



MY VISIT TO HAWAII

by Donald A. MacRae

A Canadian delegation and a French delegation made a "state visit" to Hawaii on Feb. 20-22 to meet members of the University of Hawaii, the Institute for Astronomy and the state government. It included a one-day visit to the island of Hawaii, and to the site of the proposed telescope on Mauna Kea.

The Big Island, as they call Hawaii, is the farthest east, the newest, and the largest of the Hawaiian Islands. In shape it is nearly an equilateral triangle 80 miles on a side. Perhaps this geometry is somehow related to the crustal rifts which typically form at angles of  $120^\circ$  to each other as a consequence of sub-crustal "plumes". One side of the triangle forms the west coast which is undergoing resort and retirement-home development, even though the land on that side descends steeply to the sea, is generally without beaches, and is scarred in many places with fairly recent lava flows. The second side of the triangle is the south-east coast with the currently-active Kilauea volcano near the mid-point. The north-east shore contains the small Hilo Bay (perhaps a submerged crater) and the city of Hilo, which is about the size of Richmond Hill.

The interior of the Big Island is dominated by two huge mountains, 13,796 foot Mauna Kea (Má-oo-na Cáy-a) slightly north of the centre of the island and 13,680-foot Mauna Loa whose highest point is 25 miles farther south. Mauna Kea is the world's highest mountain (it rises 31,000 feet from the ocean floor) and Mauna Loa is the world's most massive mountain. Mauna Kea and the Kohala mountains to the north and west are dormant and are thought to be something like a million years old; Mauna Loa must be much younger for it is still active. Between 1850 and 1950 there were 15 massive lava flows from Mauna Loa. Since 1950 there has been no activity at the crest but Kilauea on its flank has erupted more or less continuously. Hawaii has very hot and fluid lava compared to that of other volcanic regions, and produces long rivers flowing downslope right into the sea; one single flow of Mauna Loa's is 30 miles long. Because of this the mountains have been built with broad gentle slopes, not as steep cones.

The road west from Hilo traverses the saddle between the two mountains, from time to time uphill along one or another of Mauna Loa's lava flows. After 30 miles

the Saddle Road crests and begins its slow descent to the far side of the island. One is then in the midst of a huge lava pool formed by the 1843 flow and the 1935 flow from high up on Mauna Loa on the left. Here a road branches off to the right and begins to ascend the south slope of Mauna Kea. The lava ends abruptly, vegetation sufficient for cattle grazing takes over, and there are some scrub trees. The road winds around and between ancient cinder cones and is now being regraded and paved as far as Halepohaku which, as the name implies, is simply a stone house to shelter hikers and campers at about the 10,000 foot level. At present there are additional wooden structures there which serve to feed and house the astronomers at the peak. But more modern and extensive support facilities will be built soon nearby and at about the same level. From Halepohaku to the top is about 7 or 8 miles; the road is rather primitive now but will be improved, though not paved. We had coffee and a stretch at Halepohaku and arrived at the top about mid-day.

The top of the mountain is a gently rounded plateau formed of old lava with many cinder cones rising several hundred feet above the plateau. It must have been relatively easy to bulldoze mounds or fill in the depressions of one of these cinder cones when the Institute's 88-inch and two smaller telescopes were erected. The very highest point of the mountain is sacrosanct but the present telescopes are located only a few tens of feet lower and the northern-most site here has been set aside for the Canada-France-Hawaii telescope. A flat 150-foot diameter area has been bulldozed already but this will have to be increased since the ground slopes away steeply on all sides. Wind tunnel tests on a model of the mountain-top, carried out in France, have shown that this particular site is perhaps the best of all. The angle of repose of the cinders of a cone is about  $\arctan 1/2$  or  $27^\circ$ . There are interesting variations of colour in the volcanic ash. There was still some snow, especially on the north slopes, but it was being eroded by sunlight.

The inversion layer on a mid-ocean island tends to be low, and in Hawaii it is usually below 8,000 feet. We were clearly above it, but unfortunately the current weather pattern was such as to produce a layer of stratus or cirro-stratus clouds above us at perhaps 25,000 feet. What else could one expect on the day of the state visit to the site?

