

THE ^{DAVID} DUNLAP DOINGS

Vol. 18, No. 1

February 4 1985



Finding Chart p.3

CONGRATULATIONS TO ...

Neb Duric, who defended his doctoral thesis entitled "The Origin of Cosmic Rays in Spiral Galaxies" (abstract in this issue).

Bernard Bois and Jacinthe, whose second daughter Julie was born on the 7th of September.

Doug Gies, who defended his doctoral thesis. The abstract will appear in the next issue of the "Doings".

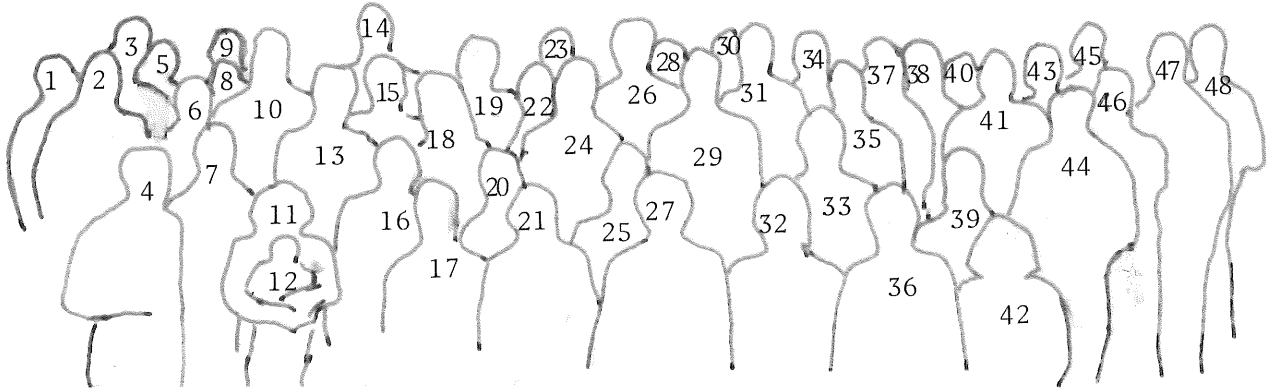
W E L C O M E T O . . .

Wlodek Kunowski, who has joined us as an Engineering Technologist at the Observatory. Wlodek and his family have recently settled in Canada; Wlodek worked previously as an electronics engineer in Warsaw.

Rob Managan, who is working as a post-doctoral fellow with Maurice Clement. Rob recently completed his Ph.D. thesis on the stability and equilibrium of rotating configurations at the University of Chicago. He also spent some time recently at the University of Florida.

Slawek Rucinski, who is working at the Observatory as a Research Officer. He and his family have just settled in Canada after spending four years in Germany and at the Institute of Astronomy, Cambridge, U.K. Slawek was previously at the Warsaw University Astronomical Observatory. He is a noted authority on close binary stars.

