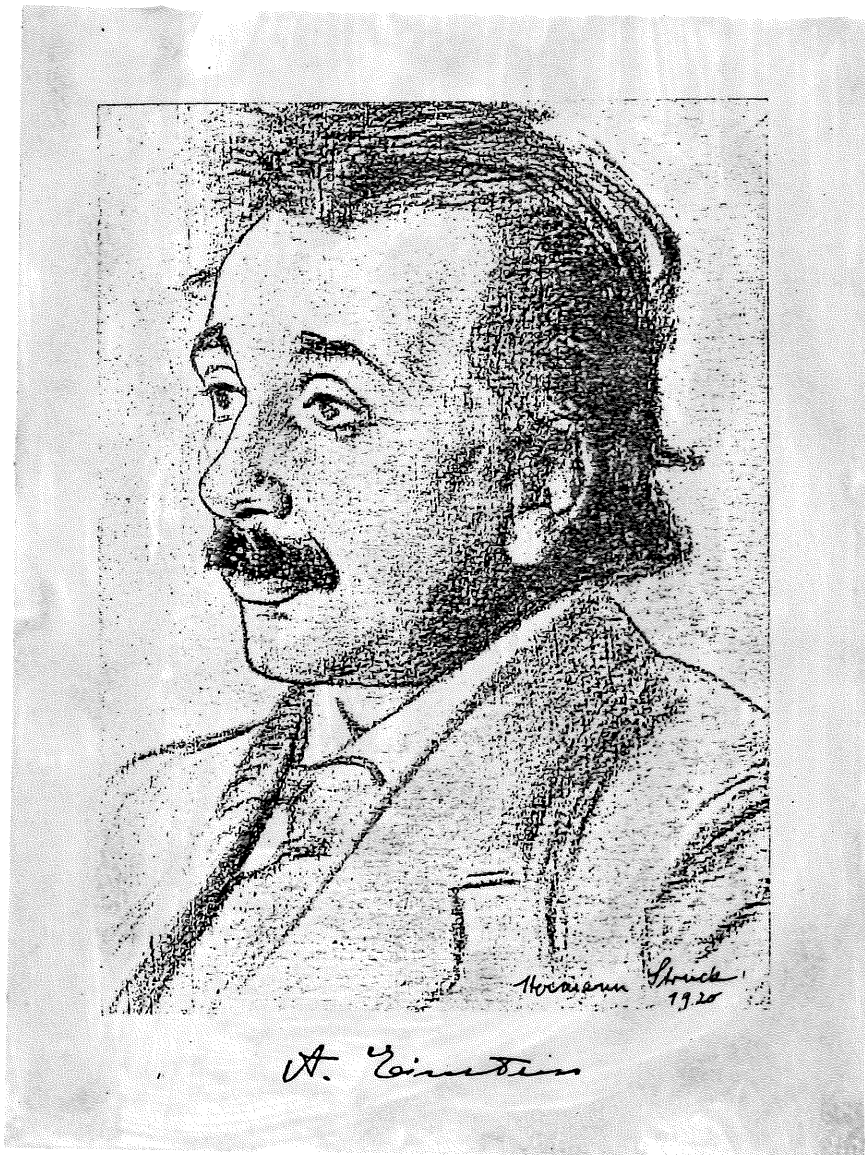


# DAVID DUNLAP DOINGS

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EINSTEIN CENTENNIAL

The 14th of next month marks the 100th Anniversary of the birth of Albert Einstein, and around the world - in Berne, Jerusalem, East Berlin, Princeton and New York - there are special events to celebrate the occasion. Even the binary pulsar is getting into the act in providing what appears to be rather timely confirmation for the existence of gravitational radiation (see Taylor, Fowler, and McCulloch, *Nature* 227, p. 437). Closer to home we have a number of activities which fit the Einstein theme. On March 1, G.F.R. Ellis (University of Capetown) gives a Joint Astronomy-Physics Colloquium on "Observational Cosmology." Robert Roeder will give a popular lecture entitled "Einstein and Cosmology" to the Royal Canadian Institute on March 17 and the Ontario Science Centre and the Royal Society of Canada are combining to hold an Einstein Symposium on March 10. In his *Final Item* this month Don Fernie concludes the story of the search for Vulcan - a planet which lost its *raison d'être* in 1915 when Einstein announced his General Theory of Relativity.