My ascent through 13,700 feet had taken less than two hours, and when I stepped out of the Land Rover I was curious to know how the altitude would affect me. Disorientation is a good way to describe it, but it is not easy to be specific. The malaise may have been accentuated by the contours of the landscape, which have aptly been likened to those to be seen in the later Apollo photographs. Like the astronauts, I found it difficult to judge distances. I also seem not to have recorded my relationship to my surroundings in detail, so I could not now draw a map of the top with the road, the domes, etc. in their relative positions. I found it difficult to concentrate on what was right before my eyes -- it was as if everything was being seen with peripheral or averted vision. At the beginning I experienced a feeling of nausea quite likely associated with my disoriented sense of the vertical. The latter made me walk with a peculiar gait when I first set out for the site. I had a tightness or mild ache between my temples. I also noticed a severe pain in both hands, the kind of pain we associate with frost-bite, but it was not confined to my fingers; quite possibly it was due to an unusual pressure differential between arterial and venous blood. It did not last long. In fact all the symptoms I have described were quickly mitigated and I soon found myself loping about on the 3.6 meter site like a true astronaut until I

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thought better of it. I challenged Jack Locke to a 100-yard dash but he declined and I was not sorry. At no time, though, was I aware of shortness of breath or of a heightened pulse-rate. However, the mild disorientation persisted longer than the other symptoms.

I had prepared ahead of time some columns of figures, each containing 12 four-digit random numbers, and I timed myself adding them up. The task was done under stress, namely, as we began our descent with the NSF representative, Dr. Jim Wright, at the wheel of the Land Rover. He assured his passengers that he had driven one once before. Three out of five of my totals were wrong, in such a way as to indicate that there had been 5 errors in 250 operations, or an error rate of 2% (when I added the columns here in Richmond Hill I got them right the first time). As for speed, I averaged consistently 40% longer at 13,000 feet and under stress than at 800 feet on a Sunday afternoon.

They gave us a magnificent meal at Halepohaku on the way down. When I got back to Hilo I was surprised to find myself quite tired physically.

The next day, as we flew out of Hilo, the broad black top of Mauna Kea was thrusting itself up out of the low-lying cloud which all but covered the Big Island, and there above was a perfectly clear blue sky.

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#### A BULL MARKET FOR ASTRONOMY?

*by Philipp P. Kronberg*

To predict the future career opportunities for astronomers is a little bit like forecasting the behaviour of "Industrials" index of the Toronto stock exchange over the next 20 years. However, if you will suffer my analogy a bit further, it surely must be true that, as for the stock market, more information is better than none, or frivolous speculation.

As you can see, I am not going to predict the job situation for astronomers, but what I shall do is briefly describe first, what has been done to gather information, and then leave a few comments which may help you arrive at your prediction of the future for astronomy in Canada.

First, what are we doing in Canada to assess and improve the employment prospects for astronomers? In 1971, the N.R.C. Associate Committee set up a subcommittee on Manpower. The main activity of the Manpower subcommittee thus far has been to survey the manpower and research activities of Canadian astronomers. The result-derived in part from a questionnaire sent to all Canadian optical astronomers last year -- were used to support the recommendation that Canada acquire a large optical telescope at a prime site. The next major project that this committee will undertake is to assess the prospects in, and significance of, professional fields which support astronomy research and teaching. These would include such things as planetaria, computer fields, optical and electronic engineering, etc. etc. .

In addition, the Canadian Astronomical Society has recently formed a "Committee on Employment". This committee's immediate aim is to assist astronomers to find employment, and as far as possible to sell the advantages and unique qualifications of

graduate astronomers to would-be employers - in particular our universities and colleges.

Now, to the interesting question, what about the career opportunities for Canadian astronomers over the near (hence partially predictable) future? The most recent predications which apply to Canadians in particular (refs. 1 and 2) are not encouraging. The supply seems to outstrip the demand for teaching and research positions for Ph.D.'s. Even at the M.Sc. level, where high school science teaching was an available field, the job openings are considerably reduced, now that the declining edge of the baby boom is passing through the high school stage. The prospect that this phase of the wave is soon to pass through the university age group does little to brighten prospects at the Ph.D. level. Universities are already envisaging an era of zero growth. Even the planned Canada-France-Hawaii telescope is unlikely to have an immediate effect on the number of jobs for optical astronomers.