Finding Chart



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|----------------------------|-------------------------------|------------------------------|
| 1. <i>Dave Turner</i> | 17. <i>Laura Fenton-Lloyd</i> | 33. <i>Doug Welch</i> |
| 2. <i>Peter Leonard</i> | 18. <i>Mike Bietenholz</i> | 34. <i>Ed Zukowski</i> |
| 3. <i>Archie Ridder</i> | 19. <i>Fred Schmidt</i> | 35. <i>John Lester</i> |
| 4. <i>Dave Earlam</i> | 20. <i>Marlene Cummins</i> | 36. <i>Anne Chreptak</i> |
| 5. <i>Frank McDonald</i> | 21. <i>Helen Hogg</i> | 37. <i>John Percy</i> |
| 6. <i>Dave Blyth</i> | 22. <i>Carolyn McCall</i> | 38. <i>Alex Fullerton</i> |
| 7. <i>Shenton Chew</i> | 23. <i>Lee Oattes</i> | 39. <i>Dan Blanchard</i> |
| 8. <i>Esther McCleary</i> | 24. <i>Don Fernie</i> | 40. <i>Christine Clement</i> |
| 9. <i>Ron Lyons</i> | 25. <i>Rosemary Diamond</i> | 41. <i>Richard Gray</i> |
| 10. <i>Chris Rogers</i> | 26. <i>Don MacRae</i> | 42. <i>Josephine Chan</i> |
| 11. <i>Pat Turner</i> | 27. <i>Joan Tryggve</i> | 43. <i>Dieter Bruckner</i> |
| 12. <i>Jennifer Turner</i> | 28. <i>Ernie Seaquist</i> | 44. <i>Wlodek Kunowski</i> |
| 13. <i>Slavek Rucinski</i> | 29. <i>Stefan Mochnacki</i> | 45. <i>Barry Madore</i> |
| 14. <i>Russ Taylor</i> | 30. <i>Maurice Clement</i> | 46. <i>Frank Hawker</i> |
| 15. <i>Jan Taylor</i> | 31. <i>Tom Bolton</i> | 47. <i>Tom Wells</i> |
| 16. <i>Marshall McCall</i> | 32. <i>Judith Irwin</i> | 48. <i>Jim Thomson</i> |

Editorial

Last October, I went to Pasadena to represent Canadian interests in the future of Mount Wilson Observatory, which will almost certainly be permanently closed down in July, despite excellent scientific reasons for keeping it in operation. Soon after that, we heard that some of the smaller telescopes at Kitt Peak may be closed down. It is clear that at a time of numerous astronomical mega-projects such as Space Telescope, the CalTech 10-metre and various similar projects in various stages of funding, the smaller and older observatories are being starved of money. While the replacement of obsolete facilities is necessary for progress in our science, the telescopes being closed down in the U.S. are producing fundamentally important results, at good sites. Closer to home, the current preoccupation with cutting government spending poses a serious threat to scientific facilities dependent largely on the federal government. The closure of the NRC balloon and rocket programme is a salutary caution. This programme and the telescopes being closed down in the U.S. are precisely the facilities most important for graduate training and research. We must not forget that cuts or closures in Canada could make it politically more difficult for us to get access to American facilities. University observatories such as ours clearly have a responsibility in providing the up-to-date instrumentation and facilities which may become much less accessible to us elsewhere, and which are a vital complement to the giant telescopes on Earth and in space.

As reported in WELCOME TO ... and CITA NEWS, we now have several people with Slavonic names. Unfortunately, as I know too well, there are problems with pronunciation. Here's a phonetic guide to Polish names:

Wlodek Kunowski	=	"Vwo-dek Koo-noff-ski"
Jurek Madej	=	"Yoo-rek Mah-day"
Stefan Mochnacki	=	"Stefan Moch-nuts-ki" ("ch" as in "loch" or "Bach")
Slawek Rucinski	=	"Swah-vek Roo-tseenski"

In general, "w" is pronounced as "v" or "f", "c" as "ts", a crossed "l" more or less like an English "w". Now, should I transliterate Kowalsky and Zukowski too?

Mki

Comings and Goings

Tom Bolton was in Waimea, Hawaii in early November for the CFHT Scientific Advisory Council meetings. In early December Tom and Alex Fullerton had a six night run at the Coude of the CFHT. Ex Torontonians Rick Crowe, Peter Wizinowich and Rick Salmon worked as support staff. Tom and Alex had moderate success, but they lost two nights to clouds and ice, and suffered from poor seeing and cirrus for most of the remaining four nights. They were entertained by the eruption of Pu'u O, which sent rock fountains 1500 feet into the sky the night before they run began. After the run, Tom gave a talk on spectrum variables to the CFHT staff.

Neb Duric has started working at UBC with Phil Gregory. He doesn't advise others to drive across Canada in mid-winter ...

Dale Frail has again visited the DRAO at Penticton. He is reducing aperture synthesis data in a search for a possible supernova remnant around the variable Be star LSI+6 303, which is also an X-ray source in a region of ongoing star formation, W3. He also is producing HI and spectral index maps of a $2^\circ \times 2^\circ$ region around this source.

