



DAVID DUNLAP DOINGS

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U. OF T.'S
NEWEST
TELESCOPE

*Dedicated at
Scarborough College*



Cover: p. 2

*Photo: David Harford
Scarborough College*

CONGRATULATIONS

To *Tom Bolton* and *Peter Martin* on their promotions to the rank of Full Professor effective July 1, 1980.

To *Pamela* and *Alan Sullivan* on the birth of their first child, *Todd Alan Sullivan*, born on Valentine's Day, February 14. Young Todd, who weighed 8 lbs. 4 oz. (3.74 kg) at birth, has experienced steady mass accretion during his first six weeks and now weighs 10 lbs. (4.54 kg).

To *Peter Martin* and *Camie Geary* who were married in Niagara-on-the-Lake on February 9 and then spent the week of February 18-25 in sunny Cuba.

To *Pim FitzGerald* on being promoted to Full Professor at the University of Waterloo. To a small extent we bask in the reflected glory since Pim got his B.Sc. degree with us in 1962 in the Astronomy Division of the old and honourable Mathematics and Physics course, and then enrolled here for his Master's degree, completing it in 1963. He did his Ph.D. at the Warner & Swasey Observatory and then went directly to Waterloo in 1967. Everyone knows of his massive study of the distribution of interstellar reddening material near the Sun. His later work has been in the general area of galactic structure, some of it done with the Las Campanas telescope. The promotion is certainly well-deserved.

JUNE INSTITUTE 1980

MODERN ASTRONOMY AND ASTROPHYSICS

The Graduate Department of Astronomy and the David Dunlap Observatory announce the 1980 JUNE INSTITUTE. This will be held from TUESDAY JUNE 3 to FRIDAY JUNE 6 inclusive, on the St. George campus. Four invited speakers will each present four lectures on topics related to recent developments in astronomy and astrophysics. The speakers and their major fields of interest are:

- W. David Arnett* - *University of Chicago*
Nucleosynthesis and dynamical evolution of stars
- Arthur N. Cox* - *Los Alamos Scientific Laboratory*
Stellar structure, evolution and stability
- Stephen S. Murray* - *Centre for Astrophysics, Cambridge, Mass.*
X-ray astronomy
- Ben M. Zuckerman* - *University of Maryland*
Interstellar Matter, interstellar molecules, radio astronomy

For further information including registration details contact: Prof. John R. Percy, Department of Astronomy, University of Toronto, Toronto, Ontario, Canada M5S 1A7.

SS 433 - CONTINUING RADIO STUDIES

Ernie Seaquist spent the period February 17 - March 1 at the VLA carrying out observations and analysis on two programs. One set of observations contributed to an ongoing investigation of SS 433. Maps, including polarization, are being obtained at two epochs to examine the time variability in the structure of the "jets". The epochs chosen correspond to times when, according to the popular "precessing beam" model, the position angles of the collimated beams exhibit a maximum difference. If the jets are related to the beams, then a variation in their position angles might show up. The variation in the polarization angle might indicate whether the magnetic field in the compact radio source is "locked to the beams".

Ernie returned via Tucson, Arizona, where he conferred with people there on SS 433 and gave a colloquium on March 3 entitled "Radio Observations of SS 433".

Sq

LETTER TO THE EDITOR

Dear Editor:

My RASC presidential travel duties are not quite as tightly constrained as you reported in the January 31, 1980 edition of the Doings, nor are they as far from completion. I actually have a two-year (and six weeks) term of office, ending this coming July, and I only have Montréal, Québec, Halifax and St. John's left to visit.

Yours sincerely,

John Percy.

P O T P O U R R I

Linda Twitchin, who incidently serves as the Production Department of DDD, has returned from a brief leave of absence, part of which was spent in sunnier and warmer climes than Richmond Hill affords. Her absence does not account for the stretched-out interval between issues of DDD. That, in part at least, was an economy measure (both temporal and financial).