At this point you may well ask if there are no encouraging signs that one can point to. Yes, I believe there are. Perhaps most significant is the increasing interest in astronomy which is growing among the physicists. This new interest in astronomy is perhaps best illustrated by C.H. Townes' editorial in the March '73 issue of *Physics Today*, in which he draws attention to the vast "undeveloped" regions of the electromagnetic spectrum made available by space astronomy. (The use of the word undeveloped -- under-developed? -- in connection with our field seems to bear a curious connotation!?) In this connection it is also noteworthy that in "Science" magazine's (Feb. 16, 1973) recent short list of the most significant new discoveries in physics and astronomy during 1972, five out of twelve were in astronomy. If this shift to astrophysics continues, funding for astronomy research can hardly but be increased in the long run. Perhaps the surest prospect in the long run lies in space-based astronomy. Large financial support for increased space effort is inevitable, and more countries than at present will be required (for reasons other than purely scientific ones) to commit more funds to space research.

I suspect that these two trends - more astrophysical research in physics and more space-based research - are the real encouraging prospects for someone entering a career in astronomy. Probably only the most committed and/or the most competent should consider doing so. The short-term prospects for astronomy graduates are still not encouraging. However, if we are careful not to oversupply the job market, the long term prospects may show signs of being bullish - as the investment dealers say.

#### REFERENCES

1. "Canadian Astronomy" Manpower Supply and Demand" R. C. Roeder and P. P. Kronberg, *J.R.A.S.C.* 64, pp. 315-18, 1970. (Reprints at D.D.O.)
2. "Astronomical Education and Manpower in Canada", R. C. Roeder. *Annals of the New York Academy of Sciences*, 198, pp. 77-83, 1972. (Reprints: R.C.R., Scarborough College)

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#### OBSERVING

##### Follow-up on $\gamma_2$ Velorum

The short-period variation of the strength of emission lines in the spectrum of  $\gamma_2$  Velorum reported by Drs. Jeffers, Sanyal and Weller from

their Las Campanas observations with the Jeffers rapid-scanning spectrometer has been supported by observations from New Zealand and Chile. In a letter to Dr. Jeffers, Dr. F. B. Wood has reported that Mr. Wilbur Schneider at Mount John Observatory had observed the star with a six-colour narrow-band photometer and has found short-time variations in the 10 Å band centred on He II 4686 with little or no variation in the nearby continuum. Also ESO observers Tony Moffat and P. Kjaergaard have found significant short-time variations of CIV 5805 with weak suggestion of a 2 1/2-minute period (IAU Circ. 2508).

### Las Campanas

Bill Herbst reports that he had an extremely good observing run, Feb. 17 - Mar. 12 on reflection nebulae for his thesis with the 24-inch telescope, 23 of the 24-nights being photometric. Photometer, spectrograph and telescope were working well, and the temperature was 70 by day and 60 by night. Dr. Pim FitzGerald of Waterloo has also been observing, and Barry Madore is there now. Rick Salmon has returned to Toronto for a few weeks vacation.

### Classification Spectrographs

Dr. Garrison reports as follows:

*The paragraph on classification spectrographs in last month's DDD has aroused some interest and we summarize the answers to some of the questions raised.*

*The newest version has now been tested. After a few slight modifications, it will be ready to be anodized and should be operating by the end of April. David Blyth or Dr. Garrison will be glad to show it to anyone who may be interested. The development of a new instrument like this is an evolutionary process and depends on the work and suggestions of many people. Since no detailed drawings were provided, David Blyth should get special mention for the actual working out of the mechanical design to Dr. Garrison's specifications. Without a superb and creative machinist of his calibre, such a beautiful result would not have been possible.*

### Pleione: The New Shell Episode

Since the discovery of the shell outburst of Pleione on a G12 plate taken on January 26, subsequent G12 plates and G16 plates have shown marked changes. These new plates have also revealed interesting differences between the present behaviour of Pleione and its appearance during the first shell episode.