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Cover: The portrait of Albert Einstein is one he himself supplied for use in the translation of his book "Relativity, the Special and the General Theory", a popular exposition published by Methuen & Company Limited in London, 1920.

### COMINGS AND GOINGS

*Peter and Jody Biermann left Toronto at the end of February on their way home to Bonn where Peter will resume his position at the Max Planck Institute. During his six-month stay as Visiting Professor, Peter gave our scheduled graduate course "Galaxy Clusters, Radio Galaxies, and Quasars" and then as an encore after Christmas gave a series of lectures on "Elements of Gas Dynamics". The latter was attended by more than a dozen people including graduate students, post-doctoral fellows, a faculty member and three undergraduates.*

*The insight and enthusiasm Peter brought to lectures, colloquia, and countless impromptu discussions were greatly appreciated by all of us as was the keen interest he showed in Department affairs in general. We hope we will see you again soon Peter, and in the meantime, please accept a small token of our appreciation - a free subscription to DDD!*

### TRAVELS WITH BOB

Despite a heavy teaching load this term, *Bob Garrison* still finds the time and energy to promote Astronomy to a much wider audience. In December he discussed Astronomy with *Malcolm Dean* for the CBC program *Ideas*. On February 8 it was Calendars and the Chinese New Year on CBC TV's *Time for You* and the topic at Woodsworth College on February 13 was "The Astronomical Search for Extra-terrestrial Life".

Bob attended the AAS meeting in Mexico City and gave a poster session paper with *Armando Arellano Ferro* "The  $\lambda$  4430 Band: A Visual Classification". He comments on the poster session, "For this kind of paper, it is great. People who are interested can see it in good detail; those who are not particularly interested can glance at it and go on their way. Also avoids conflicts with other papers."

As we go to press, we find Bob on Hecla island in Lake Winnipeg - right on the eclipse path and planning to attend the CAS Council meeting in Winnipeg the next day.

### REVISIONIST'S CORNER

Jim Hunt is professor of Physics at the University of Guelph and promotes Astronomy at every opportunity. He writes that he has enjoyed the "Revisionist's Corner" in the DDD "in the rueful way one enjoys a shared hopeless experience", and comments that "the problem is not new (as if you thought it was) for Professor Chant reported some examples seventy years ago". Here are a few:

"A light year is one in which not many stars are discovered."

"The ninth moon of Saturn has a peculiar reprobate movement."

"A hypothesis is the side in a right angled triangle opposite the right angle."

The Editors are pleased to hear from their readership and thank Professor Hunt for the references in the JRASC (3, p. 329 and 406, 1909, and 5, p. 156 and 244, 1910) where other examples are to be found.

John Percy submits the following from an otherwise good essay on black holes:

"... Cygnus X-1 began emitting radios ..."

And this might be an appropriate place to reprint the words of Len Jaroff, Senior Editor of *Time*, as he reviewed his experience working on the cover story of the February 19 issue: "General relativity blows your mind".

#### A DDD ERROR

In the January 31 issue we said that Father Burke-Gaffney was one of a group of Jesuit priests sent to Halifax in 1940 to establish St. Mary's University. In fact, St. Mary's was founded in 1802 and received university status by act of the Nova Scotia Legislature in 1841. The Jesuits went to Halifax in 1940 to undertake teaching and administration. The university was under the auspices of the Roman Catholic diocese of Halifax until 1970, when it became non-denominational.

We thank *Gerry Diamond* (M.Sc. 1976) for alerting us to our error. Gerry is currently located a few floors below us and, he says, a couple of years away from a Ph.D. in Meteorology.