John Lester and *Mary Lane* were at the Goddard Space Flight Center in Maryland February 21-26 and report a successful observing run on the IUE. They had two 16-hour shifts, fortunately not consecutive, to observe the ultra-violet spectra and energy distributions of metallic-line stars.

Bob Garrison and *Bob McLaren* were in Ottawa on February 1 to attend a combined meeting of the Working Group on Space Astronomy and the Task Force on the Canadian Space Telescope.

Bill Gilmore returned to Toronto on March 25 after a five-week stay at NRAO in Charlottesville where he had been reducing VLA data from 3 different experiments. The first of these involved July 1979 observations of 8 compact radio sources in the direction of SNR's. In the second experiment, the flux and polarization of SS 433 was monitored during two flares in October 1979. This was simultaneous with HEAO-B X-ray observations. The third program, which also involves SS 433, is described in *Ernie Seaquist's* item in this issue of the Doings.

Bill reports that the Washington area is being hit by a hockey craze, presumably as a result of the recent improvement in the Washington Capitals. He predicts substantially increased U.S. TV coverage of this year's Stanley Cup. (Just remember where you read this first - Ed.)

Bob McLaren gave a colloquium to the Physics department at the Royal Military College on March 14. His title was "Radio Astronomy at 30 THz - The Infrared Heterodyne Technique".

Bob Garrison has been appointed to the NRC Associate Committee on Space Research and attended a meeting of that committee on March 14. Bob was at Harvard on March 7-10 to consult with *Dr. R.E. Schild* on a joint project.

COLLOQUIA*

- April 2 *William Fowler, California Institute of Technology*
 "The Solar Neutrino Problem"
 (Room MP 202, 4:10 p.m.)
- April 3 (Thurs.) *William Fowler, California Institute of Technology*
 "The Age of the Universe, the Galaxy, and the Chemical Elements"
 (Joint Astronomy-Physics, Room MP 102, 4:10 p.m.)
- April 9 *Louis Noreau and Karen Finstad, University of Toronto*
 G-2000 Current Literature Seminar
- April 16 *Läle Akatli, University of Toronto*
 G-2000 Current Literature Saminar

* Unless otherwise noted, colloquia are held on Wednesdays at 4:00 P.M. in Room MP 137 with TEA at 3:45 in the Reference Room, MP 1404.

PAPERS SUBMITTED

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| C. Corbally and
R.F. Garrison | New Spectral Classifications on the MK System
for Visual Double Stars |
| M.Simard-Normandin,
P.P. Kronberg and
J. Neidhofer | Linear Polarization Observations of Extragalactic
Radio Sources at $\lambda\lambda$ 2 cm and 17-19 cm |
| B.F. Madore | The Period-Luminosity Relation for Cepheids -
III Widening the Gap |
| C.T. Bolton and
J.R. Thomson | A Population II UV-Bright Spectroscopic Binary |
| P. Murdin, D. Clark and
P.G. Martin | The Optical Spectrum of SS 433 |
| J.D. Fernie and
C.T. Bolton | HD 219150: A Star with a Remarkable Ultra-
violet Excess |
| P.P. Kronberg,
J.N. Clarke and
S. van den Bergh | The Quasar 3C351: VLA Maps and a Deep Search
for Optical Emission in the Outer Lobes |
| J.D. Fernie | 89 Herculis: Further Misdemeanors |

INSTRUMENTATION UPDATE FROM DDO

The editors are pleased to present three articles dealing with instrumentation and data reduction procedures at the Observatory. The first describes the latest developments with the PDS. The second, which is in two parts, discusses recently derived systematic corrections to our radial velocity measures. The final item deals with significant improvements to the Grant measuring engine. We wish to thank our contributors Tom Bolton and Karl Kamper.

PDS News

DEC has at last delivered the parts ordered from them for the PDS upgrade. This means it will finally be possible to connect all of the pieces that have been sitting around next to Ron's desk. Hardware installation is scheduled for March 18-19, and software modifications/improvements will begin immediately thereafter. The old software is unaffected by the system upgrade, so the changeover should cause minimal disruption.