Pleione's previous shell phase was discovered by McLaughlin and Mohler in late 1938, but it was believed at the time that the shell had been ejected either one or two years earlier. Examination of published prints and descriptions of the early development of that shell indicate that we are now seeing the beginnings of Pleione's shell phase for the first time.

On the first plates of Pleione, the hydrogen shell cores were weakly present in only the first few Balmer lines. The metallic shell lines were also weak and very broad presumably because the shell is still strongly coupled to the star itself. Subsequent plates have revealed a substantial strengthening of the hydrogen shell cores accompanied by a similar increase in the strength of the metallic shell lines. This rapid development of the shell is surprising. Variations on a time scale of days have been observed; by comparison, the previous shell episode showed changes over periods of months.

If this shell develops as in the 1930's, the hydrogen cores will become much stronger and the metallic lines will also strengthen and become much narrower. At maximum intensity of the shell, Pleione will be virtually indistinguishable from an F supergiant.

A.F.G.

#### HN ROSS \*

Dr. MacRae reports a visual observation made on Feb. 27, 1973 of the object HN Ross. This star is at present embedded in Cal Tech and is interacting vigorously with its surroundings in accordance with the well-established theory for such cases. The observation indicated that a slight increase in mass had taken place and some reddening could easily be detected, compared to observations made as late as last December. The object appears to have stabilized somewhat since the eruptive phase of 1972 but further output is to be expected in the near future.

\* *Sometimes known as U Ross*

#### COMINGS AND GOINGS

Dr. Bolton attended the Workshop on the Physics of Compact Galactic X-Ray Sources at Kitt Peak Observatory Mar. 5-9. He gave a presentation on the Optical Observations of Cygnus X-1.

Dr. Heard spoke on "Celestial Navigation: Science and Hobby" to the Hamilton Centre of the R.A.S.C. on Mar. 7.

Dr. Hogg spoke on "Variable Stars in Globular Clusters" to the Toronto Centre of the R.A.S.C. on Mar. 16.

Dr. Martin spoke on "Recent Results in Interstellar Circular Polarization" at U.W.O. on Mar. 9.

Dr. van den Bergh spoke at St. Mary's University on Mar. 15 and at the University of Moncton on Mar. 16 on "The Supernovae of the Second Millennium A.D."

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Drs. Heard, Hogg, Kronberg and MacRae attended meetings of the NRC Associate Committee on Astronomy and the IAU National Committee on Mar. 6 in Ottawa.

Dr. Walborn gave seminars on "The Stellar Population of Some Grant HII Regions" and "Nitrogen and Carbon Anomalies in OB Spectra" at the University of Rochester on Mar. 12-13.

### SEMINARS

MARCH -- As announced with the addition of today's talk by Dr. van den Bergh on "Optical Observations of Supernova Remnants".

### APRIL

Tues. 3rd Dr. John Sorvari, Univ. of Rochester, "An Oxygen-line  
DDO 4 p.m. Photometric System"

Tues. 10th Prof. William Liller, Harvard College Observatory,  
DDO 4 p.m. "Galactic X-Ray Sources"

Tues. 17th Prof. William van Altena, Yerkes Observatory, (title to be  
DDO 4 p.m. announced) *Membership in the young Open Cluster NGC 2264.*

### ADVANCE NOTICES

A Symposium on "Chemical Evolution in the Universe" is planned for June 6, a.m. at the Royal Society of Canada's Annual meeting at Queen's University. Dr. Fernie, in charge of arranging the program, has announced the speakers as Dr. Richard Sears (origin of chemical elements and stellar evolution), Dr. Barry Turner (interstellar molecules), Dr. Peter Millman (interplanetary material), Dr. David Stranway (moon). All are welcome to attend. Write Dr. Fernie for further details.

The June Institute will be held at U. of T. this year on June 12-15.