#### COLLOQUIA\*

- |          |         |  |
|----------|---------|--|
| March 1  | (Thur.) | G.F.R. Ellis, University of Capetown<br>"Observational Cosmology"<br>(Joint Astronomy-Physics, Room MP 102 4:10 P.M.)                    |
| March 7  |         | Nancy Houk, University of Michigan<br>"Analysis of the New Henry Draper Catalog"   |
| March 14 |         | R.E. Schild, Harvard-Smithsonian Center for Astrophysics<br>"The Multi-Mirror Telescope: A Progress Report"                              |
| March 17 | (Sat.)  | Robert Roeder, University of Toronto<br>"Einstein and Cosmology"<br>(Public Lecture, Royal Canadian Institute Convocation Hall, 8:00 pm) |
| March 21 |         | Nancy D. Morrison, University of Toledo<br>"Evolution of Massive Stars: A Game with New Rules"   |

March 28 Barry Madore, University of Toronto  
"Quantity vs. Quality: In Search of the Cepheid Calibration"

April 4 Joan Wrobel and Gerry Grieve, University of Toronto  
G 2000 - Current Literature Seminar

\* 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

R.F. Garrison & R.E. Schild	The Main Sequence of NGC 6231
S.M. Jakate	A New Class of Early-Type Ultra-Short Period Variables
A.W. Irwin	A Simple Formula for Atomic Line Broadening by Neutral Hydrogen
A.W. Irwin	An Improved Direct Approach for Determining Molecular Constants
A.L. Betz, R.A. McLaren & D.L. Spears	NH <sub>3</sub> in IRC +10216
C.W. McAlary & W.H. Wehlau	Light Variability of HD 116994
J.R. Percy, J.M. Matthews & J.D. Wade	Period Changes in Dwarf Cepheids
B.F. Madore	Contamination Gradients in Galaxies

#### P O T P O U R R I

It is always a very pleasant occasion when an alumna returns to give a Colloquium, and such was the case on February 21 when *Judy Pipher* (Univ. of Rochester) told us about her work on "Infrared Spectroscopy of H II Regions and their Molecular Clouds". Judy was an M+P graduate 6T2 (same year as Pim FitzGerald, Richard Larson, Mike Marlborough, and John Percy) and later did her graduate work at Cornell with Jim Houck. Our usual colloquium audience was augmented by two additional groups, one of which included Judy's sister Linda Andrews and former classmates, Sue Reader (née Priddle) and Iris Buchan (née Hogg). The other comprised several molecular physicists from the nether regions of the building (former haunt of one DDD editor) who had come expecting to hear about "H<sub>2</sub> Regions" as a result of a typo on the notice. They appeared to suffer no (additional) ill effects.

*Dave Turner* was at Université de Montréal on February 7 to give a talk entitled "The Determination of the ZAMS and its Consequences for the Extragalactic Distance Scale". Dave was to have given the same talk at Laval two days later but was pre-empted by *Bonhomme* as the University declared a holiday in honour of Winter Carnival.

*Barry Madore* attended the Royal Society specialists' meeting on Galaxy Formation held in London England on February 14 and 15. Despite bad weather (everywhere) and strikes right across England the attendance was good and the conference was very exciting.

Barry passes on a word of warning about travelling stand-by to London via NYC - "You have to register at least three hours in advance. Perhaps the Russians have a different scheme; their invited speakers never made it".

*Don Fernie* attended a meeting of the IAU National Organizing Committee in Montreal on January 25 followed by a meeting of the NRC Associate Committee on Astronomy the following day in Ottawa. On February 20, Don gave a talk to the Spectroscopy Society of Canada on "Transits and Tribulations".

*Maurice Clement* was at Yale on February 22 to give a talk on "Current Problems in the Theory of Rotating Stars".

*Martine Normandin* gave a talk entitled "Some New Large-Scale Magnetic Features of the Milky Way" at the Herzberg Institute of Astrophysics on February 9.

*Don MacRae* and *Bob Garrison* were invited to a reception at the French Embassy in Ottawa on February 8. Don went as a member of the Board of Directors of CFHT Corporation, and Bob as a member of the CFHT Scientific Advisory Committee. The occasion was the visit of M. Barre, Prime Minister of France, to Ottawa, en route to Quebec. Don MacRae also attended the NRC meetings in Ottawa on January 26 (National Committee for Canada of the IAU and Associate Committee on Astronomy).

#### LAS CAMPANAS NEWS

The New "Phernie Photometer" is now in use on Las Campanas, and from all reports it is a great improvement over the old one which, to be fair, did serve us well for most of its seven-year lifetime.

