



Christmas Greetings

From the Director

APOLLO 17 AND BEYOND

Because it was a night-time launch, they had gone to special lengths to illuminate the scene. There was a close-in ring of very powerful searchlights set up to concentrate their blue-white beams on the rocket and its gantry. The spill-over, however, produced a great fan of light diverging outward and the rays in perspective seemed to reach all the way to the grandstands, to the left and right of us as well as overhead. It was something that television could never get across, the dramatic three dimensionality of the event.

The stands are two-and-a-half miles from the launch pad but the rocket could easily be seen. In any case the only action during the four hour wait was the gently undulating plume from half way up the rocket where the liquid oxygen was being allowed to boil off. The voice on the loudspeakers told us that the hydrogen which also boils off is continually being burned with a colourless flame a little way apart, but at the moment of the 30-second hold there was an orange puff in that area that made me think something serious had occurred.

To my right was the cube-shaped rocket assembly building, its full immensity disguised by its shape and its simplicity, until you noticed the tiny mouse-hole of a doorway. A little way in front and to right and left of me were upwards of 10,000 people, and behind were the hundreds of buses which had brought us there. It was a hot night and far out over the Atlantic occasional lightning flashes could be seen, illuminating thunderheads in the sky.

This wide panorama suddenly shrank to a single point the moment the countdown began again. The murmur of voices ceased, the crowd became motionless, every person faced the tall cool sentinel-like rocket bathed in light. Nearby lights were turned off. The laconic voice counted down to zero.

The first thing to be seen was a gently suffusing reddish glow at the base, followed no more than a half-second later by the great eruption of flame familiar to everyone. "Go, baby, go!" somebody said.

I wasn't so impressed by the brightness as I thought I would be -- even in the daylight it is overwhelming. As the rocket cleared the tower and got away I remember having the idea that a brilliant flare was dangling above me at the end of a long invisible wire and that it was swinging towards me. I suppose I thought that such a bright light must be close by. The separation could easily be seen, and then the rocket was a point of light slowly fading down range. Six or seven minutes later it was several hundred miles away and a zero-magnitude star in the southeast at an altitude of thirty degrees or so.

So the show was over and people immediately streamed away to their buses, just like the crowd at the end of a football game. The gantry was still there, and the clouds of steam now rising from the empty pad were illuminated by the searchlights. The great fan effect was still in the sky. "Gosh", said a girl behind me, "that makes me think of the Second Coming".

The news media over-emphasized the fact that this was the Last Going of Apollo. Actually the returns from Apollo have been both voluminous and puzzling and a great deal of work remains to be done with the samples and the other data we now have. Skylab is scheduled for April, 1973; in that exploit, to last eight months, the first three-man crew will stay up four weeks, the second and third crews will stay 56 days each. Skylab will carry a solar telescope, an X-ray telescope, cosmic ray detectors and several other astronomical instruments. Even more exciting is the prospect of the Space Shuttle and its 120-inch optical telescope before the end of the decade. And sooner or later we'll be back on the Moon.

As we turn the corner of the year we can pay our respects to the Apollo program and look forward with great expectation to continued boosts to astronomy through the space program.

HAPPY NEW YEAR TO ALL!

MR

From the Students

I find it especially appropriate for me to write a Christmas Greetings message for no other reason than that I have been away for so much of this last session. And possibly, rather than a greeting from me and GASA, this should be a greeting from me to GASA.

Being in Chile on top of an isolated mountain it is hard enough to imagine that time is passing let alone that it is nearing Christmas, but stepping off the plane at Malton is as much cold reassurance as one could want. None-the-less it's great to be back. While the spirit of Christmas may be universal, the season for Christmas can only be in the northern hemisphere.

So from La Serena to Toronto, a MERRY CHRISTMAS, a HAPPY NEW YEAR, and a pleasant perihelion passage!

Barry Madore for GASA

From Las Campanas

GREETINGS FROM DRY BLUE SKIES UNDER CARINA!

By way of introduction to the south, picture Orion at the Zenith with everything to the north upside down. Everything to the south is new.

Lately, everyone here, - on the mountain, and in La Serena has been preparing for the beaches - over 200 miles of the best white Christmas -- well, at least the water is cold.

My own plans are to get broiled on the beaches around Christmas, but first do some camping to the south in Chile's magnificent Lake District, which is punctuated by spectacular snow capped volcanoes - some of the most beautiful in the world.

It's said that on some of them, one can snow ski in the mornings and spend the afternoons swimming in the lakes roundabout. I hope your holidays prove to be as interesting as a Chilean Christmas promises to be. Until we see you down here, then, or back up north, Mister Papic, Alberto, Angel and I wish you all a very Merry Christmas and the best of New Years.

Rick Salmon

From the Editors

To our growing numbers at the Observatory and to our many friends in the astronomical community elsewhere who seem to enjoy hearing from us we wish a very MERRY CHRISTMAS and all the best of success and happiness for the New Year.

