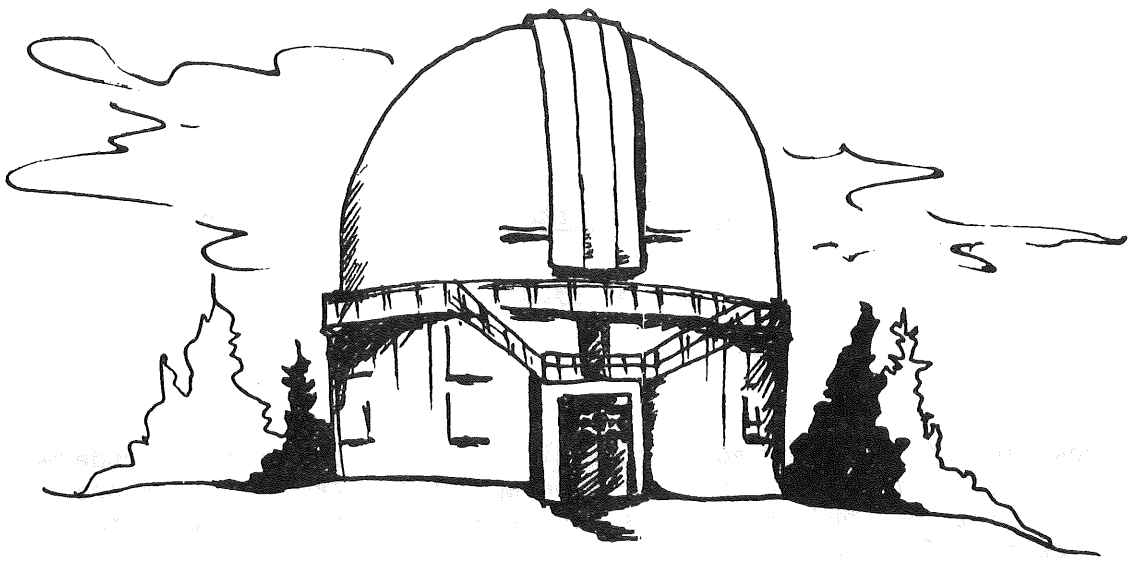
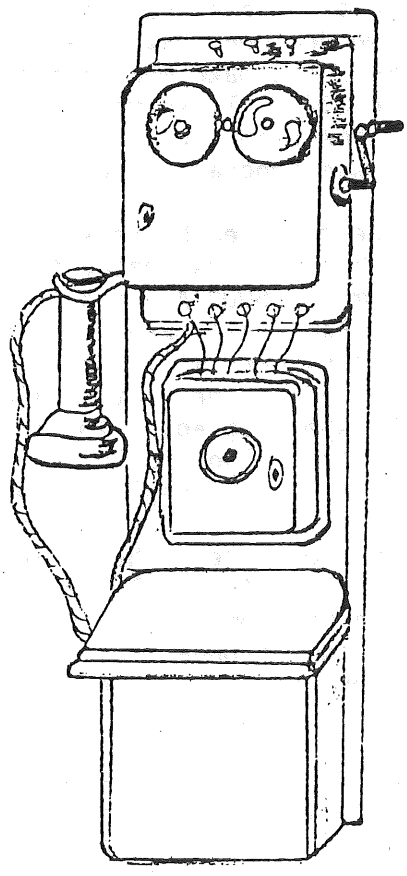


DAVID DUNLAP DOINGS

VOL. 9, NO. 4 APRIL 27, 1976



Telephone Exchange Changed

The University's exchange is now 978 (in place of 928). The departmental numbers are thus

978-3149

and

978-3150

The Observatory number remains unchanged,

884-9562

Proposed Modifications to the 74-inch Spectrograph

by Tom Bolton

By now many of the DDD readers have already heard that work is underway to modify extensively the Cassegrain spectrograph of the 74-inch telescope. The editor of this distinguished journal has kindly provided me with space to outline these modifications for you.

Our original proposal was to replace the present G40 camera system with a fast external-focus camera suitable for moderate dispersion work with image tubes and other types of modern detectors as well as photographic plates. However, it quickly became clear that the design of such a camera that would fit within the present spectrograph casing was not straight forward. Accordingly, Harvey Richardson was invited to take a look at our system and make suggestions.

