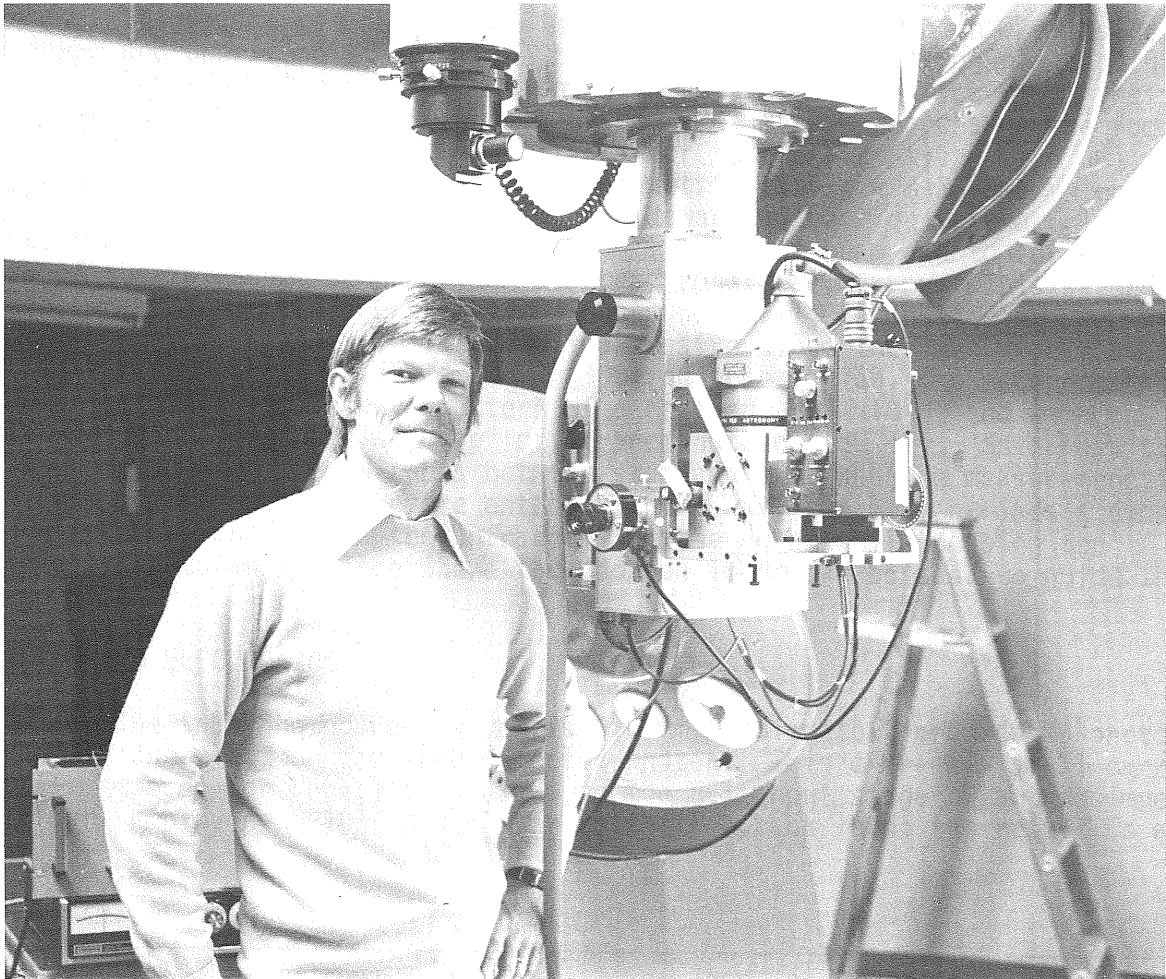


# THE <sup>DAVID</sup> DUNLAP DOINGS

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*Rick McGonegal with the Infrared Photometer (see p. 2)*

The cover photo shows Canada's only operational near-infrared photometer mounted at the Cassegrain focus of the 16-inch telescope at DA. Alongside the instrument, and appearing not unlike a proud parent, is Rick McGonegal. Rick has been primarily responsible for bringing the photometer into operation. His description of the device and its performance follows.