## OBSERVING

### CPD -31°1701

The most interesting spectrum to turn up in Dr. Garrison's survey of 1500 southern stars being observed with the Las Campanas 24-inch telescope and classification spectrograph is CPD -31°1701. The spectral type is O8, but, unlike any other known star spectrum, it shows no sign whatever of hydrogen lines - in fact nothing but He I and He II. In a paper submitted to Ap. J. Letters recently, Garrison and Hiltner provide arguments for a probable distance of several hundreds of parsecs and a probable absolute visual magnitude of +3, which makes the star definitely subluminescent but not so faint as to be a white dwarf.

## COMINGS AND GOINGS

Dr. MacRae was in Florida Dec. 6-8, watching the lift-off of Apollo 17 at Cape Kennedy on the 6th, and attending a meeting of the Board of Trustees of the Universities Space Research Association at Vero Beach on the 7th.

Dr. van den Bergh gave a talk at Queen's University on Dec. 13 on "What Radio Astronomers Should be Observing". (He hastens to say that the choice of title was theirs, not his.)

Barry Madore was scheduled to return from Las Campanas on Dec. 16 after a three-week observing session which we trust was successful!

Dr. Fernie and family are enjoying a Christmas holiday in the Caribbean; and the Heard's are with their daughter Judy and her family in Powell River, B.C.

Lars Rogers is spending two weeks in Victoria where Dr. Wright has arranged for him a generous allotment of time on the 72-inch telescope for spectroscopic observations of his early-type stars.

Dr. Racine visited Halifax on Nov. 8 giving a lecture at St. Mary's University and Dalhousie on "Galactic and Extragalactic Globular Clusters" and addressing the Nova Scotia Institute of Sciences on "The Local Expansion Rate of the Universe". He reports that our two alumni, Dr. George Mitchell and Dr. David DuPuy are very busy completing the installation and equipment of the new Burke-Gaffney Observatory at St. Mary's and expanding the astronomy curriculum there. On Nov. 29 Dr. Racine attended a meeting of the Advisory Committee to the National Museum of Science and Technology in Ottawa, and on Dec. 7 he gave a lecture to the Erindale Associates entitled "Heavens above Chile".

Dr. Hogg spoke to the North York Science Teachers and Students in their Board of Education Auditorium in Willowdale on "Variable Stars" on Nov. 27. She also spoke to the London Centre of the RASC on Dec. 14 and conferred with Dr. Amelia Wehlau on research matters.

Dr. Garrison left last week, for the Hale Observatory and then on to Mauna Kea, Hawaii, for an observing run with his spectrograph on one of the 24-inch reflectors. He will return around the 1st of January. For the really exciting news about Mauna Kea see the last page.

Nolan Walborn will be spending his Christmas at Las Campanas on an observing run and returning Jan. 2nd to Toronto.

#### SEMINARS

DECEMBER: As announced last month.

#### JANUARY:

- Tues. 9th Dr. Nolan R. Walborn, "The Stellar Population of Giant  
DDO, 4 p.m. HII Regions"
- Thur. 11th Dr. Victor Weisskopf, M.I.T., "Atoms, Molecules and Stars"  
McLennan 102  
4 p.m. (Joint with Physics)
- Tues. 23rd Prof. Stillman Drake, Institute for History & Philosophy of  
DDO 4 p.m. Science and Technology.  
(Title to be announced)
- Tues. 30th Prof. I. W. Iwanowska, Mikolaj Kopernik University, Torun,  
4 p.m. Poland (Title to be announced)

#### PAPERS SUBMITTED IN DECEMBER

- J.P. Angel & Observations of Circumstellar Circular Polarization  
P.G. Martin in Four More Infrared Stars.
- A.F. Gulliver Spectrum and Light Variations of the Peculiar A Star  
J.E. Winzer HD 51418
- J.R. Percy & Period Changes in  $\beta$  Cephei Stars: Comparison of  
P.P. Eggleton Observation with Theory
- J.R. Percy A Search for Delta Scuti Stars.
- Wm. Harris The Globular Cluster NGC 6934  
& Racine
- P. Kronberg The 49 Centimeter Linear Polarization Distribution  
J. Crelinsten in 3C327 and the Density of Intergalactic Gas.
- P.G. Martin Interstellar Circular Polarization: A New Approach  
to the Study of Interstellar Grains.

Letters

To the Editor, DDD

4 Dec. 1972

I could not read your references to Sydney Gould in your last DDD without bringing you up to date! The enclosed is from the October number of Notices of the American Math. Soc. He is a remarkable person. I knew him in Ottawa during the war and was sorry he did not stay in Canada.

Best wishes,

Gilbert de B. Robinson  
Department of Mathematics

The enclosure was an item regarding S.H. