\)C/\(^{13}\)C abundances for giants in 47 Tuc and M55. M. Malkan (Cal Tech) discovered several heavily reddened globular clusters and is estimating their metallicity, reddening, and structural parameters with IR observations. M. Liller (Harvard-Smithsonian) found that NGC 6584 has a surprisingly large number of RR Lyrae stars, and that eclipsing variables in globular clusters appear to be extremely rare, suggesting a lack of close binaries in these clusters. The color–magnitude diagram of the extremely distant (probably 300 kpc) globular cluster AM-01 is being determined by B. F. Madore (Toronto).

2. Open Clusters and Associations. H. Levato and S. Malaroda (La Plata) have found that NGC 2287 is rich in binaries and that NGC 6231 has four binaries with massive companions. A. Feinstein (La Plata) is studying photometrically the fainter stars in the Carina OB complex. A joint investigation by N. Walborn (CTIO) and J. Hesser (DAO) of interstellar lines of stars immersed in the Carina Nebula is being carried out with the echelle spectrograph of CTIO’s 4-m telescope and the echelle spectrograph of the IUE. The new data provide information about Na i as well as Ca ii and show, for the highest-velocity components, the large Ca ii/Na i ratios characteristic of interstellar material elsewhere in the Galaxy. In one star 10 Ca ii components spanning 300 km/s were resolved.

3. Stars and Binaries. P. S. Conti (Colorado) has obtained spectra of WR stars for preparation of a catalog of such stars in collaboration with v. d. Hucht (Utrecht), and I. Lundstrom and B. Stenholm (Lund). Spectral types in the Lindsey Smith system will be included for about 160 WR stars in the catalog. T. Oswalt (Ohio) continued a study of suspected degenerate objects in common proper motion systems. About 12 cases of degeneracy have been found. B. A. Twarog (Yale) obtained classification spectra of several white dwarf candidates in the Pleiades-age open cluster IC 2602. These candidates imply a progenitor mass of 76\(M_\odot\). A. Slettebak (Ohio) is obtaining classification spectra of bright Be stars. Together with similar observations obtained in Flagstaff, an all-sky survey of the luminosities, spectral types, and rotational velocities for Be stars is aimed at.

4. Emission Nebulae, Circumstellar Shells, and Interstellar Material. An extensive spectrophotometric study of southern planetary nebulae has been initiated by A. Gutierrez-Moreno and H. Moreno (Chile). Chemical abundances in ring nebulae surrounding Wolf-Rayet stars are being investigated by K. Kwitter (Williams College), who finds that in the prototype NGC 6888, N and He are significantly enhanced relative to normal H ii regions. Mass-loss rates in red giants are being evaluated by A. Bernat (KPNO) with spectroscopic observations of binary companions. Extensive infrared observations of the H ii regions RCW 57, RCW 38, G 333.6—02, and NGC 6334 have been carried out by J. Fischer and M. Simon (Stony Brook).

5. X- and Gamma-Ray Sources. Attempts were made by G. J. Fishman, R. S. McMillan, J. G. Duthie (NASA-Marshall), and R. Dufour (Rice) on the identification of the optical counterpart of a very energetic gamma-ray burst near the south galactic pole. J. Middleditch and J. E. Nelson (Lawrence Radiation Lab) found the orbital period of 4U 1626 — 67 and were able to derive pulsar spin, orbital dimensions, inclination, and limb brightening for reprocessed pulsations in the companion star. The 81-min x-ray binary 0311 — 12 was found by A. P. Cowley (Michigan), D. Crampton, and J. B. Hutchings (DAO) to show 12-min periodic variations in emission lines. S. Beckwith and N. Evans (Cornell and Texas) have investigated the nature of x-ray sources found in the \(\rho\) Oph dark cloud. Magnitude and colors for most of the counterparts were obtained. The x-ray emission of these sources may explain the radio-molecular temperatures observed in the \(\rho\) Oph and other clouds.