Tony has recently returned from his semi-annual "engineering run" having concentrated this time on moving the battery-inverter to its new location in a small stone house just off the eastern corner of Casa Canadiense. This will improve the seeing by reducing heat in the dome. A plate-baking facility will also soon be located in the house. Tony made a number of other improvements including a rewiring of the dome to provide a better ground.

All recent observers have reported very successful runs.

## A REPORT ON THE SCARBOROUGH COLLEGE TELESCOPE

A P.O. has been issued (Feb. 22, 1979) to Questar Corp. of New Hope, Pennsylvania, for a 12-inch (30 cm) telescope. Delivery is expected in nine months!

This purchase order represents the outcome of a campaign that began in 1974 with a submission by the college astronomers to Prof. H.C. Corben, then Chairman of the Physical Sciences Group, for an observatory for adult education and academic use. This proposal was accepted by the then Principal, D.R. Campbell, and went forward to the Sesquicentennial Committee and became one of the university's items for the forthcoming "Sesqui Campaign". As everyone knows, this evolved into the "Update Campaign". Shortly before he left the college, Principal Campbell found money to buy a small Ash-Dome, but it became clear that the complete \$250,000 project might never be funded.

With the change of Principals in 1976, other college divisions succeeded in re-opening the issue of "Update" projects, mainly because it appeared that no provincial financing for a library would be forthcoming. As a result, the Update review committee approved an item for a "telescope and equipment only" at \$83,000 in 1977.

In the spring of 1978 the Update Committee released \$91,000 of unallocated money to Scarborough College. This inspired another furious round of activity by the college astronomers to get the latest prices, which had, of course risen from 1974 levels. In view of the limited funds available, we officially reduced our request to ~\$60,000, for which sum "Lorenz Scientific" of Downsview stated that it would deliver a 16-inch telescope. Two weeks after this action, Lorenz declared itself out of the telescope business!

Summer of 1978 was spent awaiting word from Boller and Chivens on the official release of their new 16-inch telescope, which was to cost \$50,000 (U.S. funds). Last fall, the Principal declared her intention to put all the "Update" money into the library project and to cover the astronomers' request with funds from the college budget during the current and following fiscal years. The implication was that a substantial fraction of the price of a telescope would have to be committed during the current fiscal year, or the whole project would fall through. This led to the approach to Questar.

The instrument will be mounted on a German Equatorial mount built by Byers in California (and capable of driving a 16-inch instrument). The optical system is, of course, a Maksutov Cassegrain Catadioptric with 12 inches clear aperture, a focal ratio of f/15, and a field of view of 0°48'. The primary mirror has a diameter of 12.67 inches and is of Cer-vit, coated with AlSiO. The corrector lens has a diameter of 12.35 inches and is BK-7AR coated. We are also acquiring a Questar 700 mm f/8 lens with double offset capability for use either as a guider or as a photographic instrument. The price tag for all this comes to \$45,926 (U.S. funds) and does not include shipping. In addition, some \$5,000 has been set aside to allow for improvements in roof access during the coming summer.

The new telescope will be capable of carrying up to 30 pounds of instrumentation. Since we have spent most of our money already, any surplus equipment will be more than welcome!

F I N A L I T E M

The Search for Vulcan. II.

Separation, Wyoming Territory, had its population temporarily doubled that sunny Monday of July 29, 1878, when three astronomers and their four assistants were there for what one Wyoming newspaper hailed as the "grandest eclipse of the age." Norman Lockyer was there to study the solar corona, and Simon Newcomb had several projects planned, but James C. Watson had one singular intention: to search for Vulcan.

Watson was the Ontario-born Professor of Astronomy at the University of Michigan, then forty years old and already the recipient of several prizes for his outstanding work. He had for some years followed with interest Leverrier's search for Vulcan, and it had occurred to him that this total solar eclipse, visible in the high thin air of the Rocky Mountains, would furnish an excellent opportunity to search the sun's neighbourhood for the elusive planet.

Tension mounted at this remote whistle-stop on the Union Pacific Railroad as the astronomers awaited their two minutes and fifty-six seconds of totality. It began, and smoothly, systematically Watson started scanning with his portable telescope.