Harvey visited us on March 4 and 5. After extensive consultations involving Jack Heard, Bob Garrison, Don MacRae, and myself, we decided that it would be more useful to scrap the G40 and the idea for a new camera and make modifications in the present f/5 camera system (usually known as the G12). These modifications meet most of the original objectives while at the same time enabling us to get more light down the slit and lose less light within the spectrograph itself.

The existing slit head and collimator will be replaced by sets of interchangeable optics. There will be two collimators with mirrors coated for high reflectance - one optimized for the blue (Balmer jump to 5000 Å) and the other optimized for the red and near-IR (5000Å to 1.1μ). Each collimator will have a correspondingly optimized image slicer. These image slicers will convert a 3".5 square slit on the sky into a 30μ x .8mm slit projected on the plate while guiding all of the light around central obstructions in the spectrograph. The image slicers will not only put more starlight down the slit, but they also should act as effective "moonlight" eliminators. The image slicers will be replaceable by lens slits. These will be optimized for the blue and red like the other optics and provide fixed slit widths of 22μ, 44μ and 66μ projected on the plate. These figures are tentative and suggestions for different projected slit widths would be welcomed. The changes in the slit assembly will require changes in the comparison source optics. Some consideration is being given to providing a hollow cathode Fe arc comparison source either instead of or in addition to the present Fe arc source. A neon-argon source will probably also be provided for the red-IR region.

Two changes are planned below the collimator. First, the corrector plate will receive a broad-band anti-reflectance coating to increase its transmission. Second the plateholder assembly is to be reconstructed so that the plate holder can be replaced by a diagonal mirror. This mirror will reflect the beam out through the present spectrograph casing. This casing will be rebuilt so that image tubes or other modern electronic detectors can be accommodated.

cont'd . .

It is difficult to be precise about the expected gains in exposure time and information. Roughly, there will be a 40% reduction in exposure time because of changes below the slit. That is, a one-hour exposure with the present G12 would be reduced to about 36 minutes if a comparable lens slit was used with the new system. The image slicers will give another gain of about 2.5, but that will be split between an exposure-time gain and an information gain because the image slicer produces a wider spectrum than is customarily taken. Therefore, the gain in exposure time depends on the slit setting chosen. The table below summarizes the situation for some common slit settings.

Old slit	New Slit	$\left(\frac{\text{New Exposure Time}}{\text{Old Exposure Time}}\right)$*	Information Gain	Remarks
9/.5	9/.5	0.6	1.00	Lens slit
9/.5	12/.8	0.3	1.26	Image slicer Lower resolution
13/.5	12/.8	0.4	1.26	Image slicer
13/.3	12/.8	0.8	1.63	Image slicer
25/.3	12/.8	1.33	1.63	Image slicer
25/.3	25/.3	0.6	1.00	Lens slit

*These are only intended as estimates. The actual values may be considerably different.

As of mid-April, all of the major optical components are on order. These should all be delivered by early fall. The mechanical design is still underway. The mechanical work should begin sometime this summer. I hope that the changes can be installed in mid-Winter, and that we will be fully operational by next spring. We have not yet ordered new gratings or an image tube. It is my hope that an image tube system can be provided by summer of 1977. Suggestions about what sort of dispersions and image-tube should be provided and/or financial contributions towards their purchase are welcome.

OBSERVING

Spectrophotometry Difficulties

Observers with the 74-inch who have done or are planning to do spectrophotometry should be aware that some problems with the present plate calibration system have been discovered. These problems were first detected late last Fall by Austin Gulliver. He found that line strengths on his plates were dependent on the density to which the continuum had been exposed. By taking test exposures of γ Gem covering a factor of 8

in exposure time and reducing them with a single calibration plate exposed and developed at the same time, he was able to show that our calibration curve was incorrect and that the error was different from one emulsion type to another.

The problem clearly lies with the exposure values provided by Kodak for the density step tablet that is used to expose the calibration plate. These values are correct - we have remeasured them ourselves - but they are apparently not relevant in the context we are using them. We do not fully understand the reason for the discrepancy, but one guess goes as follows. The spectra are exposed in a semi-specular (f/5) beam while the calibration plate receives a diffuse (f/0) exposure. The two "beams" will be scattered differently in the emulsion because of the different f-ratios, and as a result, each will produce a different density vs. exposure curve. The difference between the two curves will depend on the scattering properties of the emulsion and will thus be emulsion- and perhaps wavelength- dependent.