6. Galactic Structure. In order to determine the metallicity gradient in the galactic disk, H. E. Bond and R. E. Luck (Louisiana) have searched for distant F-, G-, and K-type supergiants with the Curtis Schmidt telescope, and have found a substantial number of them. Echelle spectroscopy should determine their chemical composition. Some 600 OB stars and 300 Hz emission objects have been found by J. C. Muzzio (La Plata) in a search for distant spiral arm tracers. W. Hartkopf and K. Yoss (Illinois) are studying the CN strengths and the kinematics of K giants near the south galactic pole as a function of height above the galactic plane.

C. Solar System

1. Planets, Satellites, and Asteroids. J. L. Elliot, R. G. French, and D. Mink (MIT), J. A. Frogel and J. Elias (CTIO), and W. Liller (Harvard-Smithsonian) observed two stellar occultations by Uranus and its rings. The new observations, combined with previous ones, confirmed the inclination to the planet’s equator, ellipticity, and precessional effects of rings \(\alpha\), \(\epsilon\), and 5. An accurate value for the second zonal harmonic \(J_2\) of Uranus was derived and it suggests that the planet has a dynamical flattening less by a factor of 3 than indicated by its geometric oblateness. D. Slavsky and H. J. Smith (Texas) are carrying out a photometric program from improving the measurement of the rotational periods of Uranus and Neptune. In a similar program, W. Wisniewski (Arizona) has detected, from photometry of the 8900-Å methane band, variations of about 12%. Light curves of a sample of asteroids are being investigated by H. J. Schoder (Graz).

II. STAFF RESEARCH HIGHLIGHTS

V. M. Blanco, in collaboration with M. F. McCarthy (Vatican Observatory) and B. M. Blanco (CTIO), completed a survey of the carbon and late-M giant populations in five sample areas of the LMC and SMC. In addition they initiated a similar study of 30 additional areas in the LMC and 15 in the SMC. Results show that complete discovery of stars C2 or later and of giants of type M5 or later has been achieved in the samples areas.

J. Baldwin continued his collaborative program with J. Wampler, M. Gaskell, and W. Burke (U. of California, Santa Cruz) of accurate spectrophotometry of the PKS + 4's sample of QSO’s. The program is aimed at a calibration of the relationship between continuum luminosities and emission-line equivalent widths. Baldwin also worked with R. Carswell and G. Ferland (Cambridge) and D. Allen (Anglo-Australian Observatory) in obtaining intensity ratios of Lyman, Balmer, and Paschen series emission lines in a sample of low-redshift QSO’s. All of the data is now collected for both of these programs, and a final analysis is underway. In collaboration with H. Spinrad (U. of California, Berkeley and R. Terlevich (Cam-
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Baldwin completed a study of II Zw 40 which suggests that a recent close encounter of two small galaxies or star clouds triggered formation of the massive young stars observed in this peculiar compact galaxy. Baldwin, with R. Terlevich and M. M. Phillips (formerly at CTIO), also developed a classification system for emission-line galaxies. This system groups together galaxies in which the gas is ionized by similar mechanisms.

Baldwin and Phillips have begun work on a survey of the outlying gas in Seyfert galaxies, in search of any causal connection between the presence of this gas and the Seyfert activity in the nucleus of the galaxy. All of the brighter Seyfert galaxies accessible from CTIO are being surveyed by means of direct imaging through pairs of interference filters which pick out high-excitation H II regions. Galaxies which show considerable amounts of outlying, highly-excited gas are then studied in detail with long slit spectroscopy. The data have already been collected for the first of these follow-up studies of Mkn 509, using both the SI6 vidicon on the CTIO 4-m telescope and the IPCS on the Anglo-Australian Telescope.

Photometric u, v, b, y, R, and I observations by O. J. Eggen of stars near the Vela Cloud (a = 8° to 9°, b = −40° to −50°) indicate the existence of a sheet of coeval stars about 2.5×10^6 years old which includes the clusters NGC 2547 and Tr 10 and the y Vel multiple system. The sheet lies at a distance of 400 pc, is less than 100 pc thick, and may not contain stars fainter than M_v ≈ 2. The Vela dark cloud is in the background of the sheet. In another observational program, Eggen found that M67 has about as many blue stragglers with masses twice that of the sun as there were original main sequence stars of that mass in the cluster. In Eggen’s program of observations of southern supergiants, four new cepheids were found, one of which is a member of NGC 6067.