The primary additions to our hardware include an HP2647A Intelligent Graphics Terminal and a Nicolet Zeta 1553 Pen Plotter. In addition, the computer memory has been expanded from 16K to 32K 12 bit words. The graphics terminal has an independent memory of 32K bytes and a BASIC interpreter. It

may be operated either on-line or off-line to the main system. Eventually, it will also be possible to use the graphics terminal as a remote terminal to the computers on campus. The pen plotter is more accurate than the chart recorder and at least as fast. In addition, it can produce complicated and labelled plots which are impossible with the chart recorder.

We have recently ordered a new set of objective lenses for the PDS microdensitometer. The new lenses will have a depth of focus seven times greater than the present lenses. They should greatly speed plate alignment and focusing. The greater depth of focus comes at the expense of resolution, but the resolution of the present system is far higher than required for most astronomical applications. The old objectives will still be available for users requiring higher resolution.

If you are not around DDO much, you may not be aware of the number of external users of the PDS system. Since July 1st the following individuals have either visited the Observatory to use the PDS or had work done on a "contract" basis: Tony Moffat and Robert LaMontagne (Université de Montréal), Gretchen Hagen Harris (Waterloo), Bill Harris (McMaster), several groups from the Ontario Institute for Cancer Research, Ermanno Borra (Laval), Roberto Mendez (Argentina), Lorne Avery (NRC-HIA), and Serge Demers (Université de Montréal).

Tom Bolton

Systematic Corrections to Radial Velocities
Measured From 74-inch Telescope Spectrograms

(i) The period 1968 - 1976

During the past couple of years several 74-inch telescope users have been attempting to measure high accuracy radial velocities for small-amplitude, long-period spectroscopic binary systems. This has caused us to worry a great deal about the stability of the velocity system of the 74-inch spectrograph and the size of the systematic corrections to reduce to the IAU system. Many DDD readers will be aware that we have had some problems with both systematic errors and stability since the spectrograph was modified in mid-1978. Standard velocity star measures since those modifications have been compiled by Karl Kamper and are discussed in the accompanying article.

I have been given further incentive to investigate the velocity system of the spectrograph in earlier years by my work compiling Jack Heard's unpublished work for publication. One of his completed but unpublished projects is the second epoch observations of 21 ninth magnitude IAU standard radial velocity stars (Heard, J.F. and Fehrenbach, Ch. 1972, Pub. DDO., 3, 113). Primary IAU standard velocity stars were observed frequently during both the first and second epoch observations. These provide a fairly complete record of the velocity system of the spectrograph from mid-1968 to mid-1976.

The results for the period July, 1968 to August, 1976 are shown in the table below. There is no evidence of any dependence of the systematic correction error on time or magnitude, but there is clearly some dependence on

spectral type. Inclusion of scattered 1977-78 measures does not alter any of these conclusions. On the whole the systematic corrections errors are satisfyingly small. However, inspection of the individual data points suggests that the statistical results may be somewhat misleading. One long series of measures of α Boo in 1971 showed slow drifts of $\pm 1 \text{ km s}^{-1}$ about IAU-DDO=0 km s^{-1} . The characteristic peak-to-peak time scale was about one month. In addition, we have indications from tests performed in early 1978 that small focusing adjustments errors in the spectrograph could produce systematic displacements errors. This is not surprising, since we discovered when the spectrograph was dismantled in 1978 that the collimator beam was not centered on the grating. Fortunately, it appears that it will be possible to use the temperatures and focus settings recorded in the observing log and the focus plates that were routinely obtained every night to correct for these effects.

It is unfortunate that so few standard velocity star spectrograms have been measured and that they are so unevenly distributed in time and among spectral types. However, there are several hundred unmeasured ones for the period in question. I plan to hire a summer student to measure enough of these and their corresponding focus plates to permit a detailed study of the velocity errors of the G12 system since July, 1968.