Bob Garrison spent December at Las Campanas. His report appears in this issue.

Barry Madore and Wendy Freedman returned briefly in December, and Barry was observed at the Christmas Countdown. They brought us first news of the funding of a 10-metre telescope for CalTech.

John Percy had his best run ever at Kitt Peak at the end of October, getting photometry on 7 out of 8 nights. In particular, John and his collaborators obtained simultaneous photometry, ground-based spectroscopy and IUE coverage of Persei. Simultaneous DDO twin photometer results agree very well with John's Kitt Peak data where they overlap.

Raymond Rusk and Ed Zukowski had runs at the VLA in January to obtain data for their theses. They attended the AAS meeting subsequently.

Doug Gies left in December to take up a post-doctoral fellowship at McDonald Observatory, University of Texas.

Karl Kamper attended an IAU Colloquium on stellar radial velocities at the end of October in upstate New York. His report appears in this issue.

Russ Taylor spent some time at the DAO. At the end of December Russ and his wife Jan left for the Netherlands, where Russ has taken up a position at the Kapteyn Laboratory of the University of Groningen. A memorable farewell party was thrown by the Seaquists.

CITA NEWS

Professor Scott Tremaine of MIT will become the first Director of CITA in July. He comes originally from Toronto, and was an undergraduate at McMaster University before moving on to Princeton (Ph.D.) and positions at Caltech, Institute of Astronomy (Cambridge), The Institute for Advanced Study, and MIT. A third permanent position has also been created at CITA.

CITA is gradually taking over the 12th floor of the Burton Tower, and is sponsoring many colloquia, rivalling both the Department of Astronomy and the Physics Department. The "Kingston Meeting" was held at Laval 18-20 October, hosted by Serge Pineault and his colleagues. Important upcoming meetings in Toronto include: "Galaxy Formation", 19-21 June 1985; "Jets from Stars and Galaxies", 24-26 June 1985.

COLLOQUIA

All are on Wednesday at 3:10 p.m. in Room 137 unless indicated

- | | |
|-------------|---|
| January 23 | R.N. Henriksen, Queen's University/CITA,
"Some New Ideas on Jets" |
| January 30 | M. Slovak, University of Minnesota,
"A Synoptic Synthesis of the Symbiotic Stars" |
| January 31* | J.C. Wheeler, University of Texas,
(joint with Physics) |
| February 6 | D. Nadeau, University of Montreal,
"Measurements of HII Emission in Active Regions of
Molecular Clouds" |
| February 20 | READING WEEK: NO COLLOQUIUM |
| February 27 | J. Kormendy, Dominion Astrophysical Observatory,
"Dust in Elliptical Galaxies" |

On Sunday, February 24 at 3:00 p.m., Don Fernie will be speaking at the Royal Canadian Institute on "The David Dunlap Observatory: Origins, Accomplishments, and Future". The lecture will be held in the Medical Sciences Auditorium, is free, and open to the public.

*Thursday, at 4:10 p.m. in Room 102, McLennan Physical Laboratory.

Papers Submitted

M. Rensing S.W. Mochnacki C.T. Bolton	The Mass of AW Ursae Majoris
P. Kronberg R.A. Sramek	Discovery of New Variable Radio Sources in the Nucleus of the Nearby Galaxy, Messier 82
B. Campbell R. Garrison	On the Inclination of Extra-Solar Planetary Orbits

Las Campanas News

The Chile schedule for this semester is very full. We are getting more requests than there is time available, especially for the first 4 months of the year. The telescope was used Christmas Eve and Christmas night, as well as New Year's Eve, and all were clear.

As usual, I took the two-week run covering Christmas and had excellent weather, except for $1\frac{1}{2}$ nights of clouds (89% clear). In order to fit in all of the requests, it was necessary to train an inexperienced observer for the following run (28 Jan - 6 Feb.). He overlapped with me for a week and learned what he needed to carry on alone (since the Resident was in Vancouver for a much-deserved holiday).