J. Elias carried out a survey to R ≈ 19 for faint Hz emission objects in fifteen 13-earmic diam fields in five dark clouds. A few dozen such objects were found which appear to be below the limit of previous surveys. In addition, J. Elias has made spectrophotometric observations of southern Herbig-Haro objects. Elias’ findings suggest that the 2-μm molecular hydrogen emission feature is produced in a relatively dense gas heated by shocks of about 15 km s^-1. By contrast, in the visible spectral region emission appears to be caused by larger shock velocities in a lower density gas. One cannot, therefore, infer the nature of infrared spectroscopic features from optical ones and vice versa. In collaboration with J. Frogel (CTIO), Elias collected IR data for a study of Magellanic Cloud supergiants and C- and M-type stars. Elias also collaborated with a team of observers from MIT and Harvard-Smithsonian, and J. Frogel in observing occultations by the rings of Uranus as described earlier.

J. Frogel has found that the luminosity of the brightest giant in a globular cluster is in excellent agreement with the expected theoretical luminosity as a function of metallicity of the tip of the giant branch even through a priori we would not expect stars at the tips because of fast evolutionary changes. Frogel also determined, in collaboration with J. Elias (CTIO), the bolometric magnitudes and luminosity function of the Blanco-McCarthy Magellanic Cloud carbon stars and confirmed that these stars are about two magnitudes less luminous than theoretically expected. In collaboration with E. Persson, J. Cohen, and K. Sellgren (Hale Observatories), Frogel determined the CO and H_2O indices of the semistellar nucleus of M31, finding that the dwarf to giant star ratio does not increase markedly toward the nucleus of the galaxy. The same collaborators also found, in a study of giant stars in 47 Tuc, an upper limit of 0.2M_☉ for the total mass loss suffered by the giants in evolving from the cluster’s main sequence. In collaboration with D. Gezari, L. Cheung, and M. Hauser (Goddard), Frogel mapped seven southern H II/molecular clouds at 1 mm, and found close morphological and physical similarities among them. As previously noted, Frogel also participated in a study of occultations by the rings of Uranus.

J. Graham continued his study of cepheid variables in NGC 300. Some 22 variables with periods in the range 15 to 128 days have been found. Four supergiants with non-regular periods were also found in the survey. From the latter stars the apparent distance modulus of the galaxy is 27.0, which is somewhat larger than expected from the cepheids, but definitive results await final photometric measurements.

Graham and M. M. Phillips (now at the Anglo-Australian Observatory) found a suspected globular cluster in the vicinity of NGC 5128. With J. Frogel's collaboration the object was confirmed as a moderately metal-rich globular cluster—the first to be found in this giant elliptical.

B. M. Lasker completed and distributed as CTIO Contribution No. 127 a set of monochromatic photographs of the LMC. Lasker also studied the peculiar spectrum of SNR 1006. This lacks the broad Balmer lines one would expect from similar observations of the Tycho SNR, but an interpretation consistent with the collisionless-shock theory of Chevalier, Kirshner, and Raymond is possible. In addition, Lasker collaborated with You-Hua Chu (U. of California, Berkeley) in a study of ring nebulae associated with WR stars in the LMC.

Lasker continued a long-term program on ring nebulae and supernova remnants in the Magellanic Clouds. He finds that N9 and N70 have temperature-ionization structures expected for H II regions (as opposed to recombination zones). Supernova remnant shock velocities agree with those predicted from observed line ratios, although the preshock densities based on similar line ratios do not agree well with those expected (i.e., from the [O II] doublet and a pressure-structure model in the recombination zone).