### The University of Toronto InSb Infrared Photometer

With the advent of readily available Indium Antimonide photodiodes, it is now possible to build sensitive and inexpensive photometers for the 1 to 5 micron region. About two years ago, Bob McLaren and Dennis Ward (who was here for one year as a PDF) completed the design for such a photometer. My job has been to assemble the instrument and integrate it with the telescope and with a computer data acquisition system. I am pleased to report that the photometer is now operational.

#### OPTICS

The optics can be divided into two parts: those which are inside the dewar and operating at 65 K (the temperature of solid nitrogen), and those which are outside and remain at ambient temperature. The optics chain inside the dewar includes an aperture wheel; a spherical mirror (to change the focal ratio to 35.5); a slide containing filters for the J (1.2  $\mu\text{m}$ ), H (1.6  $\mu\text{m}$ ), K (2.2  $\mu\text{m}$ ), L (3.4  $\mu\text{m}$ ) and M (4.8  $\mu\text{m}$ ) photometric bands; a BaF<sub>2</sub> Fabry lens; and the InSb detector itself. Outside the dewar, a spherical mirror, located behind the Cassegrain focus, is used to collimate the beam and to form an image of the telescope secondary on a second spherical mirror. This second mirror, which re-images the sky on the aperture wheel, is mounted on an electromechanical scanner (relatively inexpensive since they are widely used to read bar-code grocery labels etc.). During observation, the second mirror is "wobbled" in a square-wave pattern at a frequency of  $\sim 10$  Hz and with an amplitude which produces a "chop" of  $\sim 1$  arcminute on the sky. As a result, the photometer rapidly switches between star and sky, and the measurement is inherently differential. Before entering the dewar, the beam strikes a dichroic beamsplitter which directs the infrared into the dewar while passing the visible light to an eyepiece where the chopped image can be used to guide the telescope.

#### DETECTOR AND ELECTRONICS

The InSb photodiode, which is 0.5 mm in diameter, produces a photocurrent of one electron for each detected photon. This extremely small current ( $\sim 10^{-12}$  amperes for Vega!) is applied to the FET input stage of a transimpedance amplifier employing a  $10^{12} \Omega$  resistor in the feedback loop; the result is an

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output voltage proportional to the light intensity falling on the detector (1 volt for Vega). At the suggestion of George Watson, we mounted the entire high-impedance portion of the amplifier on printed-circuit board and located this inside the dewar very close to the detector. As a result, we have negligible microphonics - unlike many other InSb systems currently in use.

A lock-in amplifier demodulates the 10 Hz signal from the detector and produces a DC voltage proportional to the amplitude of this signal. This in turn is fed to a voltage-to-frequency converter which produces TTL pulses at a rate proportional to the input voltage. The pulses are then counted in a scaler.

#### DATA ACQUISITION AND REDUCTION

Starting with the scaler, all data manipulation is controlled by a NOVA 3 computer via CAMAC interface and the FORTH language. The program asks the operator for information about the upcoming observation and then starts a series of integrations. As each integration is completed, the computer prints out the counts for that integration as well as a running mean and standard deviation. The observation is terminated by hitting a control character on the keyboard. The data are stored on floppy disc as they are generated. Reduction of the data is performed on the same computer. Since the filters we use are identical to those used at many other observatories including CTIO, NASA Infrared Telescope, UKIRT, AAT, SAAO, CFHT (available second half 1981), transformation equations are not required.

#### PERFORMANCE

In terms of sensitivity, our photometer is competitive with the photometers used at large national observatories. As mentioned above, it is significantly better than many of these with respect to freedom from microphonics. On a night with good transparency, the instrument should reach  $J = 8$  with a S/N of 30 in 4 minutes on the 16-inch telescope.

I am currently making systematic observations of a large number of relatively bright stars to be used as standards. At the same time, I am obtaining infrared photometry of bright galactic Cepheids. These latter observations are an important part of a program involving Cepheids and the local distance scale.