### PAPERS SUBMITTED IN MARCH

C. Bignell "Observations of the Linear Polarization of Radio Sources  
E.R. Seaquist at 2.8 cm and 4.5 cm."

P.C. Gregory "Further Observations of the Radio Star MWC349"  
E.R. Seaquist

D. DuPuy "New Observations of RV Tauri Stars"

### POTPOURRI

#### Staff Changes

Priscilla Wagner has resigned as librarian for health reasons, effective the end of March. Miss Carol Morrison, soon to graduate from the U. of T. library school,

has accepted the librarianship, starting the beginning of May. In the interim the library is being looked after by Mrs. Jean Lehmann, our former librarian who retired three years ago. Mr. Tony Estevens has accepted the post of engineer at the Observatory. He comes to us from the Great Lakes Institute, and started work on March 12. Mr. David Still has just begun working as a Research Assistant for Dr. Racine.

#### Former Director Bereaved

Mrs. R. K. Young died in Cobourg on February 27th and was buried in Richmond Hill on March 2nd. Mrs. Young, formerly Mrs. Wm. Graham, had been a long-time resident of Richmond Hill before her marriage to Dr. Young in 1936. After Dr. Young's retirement in 1946 they continued to live in their home on Church Street until their move (in 1964) to Cobourg. Dr. Young, now 87, is planning to stay on in his home at 34 Abbott Boulevard, Cobourg, Ont. Our sincere sympathy is extended to him in his bereavement.

#### Dr. Bowen Dies

A Los Angeles Times obituary of Dr. Ira S. Bowen, was sent to DDD by our frequent correspondent Mr. Joseph Greer, of Vancouver. Dr. Bowen died at Queen of Angels Hospital in L.A. on Feb. 6.

Dr. Bowen was very generous to us with his advice in the early 1960's when we were designing our grating spectrograph for the 74-inch telescope.

#### To Give Invited Talk

Dr. Garrison has been invited to speak on "Bp Stars in Stellar Associations and Clusters" at the Sydney IAU meeting.

#### Warren Magill to go to Yerkes

Warren Magill will spend the first week in April at the Yerkes Observatory learning new photographic techniques from Mr. Joe Tapscott.

#### The Media

Dr. van den Bergh was interviewed recently on radio and TV in Hamilton on "Life in other Regions of the Universe".

Dr. Gregory was the guest of Peter Gzowski for eight interviews on astronomy for "This Country in the Morning" on CBL. These are being broadcast between 11 and 12 a.m.

Lydia Dotto wrote three half-page popular articles for the Globe and Mail for Mar. 17, 19 and 20 featuring recent work of such Toronto astronomers as Garrison, Kronberg, Innanen and Weller. Miss Dotto, who is taking first year astronomy from Dr. Fernie, is doing good work as a science reporter.

Dr. Garrison appeared on CFTO-TV for a 15-minute program on Friday, March 23. What sparked the interview was the recent announcement of ABWX250 (the Astronomy-Botany Interdisciplinary non-college second year and higher course entitled Life on other Worlds), to be offered next year.



Guests of Lt. Gov.

Dr. Hogg and her daughter, Mrs. Sally MacDonald, were guests at a reception given by the Lieutenant Governor of Ontario on March 20 following the opening of the Legislature.

Richmond Hill Centennial

Mrs. Patricia Hunt, Chief Librarian of Richmond Hill Public Library, has acknowledged receipt of several enlargements of old negatives of Dr. Chant's showing Observatory House during the alterations of 1932. These prints, made by Warren Magill and presented by Dr. MacRae, form part of a Centennial Year exhibit at the Library. (They will be on display for the month of April).

Scarborough Open House

The Scarborough College Science Open House of Feb. 24, 25 was a great success, reports Dr. Roeder, thanks largely to the help of Drs. MacRae and Kronberg and Bob Hawkins, the Madores, Louis Fortier and Liz Martin. Three Questars had to be put into action on Sunday afternoon to meet the demand for solar viewing.

The "ARO Observer"

DDD welcomes the appearance of an excellent news letter from ARO, edited by Dr. Bryan Andrew. A copy may be seen in the Public Relations ring binder in the DDO library.

Postal Code

The Observatory's postal code is L4C 4Y6. Dr. van den Bergh offers a bottle of Danish beer for the best mnemonic.

Visitor

Dr. David Crampton (Ph.D. 1967) of D.A.O. was a visitor to the Observatory and the Department on Mar. 21, 22.