P. Osmer completed a study of the three-dimensional distribution of quasars in the CTIO surveys. The availability of redshifts for the quasars eliminates the projection effects that are a source of confusion in studies based only on positions on the sky, for example. Visual inspection of the 4-m sample of quasars shows a number of close groups and pairs with small Δz. Although they are interesting in their own right, analysis of all the data indicates that they are chance fluctuations to be expected in such a sample. Application of binning analysis, the nearest-neighbor test, and the correlation function shows no evidence for clustering or other deviation from randomness on scales of 100–3000 Mpc (present epoch coordinates for H_0 = 50). This result is consistent with the expectations for galaxy clustering, which should have a very low amplitude at z = 2 on the 100-Mpc scale. The uniformity on the large scale is, of course, consistent with the basic assumption of most
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The Orion Nebula, which on seven consecutive nights changed progressively from type O6 to O4. Variations in the profile of He II λ 4686, similar and in addition to those described by P. Conti, have been observed. Walborn, as described earlier in collaboration with J. Hesser (DAO), has also studied the complex interstellar absorption profiles of stars in the Carina Nebula (NGC 3372).

Walborn also collaborated with R. J. Panek (Pennsylvania State U.) in spectroscopic and photometric observations of the high-latitude B2V star HD 192273, which had been proposed as an uncertain identification for an uncertain IUE detection. The optical observations do not establish any peculiarities or variability. Furthermore, a preexisting null proper-motion determination does not support a suggestion that the star is a nearby subdwarf. The available data are most consistent with an interpretation of HD 192273 as a normal main sequence star rather far from the galactic plane, and there is no compelling reason to associate it with an IUE source at the present time.

III. TELESCOPE USAGE AND WEATHER STATISTICS

Table I presents statistical data for usage of the CTIO telescopes in FY 1980. When intercomparing the usage of the various telescopes one should keep in mind that in general, except for the 61/91-cm Curtis Schmidt telescope, the smaller the telescope the more it is used for photometric programs in which demanding weather conditions are required. The Curtis Schmidt telescope of the University of Michigan is assigned only during the dark of the moon, and in FY 1980 it was shut down during a major portion of the year for extensive maintenance.

Table II presents, month by month, the usage of CTIO's 4-m telescope and summarizes percentages of hours observed and lost to weather and instrumental failures. Table III summarizes the division of telescope assignments for visitors and staff, and Table IV presents statistical weather data.

IV. PERSONNEL NOTES AND COMMITTEES

A. Changes in Personnel

The following administrative, engineering, technical, and scientific personnel resigned in FY 1980 or had to be laid-off in a reduction and restructuring of the CTIO staff: J. Alaniz, Machinist; S. Amenabar, Administrative Assistant and Bilingual Secretary; B. Bazurto, Assistant Purchaser; K. Czuia, Assistant Observer; C. Espindola, Assistant Observer; A. Figari, Electronic Engineer; B. Jorgensen, Engineering Physicist; C. Monsalve, Photographic Technician; M. Phillips, Research Associate; A. D. Poyner, Director of Engineering and Technical Services; J. Rodriguez, Senior Scientific Programmer; H. Rojos, Research Assistant; and G. Tabilo, Assistant Observer.

The following persons joined the CTIO staff during the same period: M. Bass, Photographic Technician; W. E. Bautian, Mechanical Engineer; B. Gregory, Physicist; J. Hackwell, Sabbatical Fellow from U. of Wyoming; V. Opazo, Bilingual Secretary; and J. Miniz, administrative programmer.
TABLE I. Nights and (hours) of CTIO telescope usage, 1 October 1979–30 September 1980.

<table>
<thead>
<tr>
<th>Aperture</th>
<th>Visitors</th>
<th>CTIO staff</th>
<th>Maintenance</th>
<th>Unschedl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-m</td>
<td>237.5[1888]</td>
<td>109.5[738]</td>
<td>19</td>
<td>—</td>
</tr>
<tr>
<td>1.5-m</td>
<td>223[1107]</td>
<td>135[747]</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>1-m a</td>
<td>255[1738]</td>
<td>85[378]</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>0.9-m</td>
<td>257[1482]</td>
<td>91[297]</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>61/91-cm b,c</td>
<td>77[460]</td>
<td>17[45]</td>
<td>171</td>
<td>101</td>
</tr>
<tr>
<td>61-cm</td>
<td>197[981]</td>
<td>23[18]</td>
<td>—</td>
<td>146</td>
</tr>
<tr>
<td>41-cm d</td>
<td>172[805]</td>
<td>20[58]</td>
<td>—</td>
<td>174</td>
</tr>
</tbody>
</table>

a Visitor figure includes Yale Program.
b Visitor figure includes Michigan Program.
c Usage generally restricted to dark of the moon.
1-m telescope: Yale = 68[447]; visitors = 187[1291].
61/91-cm telescope: Michigan = 26[113]; visitors = 51[347].