Rick McGonegal

## CONGRATULATIONS

To *Allen Yen* who was appointed to the rank of University Professor by action of the Governing Council on November 20. Allen has been "Associate in Research" on the Observatory staff roster for many years and is also cross-appointed to the Department in the School of Graduate Studies. We can bask in the reflected glory.

To *Bob and Marion McLaren* on the birth of their third child *Linda Kelly McLaren* (a sister for *Cathy* and *Janet*) on September 25. Linda is now eight weeks old and the McLaren household is beginning to return to normal. Marion is taking two years' leave of absence from her teaching position at Lawrence Park Collegiate Institute.

To *Bill and Betty Herbst* on the birth of their second son, *Peter James Herbst* (a brother for *John*) on September 30. Bill obtained his Ph.D. here in 1974 and is now on the faculty of the Department of Astronomy at Wesleyan University in Middletown, Connecticut.

## COMINGS AND GOINGS

*Shenton Chew* has recently joined the staff of the Observatory as an Engineering Technician in the Electronics Shop. Shenton comes from Malaysia via Melbourne, Australia, and Ryerson Polytechnical Institute here in Toronto. Previously he was working for a retail research foundation carrying out performance tests on radios and TVs.

*Rosemary Diamond* is our new Secretarial Assistant at DDO. She has recently come to Toronto from the Montreal area where she was employed by La Commission Scolaire de Brossard. Rosemary will be assisting Zane part of the time and she'll be found at the desk where Esther used to be. Esther has taken over Linda's former station in the same office.

## JUNE INSTITUTE 1981

### MODERN ASTRONOMY AND ASTROPHYSICS

The Department is pleased to announce that the 1981 June Institute will be held in the first week of June (June 1, 2, 3 likely) with three speakers each giving one lecture per day. Please mark this on your 1981 calendar. John Percy is once more looking after the arrangements.

## GRADUATE STUDENT NEWS

This fall we have welcomed 5 new students to the Graduate Department of Astronomy and two of our M.Sc. students admitted last year have advanced to the Ph.D. programme.

*Petrusia Bojetchko* has moved up through the Astronomy and Astrophysics Specialist's Programme here to become an M.Sc. student under the supervision of John Lester.

*Kwang Tae Kim* is from Korea, Seoul National University, and is the first student to come to the department from that country. Kwang Tae will be working on an M.Sc. with Phil Kronberg.

*Raied Nasser* has come to Canada from Iraq and spent about a year and a half studying at the University of Ottawa before coming to Toronto last September. Raied is working with Tom Bolton on an M.Sc.

*Raymond Rusk*, from the University of Saskatchewan is working with Peter Martin and Bill Weller on an M.Sc. thesis involving the Reticon system at DDO. Raymond's wife Ann, a graduate student in the Chemistry Department, is taking 3 of our graduate courses.

*Leif Schioler*, from Denmark via Cambridge is embarked on a Ph.D. in observational cosmology under the supervision of Barry Madore.

During the past few months, *Neb Duric* and *Wendy Freedman* have completed their M.Sc. programmes and have started on their Ph.D. work under the supervision of Ernie Seaquist and Barry Madore, respectively.

### Physical Science Saturday

Saturday, November 8 was Physical Science Saturday. This is the annual occasion when the Departments of Astronomy, Chemistry, Computer Science, Geology, Mathematics, Physics, and Statistics hold tours and open house for high school students. About 500 students attended, and of these, about 175 visited the Astronomy department. The Astronomy open house was organized by Christine Clement with the assistance of Bob Garrison, Chris Corbally, Rick Crowe, Gerry Grieve, Donna Zubrod-Grieve, and undergraduates Tom Box, Paul Ford, Alex Fullerton, Michael Gaspar, Rob Heathcote, Stuart Heggie, Margot Loren, Jane Parkinson, Doug Welch and Ed Zukowski. The weather was superb and so the visitors had an opportunity to look at Venus and Arcturus with the 16-inch and to view the Sun with the 8-inch and Questars.

TELEX ANYONE?

Our out-of-town readers may be interested to know that we can again be reached by Telex, but at a new number.