Yellow supergiants were the main part of my program. Don Fernie and I have turned up a couple of very interesting discrepancies during the past few years (e.g. Ap.J. 285, 698), so he, Armando Arellano-Ferro (former U of T student, now back home in Mexico), and I have started on a joint spectroscopic-photometric survey of bright yellow supergiants to look for further discrepancies. It may be that these unresolvable discrepancies are the long-sought-after signatures of high-latitude, low-mass objects. We are making many observations of each star to make sure that we eliminate variation as a possible explanation. We are using the U of T 60-cm telescope in Chile for the southern observations and the Mexican 80-cm telescope in Baja California (at 10,000 ft) for the northern observations.

We're hoping that 1985 will see the installation of the echelle spectrograph with Reticon detector as well as a CCD for direct photography. That will make us the best-equipped small telescope in the world. In case you think they are wasted on a small telescope, I must tell you that several well-known, big-telescope-type astronomers have expressed great interest in such instrumentation for a small telescope. We offer a good scale (f/15), clear skies, good seeing, and the possibility of long observing runs, which are impossible with the big guns.

My daughter, Ali accompanied me to Chile this time and we took a 5-day vacation in the south of the country. We flew to Osorno, took the bus to Puerto Montt and

used it as a base of operations. For many years I had wanted to take the boat trip across Lago Todos Las Santos, with Volcan Osorno and two other large volcanos overlooking it, but never managed to be there on the right day. North American tourists in general have not discovered it, though Chileans, Argentinians and a few Europeans know it well. They call it the Switzerland of Chile, but having seen both, I would say that Switzerland is the Chile of Europe, without the Volcanos! The views were spectacular. We stayed at an old hotel at the other end of the lake, near the Argentinian border, which is surrounded by snow-capped mountains and waterfalls. All this costs us only \$50, which included a two-hour bus trip to the lake, a two-hour boat trip across the lake, overnight lodging at the hotel and the return trip - for two people! Needless to say, I recommend it after a long run on the mountain, where one works 16 hours a day, 7 days a week and where every night is clear. (Kai Millyard observed 27 out of 28 days in November and was clearly exhausted when I saw him even after a week's rest.)

rG

Radial Velocity Conference

IAU Colloquium No. 88, Stellar Radial Velocities, met at the end of October at Union College, in upstate New York (or just "upstate" to true Big Apple types). In the not-too-distant past, a nearby meeting on such a topic would have attracted half the U of T department, but in our current radio/theoretical phase, it was attended by our resident atavist. It has been eighteen eventful years since the last such meeting and the first order of business was to respond to a letter from Richard West suggesting that Commission 30 be dissolved and made a subcommittee of Commission 29. The letter was introduced by host Davis Philip with a masterful Freudian slip: "We have here a letter from Fred West..." and thereafter a counter letter was drafted. Like the Vatican, the IAU is most often pi radians out of phase with the rest of the world (an oddly stable state) and the present is probably the least appropriate time to merge Radial Velocities with the rest of stellar spectroscopy. First, because there will probably be more RV determinations made in this decade than in the previous century and, second, because the new RV instrumentation has as much in common with photometry or astrometry as it has with stellar spectroscopy. The spectrum is rarely recognizably seen or recorded now!

Instrumentation reports were given on CORAVEL, the DAO RV spectrometer, the LPL accelerometer, and various Center for Astrophysics photon-counting echelles and the CFH hydrogen fluoride cell plus others. This was followed by a galactic structure session heavy on the halo stars and a star cluster session with equal time for galactic and globular. The faint magnitude capability of modern instrumentation has brought Population II well downstage. Finally, there were short sessions on standard stars and RV studies of variable stars.