We have attempted to derive corrections to the standard exposure values given by Kodak by exposing calibration curves obtained from the strip and from the new spot sensitometer using the same photographic plate. The standard exposure values for the strip are adjusted to give the same calibration curve as the spot sensitometer. This should suffice since the spot-sensitometer produces a semi-specular exposure similar to that of the spectrograph. The adjustments to the strip calibration are then checked by comparing plates of various exposure lengths of γ Gem. The new standard exposures are not considered acceptable unless the Hγ (for blue plates) or Hα (for red plates) line profile is exposure-independent and fits the published photoelectric and photographic line profile to within the expected photometric errors.

So far a satisfactory recalibration has been completed for the IIa-0 emulsion. Tests indicate that this new calibration removes the problems found by Gulliver. The recalibration of the IIIa-J emulsion is nearly complete. This emulsion has been a complicated problem because of its high contrast and variable wavelength sensitivity. The high contrast is a problem for γ Gem because the exposure has to be very heavy (D=3.0 or so) at the continuum before the core of the Hγ profile gets up off the toe of the characteristic curve. The rapid variation in wavelength sensitivity means that a straight line does not adequately represent the continuum across a wide H line. Austin Gulliver has written some modifications to reduct which, when installed, should remove this problem. The recalibration exposures for the IIa-F emulsion have not yet been reduced.

The recalibrated standard exposures should prove adequate, but spectrophotometrists using 74-inch strip calibrations should carefully check their data for exposure effects to insure that there are no residual problems. I would appreciate being informed of any problems that may be discovered.

Tom Bolton

Las Campanas

Dave Turner returned on March 14 from a 25-night run on the Las Campanas 24-inch. He used 81% of the nights, losing two nights to clouds, one to illness and 1 3/4 to instrumental breakdown. New sights reported on the mountain: telephone system, paved road between 40" and 100" telescopes, first light through the Carnegie 100" telescope (though not as yet aluminized).

Tony Estevens returned this month from a long (Feb. 26-Apr. 8) observing and maintenance session at Las Campanas. Many repairs, readjustments and installations were effected, ranging from house-heating to telescope-drive, some of them requiring appropriation of observing time, but most of them not. From a list of 17 items which Tony brought home it would appear practically everything is ship-shape. In addition to this, Tony engaged in diplomatic manoeuvring (at the Chief-of-Protocol level) towards the establishment of a radio link between DDO and Las Campanas. The situation looks hopeful on a six-months time scale (six months away from final clearance, that is.)

Bob Garrison has recently circulated information and application forms to prospective guest investigators. The period involved is July - December and applications are due by May 15. Any who were missed should apply to Bob for the circular.

Radio Stars at NRAO

Ernie Seaquist has been observing with Phil Gregory at the radio interferometer at NRAO at Green Bank during the week of April 12-19. Ernie is seeking confirmation of results on close binaries which he obtained last year in Australia. In particular he is studying the radio emission from UU Piscium, a new radio star which he detected at Parkes and which, quite by coincidence, is being analysed by Tom Bolton and Roel Hurkens from optical observations made at DDO. (The system is known to be undergoing mass exchange.) Ernie has been obtaining the flux at 11 cm and 4 cm and expected to obtain an improved radio position. Ernie and Phil Gregory were also observing symbiotic stars including AG Peg which they had already identified as a radio source. They also have under way a radio search program involving a number of late-type emission-line stars. While at NRAO Ernie has also been reducing some interferometer data on galaxies which he obtained several years ago.

At Cerro Tololo

Sidney van den Bergh is observing April 22 to May 8 with the CTIO 1 1/2m and 4m telescopes.

COMINGS AND GOINGS

On April 7 and 8 Sidney van den Bergh gave lectures at Ohio State University on "Life in the Universe" (the 30th annual McMillin Lecture) and on "Evolution and Clustering of Galaxies". At Cornell University April 12-17 he also gave lectures on "The Radio Source Centaurus A", "Recent Observations of Cassiopeia A and "Evolution of Galaxies inside and outside of Clusters". Sidney has also been invited to give a

review paper on the Galactic Disk and Galactic Bulge for Commission 33 (Galactic Structure and Dynamics) at Grenoble. He will also be giving a review paper on "Problems of Southern Hemisphere Astronomy" at a workshop on "The Future of Southern Hemisphere Astronomy" in Tucson in August.

Gerry and Kay Longworth are in Vancouver April 12 - May 1 visiting their daughter Lenora (Mrs. Donald Large) and family.