The new Telex number is 065-23453 and the call-back is UOFTORONTO TOR. One should be sure to include the words DEPARTMENT OF ASTRONOMY at the start of each message, to ensure rapid delivery to our office. Messages destined to be sent on to the Observatory can be received in this way as well.

COLLOQUIA\*

- November 26 Mercedes Richards and Chris McAlary, University of Toronto  
G2000 - Current Literature Seminar
- December 3 Ernie Seaquist, University of Toronto  
"SS 433 - A Status Review"
- December 4 Joseph Veverka, Cornell University  
(Thursday) "Exploring the Solar System"  
Medical Sciences Auditorium 8:00 p.m.  
(SGS ManuLife Lecture Series 1980)
- December 10 Donna Zubrod, University of Toronto  
G2000 - Current Literature Seminar
- December 16 CHRISTMAS COUNTDOWN at DDO  
(Tuesday) beginning about 3 p.m.
- January 6 Sidney van den Bergh, DAO  
(Tuesday) "Recent Observations of the NGC 5128 Globular Cluster System"  
DDO 4:00 p.m.
- January 7 Phil Seiden, IBM Thomas J. Watson Research Center  
"Stochastic Star Formation and Spiral Structure of Galaxies"
- January 14 Tony Moffat, Université de Montréal  
"Wolf-Rayet Stars: Extreme Mass Loss and the Advanced  
Evolution of Very Massive Stars."
- January 21 Bob Gauthier and Dennis Crabtree, University of Toronto  
G2000 - Current Literature Seminar
- January 28 Wojtek Krzeminski, Nicholas Copernicus Astronomical Center,  
Warsaw - currently on leave at U.W.O.  
"Ultra-Short Period Cataclysmic Binaries"
- February 4 Doug Gies and Mary Lane, University of Toronto  
G2000 - Current Literature Seminar
- February 11 Marc Aaronson, Steward Observatory  
"Infrared Magnitudes, H I Linewidths, and the Distance Scale"

\* Unless otherwise noted, colloquia are held on Wednesdays at 4:00 P.M. in Room MP 134 with TEA at 3:45 in the Reference Room, MP 1404.

PAPERS SUBMITTED

M. Simard-Normandin, P.P. Kronberg and S. Button	Linear Polarization of Extragalactic Radio Sources at 3.71 and 11.1 cm
J.R. Percy	Beta Cephei and Related Stars
K.W. Kamper and R.W. Lyons	The Spectroscopic Orbit of HD 131511
C.M. Clement, H.S. Hogg and T.R. Wells	Variable Stars in the Globular Cluster NGC 6284
P.P. Kronberg, P. Biermann and F. Schmidt	The Continuum Radio Structure of the Nucleus of M82
C.C. Dyer and R. Roeder	Galaxies as Gravitational Lenses: Realistic Models

The DDO/GASA Fall Classic

The annual DDO autumn car rally was held on October 19th under the sponsorship of GASA. A total of 11 cars set off from Caledon East to brave the roads of the Brampton-Orangeville area. There were five entries from DA/DDO including Car 2: Neb Duric, Rick Crowe; Car 3: Jeff Clayton, Wendy Freedman; Car 4: Barry and Kathy Madore; Car 10: Gerry Grieve, Donna Zubrod-Grieve; Car 11: Matt and Frances Bates. The action started early with Car 5 (an all-woman team from Quebec) sliding off the road while attempting to answer the first question, "How many years before Columbus sailed?". One and a half hours and a \$20 towing charge later they showed great spirit by rejoining the rally in Section IV. All the rest of the cars made it through the first two checkpoints without too much trouble, although at the second checkpoint Barry was seen trotting down the road after the car as Kathy seemed to be leaving the checkpoint without her navigator! Section III (non-accumulative, not in order) caused a fair bit of confusion for some of the entries and spread the field out. Car 7 was delayed in Section IV by a county official who informed them that car rallying was not allowed in Mono Township and proceeded to take their names and addresses (future rally organizers take note!)