TABLE II. CTIO 4-m telescope usage statistics, Oct 1979-Sep 1980.

<table>
<thead>
<tr>
<th>Month 1979/80</th>
<th>Nights assigned for observing</th>
<th>Maintenance nights</th>
<th>Total hours observed</th>
<th>Observing hours lost to weather</th>
<th>Instr. failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>31</td>
<td>0</td>
<td>267.5</td>
<td>51.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Nov</td>
<td>28</td>
<td>2</td>
<td>200.5</td>
<td>53.6</td>
<td>9.1</td>
</tr>
<tr>
<td>Dec</td>
<td>31</td>
<td>0</td>
<td>216.4</td>
<td>50.0</td>
<td>18.2</td>
</tr>
<tr>
<td>Jan</td>
<td>28</td>
<td>3</td>
<td>221.6</td>
<td>11.8</td>
<td>16.6</td>
</tr>
<tr>
<td>Feb</td>
<td>27</td>
<td>2</td>
<td>243.4</td>
<td>9.4</td>
<td>12.2</td>
</tr>
<tr>
<td>Mar</td>
<td>30</td>
<td>1</td>
<td>284.5</td>
<td>35.0</td>
<td>8.5</td>
</tr>
<tr>
<td>Apr</td>
<td>26</td>
<td>4</td>
<td>136.4</td>
<td>125.2</td>
<td>4.2</td>
</tr>
<tr>
<td>May</td>
<td>29</td>
<td>2</td>
<td>165.5</td>
<td>152.5</td>
<td>12.7</td>
</tr>
<tr>
<td>Jun</td>
<td>30</td>
<td>0</td>
<td>234.1</td>
<td>87.6</td>
<td>22.4</td>
</tr>
<tr>
<td>Jul</td>
<td>29</td>
<td>2</td>
<td>183.3</td>
<td>152.6</td>
<td>31.6</td>
</tr>
<tr>
<td>Aug</td>
<td>31</td>
<td>0</td>
<td>291.9</td>
<td>81.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Sep</td>
<td>27</td>
<td>3</td>
<td>182.7</td>
<td>90.8</td>
<td>26.8</td>
</tr>
</tbody>
</table>

FY 1980 Totals | 347 | 19 | 2625.8 | 880.7 | 184.8

Summary

<table>
<thead>
<tr>
<th>FY 1980</th>
<th>FY 1979 Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Available hrs observed</td>
<td>71.1</td>
</tr>
<tr>
<td>%Available hrs lost to weather</td>
<td>23.9</td>
</tr>
<tr>
<td>%Available hrs lost to instr. fail.</td>
<td>5.0</td>
</tr>
<tr>
<td>Average No. observed hrs/assigned night</td>
<td>7.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aperture</th>
<th>Visitors (%)</th>
<th>CTIO staff (%)</th>
<th>Maintenance or bright moon</th>
<th>Unschedld.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-m</td>
<td>65.0</td>
<td>30.6</td>
<td>4.4</td>
<td>—</td>
</tr>
<tr>
<td>1.5-m</td>
<td>60.9</td>
<td>36.9</td>
<td>2.2</td>
<td>—</td>
</tr>
<tr>
<td>1-m</td>
<td>69.7</td>
<td>23.2</td>
<td>1.4</td>
<td>5.7</td>
</tr>
<tr>
<td>91-cm</td>
<td>70.2</td>
<td>24.9</td>
<td>1.9</td>
<td>3.0</td>
</tr>
<tr>
<td>61/91-cm</td>
<td>21.0</td>
<td>4.6</td>
<td>46.8</td>
<td>27.6</td>
</tr>
<tr>
<td>61-cm</td>
<td>53.8</td>
<td>6.3</td>
<td>0.0</td>
<td>39.9</td>
</tr>
<tr>
<td>41-cm</td>
<td>47.0</td>
<td>5.5</td>
<td>0.0</td>
<td>47.5</td>
</tr>
</tbody>
</table>

*aVisitor figure includes Yale time.
*bVisitor figure includes Michigan time.
'Usage generally restricted to dark of the moon.
"The figures for the 41-cm #2 telescope are not included. Total nights (and hours) logged on the 41-cm #2 telescope were 6(46).