Results From Observations of IAU Standard Velocity Stars With
The G12 Camera [IAU-DDO \pm m.e. (number of plates)] *

a) ALL DATES July, 1968 - April, 1976 according to spectral type

F-stars	+0.4 \pm 0.2 (18)
G-stars	+0.0 \pm 0.2 (27)
K-stars	+0.0 \pm 0.1 (74)

b) According to date and spectral type

	July/'68-March/'71	April/'71-Jan/'73	March/'75-Aug/'76
F-stars	+0.4 \pm 0.2 (13)	—————	+0.4 \pm 0.7 (5)
G-stars	+0.1 \pm 0.3 (15)	-0.4 \pm 1.2 (2)	+0.0 \pm 0.3 (10)
K-stars	+0.2 \pm 0.2 (27)	-0.1 \pm 0.2 (41)	-0.4 \pm 0.2 (6)

c) According to magnitude and spectral type

	F	G	K
Bright IAU standards	+0.2 \pm 0.6 (4)	+0.2 \pm 0.3(15)	-0.1 \pm 0.2(50)
Faint IAU standards	+0.4 \pm 0.3 (14)	+0.1 \pm 0.3(12)	+0.1 \pm 0.2(24)

Note: Velocities for suspected variable IAU standards (HD 26162, 84441, 102870, 103095, 144579, 145001, 187691, 206778) have been included since their inclusion did not materially affect the results.

(ii) Recent Changes 1977 - 1980

As would be expected from the many changes made in the grating spectrograph since May, 1978, the relatively constant behaviour described by Tom Bolton in the accompanying article suffered some disruptions. Fortunately, we are now back to a reasonably stable and reliable arrangement as far as the radial velocities are concerned with a substantial improvement in system speed. Hopefully, both will be further improved when we have another try at bringing the image slicers into operation over the next month or two. Fortunately, this can be done without any changes that will affect the slits, so that less daring observers (almost everyone) can rest easily.

Through the combined efforts of Ron Lyons, Nancy Evans, and others, we have some 110 standard velocity star plates measured from 1977 to the present, which covers some four major "instrumental epochs": the old slit system up to April 1978; the image slicers and new optics to January 1979; a chaotic period with lens slits from January to November 1979; and a stable lens slit system up to the present. For historical perspective, recall that after several months of effort, we were unable to obtain satisfactory image quality from the slicers which were then returned to Victoria for internal reworking while we fell back on the lens slits. These gave good images but worse velocities, a situation attributed to mechanical instabilities which were gradually corrected by semi-brute force techniques throughout early 1979. Simultaneously, changes were made in the plate-holder mount to cure focus repeatability problems which had been with us since at least late 1977 so that we now stay almost always within the diffraction limit.

The table below gives the average error in the sense observed minus standard with the standard deviation of its determination for several recent time periods. The critical dates are the times of specific changes in the spectrograph, but not all changes appear to have affected the velocities. The last two columns give the number of plates measured and the standard deviation of a single plate about the average, which, of course, includes the errors of the various standard velocities themselves.

<u>Time</u>	<u>System</u>	<u>IAU-DDO</u>	<u>No</u>	<u>σ_1</u>
78 I 1 - 78 V 11	G12, old slit	+0.3 ± 0.3	16	1.3
78 VI - 79 I	G12, slicer	+1.3 ± 0.3	22	1.3
79 I - 79 V 9	G12, lens slit	+2.8 ± 0.6	23	3.0
79 V 10 - 79 VI 11	G12, lens slit	+1.8 ± 0.2	14	0.9
79 VII 2 - 80 III	G12, lens slit	-0.1 ± 0.2	24	1.2
79 I - 80 III	G8, lens slit	-0.3 ± 0.2	8	0.5

Karl Kamper

Grant Measuring Engine

The data acquisition and radial velocity reduction programs for the HP 9815 data acquisition system on the Grant measuring engine are now operational. The subroutine for averaging direct and reverse measures has not yet been written, but this is at most a minor inconvenience. As of March 4, we had not yet created line list files for all spectral types and DDO dispersions. Prospective users should check with Matt Bates to see what files are available or to learn how to create their own standard position files.

Tom Bolton