Naturally, my main interest, after instrumentation, was the standard stars and the newest CORAVEL results dominated. After many years of flagging one standard after another with "so-and-so says this may be variable" so that they were hardly any left to use, it appears that most of those on the old IAU list are quite constant, with the expected exception of the supergiants and Bob McClure's "double-lined binary IAU standard". A single observation with the improved CORAVELs now has a standard error of 0.2 km/sec, so that their individual observations have about 20 times the

weight of those used to form the current standard velocities, which naturally sharpens the picture. In a review, Alan Batten suggested that a new list of primary and secondary standards be prepared to meet current needs including stars down to magnitude 16 (so as not to blind some of the instruments now used). Old timers will remember Jack Heard's many man-hours spent in extending the system merely down to ninth or tenth magnitude.

Coffee and cocktail discussions, as usual, were as informative as the meetings and much enlightenment shared on practical topics. ("You mean you actually have to adjust a Richardson image slicer after you get it? You don't just plug it in?")

Lastly, I was pleased to have a meeting with an excuse to travel, antediluvian fashion, by train and went Richmond Hill - Schenectady - Richmond Hill entirely by steel wheels and rails at convenient times even! The Richmond Hill VIA station is no more than a phone booth in a mud flat and Kathy was quite impressed and relieved to see the Northland roll to a stop to return its sole detraining passenger.

"Richmond Hill, eh? Don't see many tickets for there."

KK

The Eh? Team

There is no mistaking a tarantula -- particularly when that tarantula is sitting on the wall of one's bedroom. Marshall was the first to react. He was suddenly overcome by the desire to go for a long, leisurely hike. Not wanting to let such a prime photo-opportunity go to waste, I suggested that he dig out his Nikon. This he did, albeit from a distance. After posing for a number of portraits, we discussed our next move. It was agreed that unless the tarantula could produce some sort of receipt for the room, he would have to go. The removal proved to be a relatively simple process. It turns out that if you place a container over a tarantula WITHOUT chopping off a leg (a la rG), the spider really doesn't mind.

That was just one memorable event among many during our recent sojourn to Las Campanas. Having been thoroughly taken to the cleaners by a crafty taxi-driver on the ride into Santiago, we were further humiliated by an attempt to straighten out our names on tickets for the Santiago - La Serena flight. We were dealt with by a secretary who burst into gales of laughter everytime she heard the name "Marshall". For some reason, the CTIO driver responded by making Old West Sheriff gestures. I was then asked if we were both astronomers, to which I replied, brightly, "Cerrillos airport!"

Upon arrival in La Serena, we looked up Bill and Lynda at the CTIO compound (known to some as "Gringo Gulch"). Our hunger must have been apparent in our gaunt expressions for we were quickly invited in for a feast of sweet and sour octopus (really!). We both agreed that it was, without doubt, the best octopus we had ever eaten.

Our arrival on Las Campanas was delayed somewhat by a flat tire during the final 10 km stretch. As luck would have it, the flat occurred within 100 m of some ancient petroglyphs. The driver realized how handy we were with a tire iron and suggested

that we take a hike --- to the petroglyphs. The markings proved to be largely incomprehensible apart from the repeated references to "Perkin-Elmer".

Our first task upon reaching Las Campanas was to evaluate the performance of the U of T IR photometer. Kai and Bob Slawson had observed with it for several nights prior to our arrival. They had found that when the instrument followed one star for the entire night, readings were very stable. However, if many stars were observed, repeatability disappeared. We tracked this problem down to using the x-y base to maximize the signal rather than moving the entire telescope. One major problem remains to be solved with this instrument: when the signal is maximized the beam profile is a delta function!

Our reason for being on the mountain was to observe SMC Cepheids with the IR photometer. As it turned out, the weather cooperated for 6 of 7 nights. In fact, we had the only cloudy night in an entire month. One can verify this by counting the rings beneath the eyes of Kai Millyard, who observed on the 24-inch for the entire duration.

The nights on the 2.5m proved to be very fruitful. In concert with our previous runs, we managed to observe every uncrowded Cepheid in the SMC with $\log P > 1.0$ at least once. From this we hope to extract information about the line-of-sight depth in the SMC. We also measured all 3 Type II Cepheids in the Small Cloud and 9 in the Large Cloud. We discovered that 3 of these last 9 had 2.2 micron emission. All in all, the run went very well!