FINAL ITEM

*Transit Observers in Canada: Moschettos and Frozen Brandy*

*As a concluding column on the eighteenth-century transits of Venus I thought we might look at events in what is now Canada. Although the transits were observed by a number of British North American colonists, there were only two stations in present-day Canada: John Winthrop at Newfoundland in 1761, and William Wales on the shores of Hudson Bay in 1769.*

*John Winthrop, a professor of mathematics and natural philosophy at Harvard, seems to have originated the idea of an expedition from Boston to St. John's, Newfoundland, without prompting from Europe. His appeal for funds, made through the colony's Governor to the Massachusetts House of Representatives, is an excellent example of how a scientist should go about tapping politicians for money. An eloquent emphasis on how beneficial the*

expedition would be for marine navigators did the trick, as well as produce passage on the province's sloop.

Arriving at St. John's the month before the transit, Winthrop and his three assistants immediately set to work erecting and testing their instruments on one of the mountains overlooking the town. Here they encountered that ubiquitous Canadian phenomenon, the black fly, as they went about their work"... with an assiduity which the infinite swarms of insects, that were in possession of the hill, were not able to abate, tho' they persecuted us severely and without intermission, both by day and by night, with their venomous stings." With luck that Le Gentil would have appreciated, the morning of the transit dawned clear and bright, and the observers obtained accurate results that eventually were of basic importance in determining the solar parallax.

A much more interesting and eventful expedition was that of William Wales and Joseph Dymond from England to what is now Churchill on Hudson Bay to observe the transit of June 1769. The short shipping season made it necessary for them to arrive the previous fall and winter over, an experience which may have made Wales' subsequent voyages around the world with James Cook seem rather less rigorous. Happily, Wales kept an account of his experiences in a journal which is full of delightful details of people, flora and fauna, and Arctic phenomena generally.

Wales tells us that upon arriving at Churchill "I found here three very troublesome insects. The first is the moschetto, too common in all parts of America.... The second is a very small flie, called...the sand-flie; ...the third insect is much like the large flesh-flie in England; but, at least three times as large: these, from what part ever they fix their teeth, are sure to carry a piece away with them, an instance of which I have frequently...experienced." But there was much to do; for instance on August 22 and 23 "the people were allowed to write to their friends in England, so I employed myself to the same purpose".

Then came winter. By November 6 "...the river...was frozen fast over from side to side;...also the same morning, a half-pint glass of British brandy was frozen solid in the observatory.... We now killed two or three hogs...which before they well opened, and cut into joints, were froze like a piece of ice....

"In the month of January, 1769, the cold began to be extremely intense, even in our little cabbn, which was scarcely three yards square, and in which we constantly kept a very large fire;...and notwithstanding [the outside walls] were of stone, near three feet thick, and lined with inch boards...my bedding was frozen to the boards every morning.

"It was now almost impossible to sleep an hour together...without being awakened by the cracking of the beams in the house.... It was very easy to mistake them for the guns on the top of the house, which are three pounders. But those are nothing to what we frequently hear from rocks up the country, and along the coast; these often bursting with a report equal to that of many heavy artillery fired together, and the splinters are thrown to an amazing distance.

Not only was there little sleep, but the brandy problem worsened: "...I carried a half-pint of brandy, perfectly fluid, into the open air, and in two minutes it was thick as treacle; in about five, it had a very strong ice on the top...." One evidently learnt to drink quickly and sleep tight, so to speak.

But summer and the moschettos returned, and with them the clear weather in which Wales and Dymond brought their expedition to fruition. Although, as Le Gentil was discovering, even getting home brought mixed blessings: Wales had all his much-prized Eskimo clothing confiscated by a British Customs officer.

As a concluding note to William Wales, I might say that the Dunlap Observatory owns a manuscript copy (in Wales' own handwriting) of their astronomical observations. Even though the booklet contains little more than tables of numbers, it is fascinating to sit face-to-face with the manuscript of a man who experienced so much of the delight and despair of the Canada of two hundred years ago.

(More in Harry Woolf's "The Transits of Venus", Princeton University Press, 1959, and in Helen Hogg's "Wales's Journal of a Voyage in 1768", J.R.A.S.C. 42, 153, 189, 1948.)

J.D.F.