SEMINARS

APRIL

As announced with these additions and changes:

Wed. 14th McL	Dr. Thomas Adams, University of Chicago "Morphology of Seyfert Galaxies"
Tues. 20th Erindale	Dr. Henry C. Halls, Erindale, "The Slate Island Meteor Crater" (advanced from May 4)
Wed. 21st McL	Dr. Larry Auer, Yale University, "Proto-Stellar Masers"

MAY

Tues. 4th D.D.O. 4 p.m.	Bob Watson, University of Tasmania "β Cephei Stars"
Tues. 11th D.D.O. 4 p.m.	Karl Kamper, "Cassiopeia A, the Invisible Supernova"
Tues. 25th D.D.O. 4 p.m.	Bob Garrison, "Galactic Structure from the Southern Hemisphere"

JUNE INSTITUTE JUNE 8 - 11

PAPERS SUBMITTED IN MARCH AND APRIL

P.G. Martin	Nucleus of the Seyfert Galaxy NGC 1275
R. Racine, D.A. Hanes and W.E. Harris	Globular Clusters in the Virgo System and the Value of the Hubble Constant

D.A. MacRae & Helen S. Hogg	Canadian Telescope in Chile
M.A. Buckley	Colour Magnitude Diagram and Luminosity Function for M2 to V = 25
E. Seaquist	Radio Continuum Observations of Southern Emission Line Stars and X-Ray Sources

P O T P O U R R I

Born

To Kim (Ph.D. 1964) and Sandra (M.A. 1962) Innanen a son, Andrew, on April 2.

Send-offs (sends-off?)

On April 9 in the library at D.D.O. we wished God-speed to Austin Gulliver who was about to take off (well, nearly) in his Datsun 240Z for Victoria. Meanwhile Barrow Baldwin had settled in here after arriving a week or two previously from Victoria. Both on PDF's.

On April 20 in the Faculty Club at Erindale there was a College and Departmental reception for René Racine recognizing his forthcoming (July 1 officially) departure.

Alumnus Appointed

Don Morton (B.A., M & P, 1956 and one-time D.D.O. summer assistant) has been appointed Director of the Anglo-Australian Observatory effective this summer.

Staff Honours

Helen Hogg is to be awarded the degree of D. Sc., *honoris causa*, by McMaster University, May 29.

Don Fernie has accepted nomination to the Vice-presidency of IAU Commission 27.

DDD Printer

It is with sadness that we record the recent death of Mr. Jack Stephens who had been in charge of the Duplicating Service in Sidney Smith Hall and who had been so painstaking in producing DDD.

FINAL ITEM

The Time Inventors. I.

Shortly after I had arrived in Canada I committed a very grave faux pas. In conversation with Ruth Northcott one day the name of Sandford Fleming happened to come up, and in all innocence I asked who he might be. The effect on Ruth was much as though I had casually announced that I really had no idea of the difference between a planet and a star. Luckily, news of this dreadful lacuna in my knowledge never reached the ears of the Canadian immigration authorities, who would doubtless have instantly revoked my status of landed immigrant. For, as every native Canadian learns at his mother's knee, Sir Sandford Fleming was the national hero who gave to the world the concept of standard time. However, now that Canadian citizenship is firmly mine, I might make so bold as to reveal that he was not entirely alone in this vision.

Today we flash around the world with an ease and frequency limited only by the size of the travel allowance in our NRC grants or what monies we can wheedle out of the Director. It is, as the saying goes, lunch in London, dinner in Toronto, and your baggage in Buenos Aires. Even on a more local scene it is nothing to leap into the family car and take off on a hundred mile drive to the cottage of a weekend. All of which makes it difficult to appreciate how very slowly the idea of travel for the common people developed historically. Even in a small developed country like England, it is hardly more than a century since the vast majority of the population ever travelled anywhere. Go back another century or so and one finds there were no public conveyances at all, so if a person wasn't rich enough to own a horse or his own small carriage, travel was very much a matter of walking. Thus most people lived all their lives within a radius of a few miles.

Add to that the fact that there was no radio or telegraph to bring instantaneous communication with the outside world, and one sees that there was no need for everyone to keep the same system of time. So it was that even well into the nineteenth century almost every town and village in England kept its own local time. Life was leisurely, there was no need for any great accuracy in regulating work or sleep, and the old church clock, occasionally checked against a sundial, did very nicely for everyone.