1-m telescope: Yale = 18.6%; visitors = 51.1%.
61/91-cm telescope: Michigan = 7.1%; visitors = 14.0%.

TABLE IV. CTIO weather data from 1 October 1979 to 30 September 1980.

<table>
<thead>
<tr>
<th>Month</th>
<th>Photometric</th>
<th>Useful</th>
<th>Observational</th>
<th>$T_{\text{max}}$ (°C)</th>
<th>$T_{\text{min}}$ (°C)</th>
<th>Max Wind (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>15</td>
<td>4</td>
<td>19</td>
<td>+27.8</td>
<td>+03.9</td>
<td>56</td>
</tr>
<tr>
<td>Nov</td>
<td>16</td>
<td>4</td>
<td>20</td>
<td>+29.4</td>
<td>+05.6</td>
<td>75</td>
</tr>
<tr>
<td>Dec</td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>+28.3</td>
<td>+08.9</td>
<td>54</td>
</tr>
<tr>
<td>Jan</td>
<td>21</td>
<td>6</td>
<td>27</td>
<td>+26.1</td>
<td>+10.6</td>
<td>36</td>
</tr>
<tr>
<td>Feb</td>
<td>25</td>
<td>3</td>
<td>28</td>
<td>+26.1</td>
<td>+10.0</td>
<td>44</td>
</tr>
<tr>
<td>Mar</td>
<td>23</td>
<td>2</td>
<td>25</td>
<td>+29.4</td>
<td>+07.8</td>
<td>45</td>
</tr>
<tr>
<td>Apr</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>+24.4</td>
<td>+01.0</td>
<td>81</td>
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<tr>
<td>May</td>
<td>5</td>
<td>12</td>
<td>17</td>
<td>+23.3</td>
<td>+01.7</td>
<td>70</td>
</tr>
<tr>
<td>Jun</td>
<td>4</td>
<td>9</td>
<td>13</td>
<td>+22.8</td>
<td>-04.4</td>
<td>62</td>
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<tr>
<td>Jul</td>
<td>10</td>
<td>6</td>
<td>16</td>
<td>+22.2</td>
<td>-04.4</td>
<td>70</td>
</tr>
<tr>
<td>Aug</td>
<td>19</td>
<td>1</td>
<td>20</td>
<td>+23.9</td>
<td>-02.8</td>
<td>76</td>
</tr>
<tr>
<td>Sep</td>
<td>17</td>
<td>5</td>
<td>22</td>
<td>+25.0</td>
<td>-02.8</td>
<td>66</td>
</tr>
<tr>
<td>Totals</td>
<td>189</td>
<td>256</td>
<td></td>
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</tbody>
</table>

B. Telescope Assignment Committee

The following scientists served on the CTIO Telescope Assignment Committee during FY 1980: H. Ables, U. S. Naval Observatory; O. J. Eggen, CTIO; J. Graham (Chairman), CTIO; G. Grasdalen, U. of Wyoming; H. Gursky, Harvard-Smithsonian; R. Peterson, Lockheed-Palo Alto; H. Spinrad, U. of California, Berkeley; A. Toomre, MIT; D. Wills, U. of Texas; and R. J. Zinn, Yale University.

C. Users Committee

The following individuals served on the CTIO Users Committee in FY 1980: H. E. Bond, U. of Louisiana; D. S. Butler, Yale University; A. P. Cowley, U. of Michigan; D. A. Harper, U. of Chicago; A. A. Hoag, Lowell Observatory; A. U. Landolt (Chairman), U. of Louisiana; T. D. Kinman, KPNO; R. P. Kirshner, U. of Michigan; D. H. McNamara, Brigham Young University; J. Mould, Hale Observatories and KPNO; M.T. Ruiz, U. of Chile; E. G. Schmidt, U. of Nebraska; W. F. van Altena, Yale University; and R. E. Williams, U. of Arizona.