One afternoon, near the end of the run, we hitched a ride over to ESO --- the European Southern Observatory. That operation has to be seen to be believed. The dining room contains fountains dispensing every manner of fruit juice. The fruit cup was excellent but the chocolate marble cake was a bit on the dry side. Service was a bit slow, but the waiters were very polite!

The trip home was uneventful. We were certainly sad to leave the sun-drenched high desert of Chile for the frozen expanses of Toronto. For the next little while we will just have to be satisfied by the warm flow of a computer terminal!

Wch

THESIS ABSTRACT

The Origin of Cosmic Rays in Spiral Galaxies by Nebojsa Duric

The unsolved problem of the origin and distribution of cosmic rays in galactic disks is addressed by introducing a technique for studying the problem and applying it to a test galaxy, NGC 3310.

Radio continuum maps at 6 and 20 cm were made from VLA, scaled array observations (A and B configurations at 20 cm and B and C at 6 cm) thus ensuring that all scale lengths of emission are mapped, with nearly identical uv coverage, at a resolution of 1.5" (150 pc). In addition, 2, 6 and 20 cm maps (from D, C and B arrays respectively) are utilized to determine the distribution of thermal and nonthermal radiation at a

resolution of $\sim 4''$. Optical stellar continuum and emission line imaging are used to separate the stellar populations and to trace the distribution of ionized gas. The synchrotron radiation is found to coincide with the spiral structure as defined by the ionized gas and extreme population I objects. Additionally, the synchrotron emissivity along the arms is shown to be strongly correlated with the spiral shock velocity based on an existing density wave model for NGC 3310.

A model for the production of cosmic rays involving supernova remnants is discussed and found to have a number of shortcomings in NGC 3310. A new model for particle acceleration is introduced and discussed. In this scenario, rotational kinetic energy of a galaxy is converted into cosmic rays by global spiral shocks (as modelled by density wave theory) through a diffusive (Fermi-type) shock acceleration mechanism. It differs from previous models in that it is global and uses a readily available energy source. It is shown that the model satisfies all observational constraints. The acceleration mechanism is discussed from a theoretical viewpoint and found to be efficient in galactic disks containing substantial amounts of partially ionized 10^4 °K gas. The efficiency at lower shock velocities is also discussed.

The compatibility of the proposed model with observations of nearby galaxies is investigated. It is shown that the model predictions are consistent with the integrated radio continuum properties of grand-design spiral galaxies.

Employment Opportunity

RESIDENT ASTRONOMER

Location: University of Toronto Observatory on Cerro Las Campanas in the Atacama Desert of North-central Chile.

Start: Before 1 June, 1985, at the David Dunlap Observatory for experience in observational techniques, electronics, and photography. Residence in Chile to begin before 1 July, 1985.

Duration: Through August 1986, renewable for subsequent years if work is satisfactory.

Qualifications: Preference will be given to applicants with experience in observational astronomy. Experience in electronic and mechanical trouble shooting and repair will be an essential consideration. Facility with Spanish will be taken into account, but is not important. Maturity and ability to get along with people are especially important at such a remote site. Married applicants will not be considered, because of space problems.

Description: The Resident Astronomer is responsible for maintenance and repair of the University of Toronto 60-cm telescope and associated facility. In addition, the Resident will be required to help new observers to use the telescope. There will be times when the Resident will be required to carry out a program for an astronomer who is not present. Some time will be available for a personal observing program.

Salary: Approximately \$15,000, depending on the experience and background of the applicant. Room and board on the mountain are free, but expenses are not paid during time off.

Application: Send with two references to:
Dr. Robert F. Garrison
David Dunlap Observatory
Box 360 Richmond Hill, Ontario
Canada L4C 4Y6 Telephone:(416)884-9562

Deadline: 1 March 1985. (An interview will be required sometime before 15 March for those on the short list and the announcement will be made shortly thereafter.)