The man who first really got the idea of public coaches going was a theatre owner by the name of John Palmer. He had great difficulty in moving his travelling actors around in a hurry, and worked hard at developing a network of public transport by coach. So successful was he that in 1782 he gave up his theatre interests and went into the transport business fulltime, even convincing the Government to develop a system of mailcoaches. (One hopes the Canadian Government will soon see the advantages of horse-drawn coaches over cleft-stick runners.) This did wonders for the highwayman business - mailcoach drivers came equipped with no less than a cutlass, two pistols, and a blunderbuss - but the roads were such that many people preferred to stay home. The Greenwich Observatory staff, for instance, would sooner use the expensive (a sixpence) river craft in getting to London than entrust their lives to what they called the hackney hell-cart.

And it still didn't do much for the idea of a standard time. Bristol and London, for example, had a twenty minute time difference, and the mailcoach driver, already a-jangle with his armaments, was further encumbered with a remarkable leather-pouched watch that could be set to lose twenty minutes on the down run and then reset to gain them back on the up run.

It was the Industrial Revolution that changed all that: the coming of the railways and the telegraph. In 1835, for instance, there were 400 people a week travelling by coach between Leeds and Bradford; a year later the railway was carrying 3500 a week - much to the surprise of the railway authorities, who had originally seen the railway mainly as a freight service. Things really took off in 1851, when more than six million people flocked to see the Great Exhibition in London, less than 75,000 of them being foreigners. Suddenly all Britain was travel-mad, and a certain Thomas Cook began to have visions of a prosperous future.

Until mid-century the railways got along with an unbelievable timetable that took account of local time differences, but now, with the telegraph available to distribute time signals, they began a clamour to have a single time system in the country. Immediately, all the activist citizen groups of the day took up vehement opposition against this creeping technology. (The British, of course, are a conservative race even in their sports, As Edwin Newman has recently reminded us, a soccer player found kicking the flesh off the legs of an opponent will, according to the rule book, "have his name taken by the referee". Although in cricket, a gentleman's game, should a bowler be found delivering the ball in a manner calculated to crush the skull of an unwary batsman, the umpire will merely "have a word with him".) *The Times* of London, wherein has always been delivered the quintessential of British opinion, found its letter columns deluged. Someone signing himself 'Chronos' issued a thunderous denunciation of the entire scheme, demanding that there be a "return to the only true and simple rule of keeping our clocks right instead of keeping them wrong. It happens that the world takes 24 hours to rotate on its axis. This fact may be considered 'objectionable' but so long as it remains unaltered it is simply impossible that it should be the same hour at two different places at once...."

More surprising was the fact that the Astronomer Royal, Sir George Airy, was at best lukewarm to the idea of forcing 'the provinces' to keep Greenwich time, as he later would be towards the suggestion that the Greenwich meridian be adopted as the world's prime meridian. But he, of course, by allowing the dissemination of Greenwich time signals via the electric telegraph, had really made the whole thing possible. In any case, despite the likes of Chronos, the railway authorities got the scheme approved, although it would not be until 1880 that the last of the traditionalists was stamped out by a legal Act making it mandatory for all in Britain to keep Greenwich Mean Time.

Already the question of standard time had begun to rear its head on a much wider scale, this time international. Two factors made it increasingly urgent that a solution be found. The first was the rapid increase in seafaring during the Industrial Revolution, which gave rise to the need for adopting a single prime meridian on which to base nautical charts. Hitherto every nation had adopted its own prime meridian, often not indicated on its charts, so that a navigator using someone else's charts was in a hazardous position over longitude determinations. The second factor was the opening up of the railroads across the North American continent, and already by 1879 the American railroads found themselves with 75 different time systems to contend with across the United States.

But if it was difficult to get one small country to agree internally to a system of standard time, how would it be to get international agreement when all kinds of nationalistic fervour would be brought to bear? As far back as 1824 Laplace had been able to foresee the fighting that would break out over whose meridian should be the prime one, and had therefore made the remarkable suggestion that the prime meridian be that at which it was midday when the sun reached the vernal equinox in the year 1250, the year in which the apogee of the terrestrial orbit coincided with the solstice in Cancer. (This turns out to be about 11° W longitude on a modern map.) It was a suggestion worthy of a celestial mechanician from the Age of Reason, but crusty Victorian seadogs and railroad engineers failed to appreciate its charms.

J.D.F.