*I found, about a minute before the end of totality, a star of the 4 1/2 magnitude, which immediately arrested my attention from its general appearance and place, in which there is no known star. It had a disk larger than the spurious disk of a star, and shone with a ruddy light. There was no elongation such as would be presented by a comet....*

Hastily Watson measured the object's coordinates. He and Newcomb had agreed that the latter would confirm any finding of Watson's, but Newcomb was some way off. Watson began to run, shouting to Newcomb as he went. But the sand was thick and soft, the sagebrush dense, and the gale-strength wind blew the words away. Watson was still running, Newcomb unhearing, when the first blinding light of the photosphere flashed across the scene.

Nevertheless, Watson felt certain of what he had seen, and when a while later the telegraph brought news that Lewis Swift, another prominent astronomer who had been observing hundreds of miles away down the eclipse path, had also seen the object and measured similar coordinates for it, it seemed that Vulcan's existence was finally secure.

Lockyer, founder and editor of the journal Nature\*, flashed the news to his sub-editors. The general press was ecstatic. Mouchez, successor to Leverrier in Paris, acclaimed the result and said it consecrated the glorious scientific endeavours of Leverrier. Watson respectfully submitted a donation for a statue in honour of Leverrier.

\*I cannot resist the remark that a contemporary directed at the sometimes pompous Lockyer: the editor of Nature all too easily confuses himself with the Author of nature.



But the European spoilsports were not to be denied. Airy suggested, on the basis of the measured coordinates, that the two astronomers had seen only the star theta Cancri. Many were puzzled that other experienced observers had failed to see anything unusual. Peters in Germany ridiculed the whole thing, accusing Watson of simple errors of observation, and claiming Swift had first heard of Watson's measurements before announcing his own. Flammarion fully agreed with Peters.

The anguished cries of Watson and Swift reverberated through the journals. Certainly they had seen theta Cancri - it was the very star they had used to make offset measurements of Vulcan's position. And as for Professor Peters, wrote Watson, his "whole attack upon the integrity of my observation is not of the slightest consequence, since he has created the errors in his own brain and has then produced to assail them." Watson noted that Peters and Flammarion had been enemies of Leverrier, and "it matters not to me what these men think or what motives prompt their action, I know whereof I affirm."

But it was not to be. The case of the Watson-Swift observations has never been settled completely, but the advent of dry-plate photography - much more sensitive than previous processes - steadily drove Vulcan to fainter and fainter limits with every passing eclipse. By 1909 Campbell at Lick could finally announce that there was no Vulcan brighter than magnitude 8, and beyond that it didn't matter. A fainter Vulcan could be far too small to do the job for which it was needed.

In 1882 Simon Newcomb took up the whole problem of the perihelion advance of Mercury once more. He came to the gloomy conclusion that when more recent observations were incorporated, the discrepancy between theory and observation was even worse than the 38 arcseconds per century that Leverrier had found; it was in fact 43 arcseconds per century.

Newcomb reviewed all the suggested solutions to the problem. Was the sun non-spherical? No, or at least not enough to account for all 43", because such a departure from sphericity would have shown up in the analyses of the nineteenth century transits of Venus. Was there an intra-mercurial asteroid belt? No, the inclination it would have to have would make it unstable. Asteroids between Mercury and Venus? No, it would cause a retrogression in Mercury's node that was not observed. Was Venus more massive than had been thought? No, as Leverrier had concluded, there would be a resulting perturbation of the earth that was not observed. A disk of dust around the sun? No, the zodiacal light wasn't bright enough, and cometary orbits would be perturbed.

All in all, Newcomb concluded, about the only tenable theory was that recently proposed by Professor Hall, that the exponent in Newton's inverse-square law of gravity was not precisely 2 but instead 2.0000001574. It was not a suggestion to which the world's celestial mechanics were greatly attracted.

The final - or most likely final - answer, of course, we all know. On December 15, 1915, Albert Einstein wrote to his friend Wladislaw Natanson on the subject of the new Theory of General Relativity:

*I am sending you some of my papers. You will see that once more I have toppled my house of cards and built another; at least the middle structure is new. The explanation of the shift in Mercury's perihelion, which is empirically confirmed beyond a doubt, causes me great joy .....*

The books on Vulcan were finally closed.