Well, after the dust had settled and the scores tallied, DA/DDO came out very well. First place went to Car 10 driven by Gerry and navigated by Donna with a total of only 16 points (6 time points and 1 wrong question). Finishing second with only 21 time points were the Madores in Car 4. Third place was taken by Car 3, the team of Jeff and Wendy, with a total of 30 time points. Neb and Rick finished 6th while Matt and Frances finished a close 7th. Many thanks to Zane Sterns for helping with the checkpoints and other organizational details and we hope to see you sometime next year for the next DDO/GASA rally.

### OBSERVING TRIPS

*Chris Corbally* had a lengthy observing run on the Las Campanas 24-inch from September 12 to October 16. Chris reports that the unsettled weather of the winter persisted for his first three weeks giving him only 50% of clear nights but a mountain which was both green and in abundant bloom. More typical clear skies for the last two weeks gave a final score of 66% clear. Chris left again on November 15, this time for South Africa where he will be using the DDO's 74-inch sister telescope and the Boksenberg device to obtain spectra of faint G stars.

*Bob McLaren* and *Chris McAlary* were at the NASA Infrared Telescope Facility on Mauna Kea in October to obtain H-band (1.6  $\mu\text{m}$ ) magnitudes of Cepheids in M33. After completing their run, they spent a night in Waimea, where they were graciously entertained by the Racines.

*Barry Madore* had a five-night run of prime-focus photography on the CFHT Nov. 10-14. He was back from Hawaii for only a couple of days before he left with *Gerry Grieve* for Las Campanas and an observing session on the 100-inch Dupont Telescope.

*Peter Martin* was at Kitt Peak Nov. 4-14 doing polarimetry with the 2.1-m telescope, and also using the Steward 2.3-m for the purpose of mapping the magnetic field direction in M31.

*Lindsey Davis* was at Arecibo October 16 - November 7 mapping 21-cm emission from interacting galaxies as part of her thesis research. Everything went smoothly except for some interference from solar flare activity.

### POTPOURRI

On October 10, *Helen Hogg* and *Phil Kronberg* attended the dedication of the Very Large Array on the Plains of San Augustin, 50 miles west of Socorro, New Mexico. Phil is a member of the VLA Advisory Committee and Helen was Program Director for Astronomy at NSF in 1955-56 when radio astronomy was only just beginning to receive funding from that body.

*John Percy* spent Oct. 23-25 at Hiram College, Hiram, Ohio, under the auspices of the American Astronomical Society's Harlow Shapley Visiting Lectureship Program. At Hiram College, he gave a public lecture, met with faculty and with several classes, and conducted a workshop for local school teachers. Hiram College is a small (1200 students) liberal-arts college, with a reputation for teaching excellence and with interesting and effective approaches to freshman orientation and to part-time studies. From Oct. 31 to Nov. 2, he was in Cambridge, Mass., where he attended and presented a paper at the annual meeting of the American Association of Variable Star Observers. On Nov. 7, he was an invited speaker (on "Contemporary Astronomy and its Place in the Science Classroom") at the biennial conference of the Science Teachers' Association of Ontario. On Nov. 9 to 21 he was observing at Kitt Peak.



*Don Fernie* gave a colloquium in the Department of Physics, Université de Montréal, October 10, on "Unusual Variable Stars."

*Lorne Avery*, from HIA in Ottawa, was here on November 5 and gave a colloquium entitled "Long Chain Carbon Molecules in the Interstellar Medium".

On September 12 *Helen Hogg*, as Honorary President of the RASC, gave the inaugural address of the new Kitchener-Waterloo Centre. The meeting was held at Wilfrid Laurier University where she spoke on Globular Clusters and was presented with a plaque to commemorate the occasion. Afterwards the group drove to the Dance Hill Observatory where Helen cut the ribbon for the official opening of the dome and sliding roof observatory which together house four telescopes.

*Joan Tryggve* reports that on her vacation last summer in western Canada she stopped in briefly to see the Hubes in Edmonton and later visited the D.A.O. in Victoria where Alumnus Chris Aikman reportedly gave her a V.I.P. tour of the observatory.

*Larry Morrill* visited us a few weeks ago. He was between job assignments on freighters plying the Great Lakes.