D. AURA's Committee Meeting at CTIO in FY 1980

The following members of AURA's Standing KPNO/CTIO Committee visited CTIO in FY 1980: A. D. Code, U. of Wisconsin; P. Conti, U. of Colorado; C. Bockelman, Yale University; W. A. Hiltner, U. of Michigan; R. Kraft, U. of California, Santa Cruz; D. Weedman, Pennsylvania State University; and D. Wilkinson, Princeton University (Chairman).
E. Visiting Committee

The following individuals served on the AURA Visiting Committee which met at CTIO in FY 1980: I. Iben Jr., U. of Illinois; J. Miller (Chairman), U. of California, Santa Cruz; G. Neugebauer, Cal Tech; V. Rubin, Carnegie Institution of Washington; A. Sandage, Hale Observatories; J. Taylor, U. of Massachusetts, and S. van den Bergh, Dominion Astrophysical Observatory.

F. Other Visitors

The following scientists and authorities paid nonobserving visits to CTIO in FY 1980:

V. PUBLICATIONS

The following publications by visiting scientists and CTIO staff members were published in FY 1980 or too late in FY 1979 to be listed in our previous report.


Aaronson, M.—see Mould, J.

Aaronson, M.—see Persson, S. E.

Albrecht, R.—see Wyckoff, S.


Alcaino, G.—see Liller, W.


Bahcall, N. A.—see Williams, T. B.


Bell, R. A.—see Hesser, J. E.


Blanco, B.—see Blanco, V. M.


Blanco, V. M.—see Blanco, B.

Blanco, V. M.—see McCarthy, M. F.


Boksenberg, A.—see Baldwin, J. A.

Boksenberg, A.—see Wyckoff, S.


Boudreault, R.—see FitzGerald, M. P.

Brandenburg, J. T. and Branduardi, G.—see Giacconi, R.

Burbidge, E. M.—see Baldwin, J. A.

Butler, D.—see Keith, D. W.


Calderon, J. H.—see Sercic, J. L.


Canizares, C. R.—see Remillard, R. A.

Canterna, R.—see Harris, H. C.

Canterna, R.—see Pilachowski, C. A.


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OBSERVATORY REPORTS

Demers, S.—see van den Bergh, S.
Dopita, M. A.—see Schwarz, R. D.
Doxsey, R. E.—see Armstrong, J. T.
Dufour, R. J.—see van den Bergh, S.
Ebberts, D.—see Conti, P. S.
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Feast, M. W.—see Nicolson, G. D.
Feinstein, A.—see Vega, E. I.
Feldman, F. R.—see Philips, M. M.
Fich, M.—see FitzGerald, M. P.


FitzGerald, M. P.—see Feinstein, A.

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Ford, K.—see Rubin, V. C.

Forman, W.—see Giacconi, R.


Frogel, J. A.—see Cheung, L. H.

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Frogel, J. A.—see Phillips, M. M.


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Glass, I. S.—see Nicolson, G. D.


Graham, J. A.—see Rose, J. A.


Grandi, S.—see Phillips, M. M.

Green, J. R.—see Kinman, T. D.

Gresham, M.—see Liebert, J.

Grieve, G. R.—see Turner, D. G.

Griffiths, R. E.—see Armstrong, J. T.

Grindlay, J. E.—see Canizares, C. R.

Grindlay, J. E.—see McClintock, J. E.

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Gull, T. R.—see Balick, B.

Gull, T. R.—see Parker, R. A. R.


Hagen, W.—see Boesgaard, A. M.

Hardy, E.—see Demers, S.

Harris, G. L. H.—see FitzGerald, M. P.

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Henry, J. P.—see Giacconi, R.


Herbst, W.—see Turner, D. G.


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Hunstead, R. W.—see Spinrad, H.


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Matthews, K.—see Persson, S. E.
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Miller, D. H.—see Martins, D. H.
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V. M. BLANCO
Director