#### TOM BOLTON WRITES ABOUT HIS CURRENT AND RECENT RESEARCH

With the exception of three trips to the Goddard Space Flight Center on IUE related business I stayed at DDO (during my sabbatical) and worked on writing papers and developing new projects. I spent 2 months sorting through Jack Heard's and Ruth Northcott's files in order to begin organizing their completed, unpublished research for publication and identify partially completed work that should be finished. Most of my own research work was concentrated on completing work on a number of individual variable and binary stars that have been under study with the 74-inch telescope for some time. During the year I collaborated with various staff members, students, and former students to complete or bring to the draft stage papers on the following subjects: the new RS CVn binary HD 86590 (with Kamper and Lyons), a theoretical model for the helium-peculiar stars on the upper main sequence (Shore), spectrophotometry of the helium-rich star  $\sigma$  Ori E (Shore), a new radial velocity study of HDE 226868=Cyg X-1 (Gies), spectrophotometry of Cyg X-1 (Gies), spectroscopic orbit for the eclipsing binary DR Vul (Grieve), spectrophotometry of the recent shell episode of  $\alpha$  And (Gulliver), a spectroscopic orbit for the Population II UV-bright binary HD 137569 (Thomson), and the UV excess in the star HD 219150 (Fernie). I applied for and was granted discretionary time on IUE to follow up the results of the latter paper.

I began three new projects during the year. In September, 1979 John Lester and I obtained about 30 high dispersion IUE spectra of OBN, OBC, and standard stars. These will be used along with a couple of hundred 74-inch spectra to study the atmospheric properties, chemical compositions, and mass loss rates of the OBN and OBC stars. In the Spring I began obtaining high dispersion spectrograms of runaway OB stars with the 74-inch. These will be used to better define membership in this group, search for binaries, and to

study the relationship, if any, between these stars and x-ray binaries, pulsars, supernovae, and OBN stars. Doug Gies has now taken this over as his Ph.D. thesis. Finally, this summer I joined a large international collaboration, led by Dick Thomas, that is studying variable mass loss rates in a small number of bright, active Be stars. These stars will be observed regularly by every possible technique at all wavelengths from the vacuum UV to the radio region. Most of the high dispersion visible region spectrograms will be obtained at DDO. We hope to identify, or at least describe the character of, the process (other than radiation pressure) that we now know must contribute to driving stellar winds in early-type stars.

Tom Bolton

THE 147th ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE  
ADVANCEMENT OF SCIENCE, IN TORONTO, JANUARY 3-8, 1981

For the first time in many decades, the AAAS will hold its annual meeting in Toronto at the start of the New Year. The Society has 130,000 individual members of which several thousand are expected to attend. Non-members of the AAAS are invited, with a registration fee of \$22 Can. for student or retired, and \$44 for regular.

The preliminary program appeared in Science, September 12, 1980, with a registration form. The theme of the meeting is "Science and Technology: Bridging the Frontiers" with a subtheme "Directing Science Toward Peace". The Sheraton Centre and the Royal York Hotel are headquarters with registration and events divided between them. There are nine public lectures, the keynote and first by Northrop Frye of U of T. About 150 symposia are planned with astronomical subjects dotted among them.

Last spring a local Advisory Committee was set up in Toronto to help with the planning of the meeting, most of which is done by AAAS staff. Dr. J. Tuzo Wilson, Director General of the Ontario Science Centre and John A. Armstrong, Chairman and Chief Executive Officer of Imperial Oil, Ltd., are Co-Chairmen. The committee is largely composed of top people from Ontario universities and Canadian corporations, but I have the privilege of being a member. Our meetings were held at the Four Seasons Hotel and attended by about three dozen members. Among other duties the committee has arranged interesting local tours and raised funds for the meetings.

Under John A. Fowles, Chief of Education for the Ontario Science Centre, a Youth Symposium for high school students has been arranged for Saturday, Jan. 3. After a grand opening by David Suzuki a program of "Conversations with Scientists" continues all day. I lead one on "Globular Clusters".

Helen Hogg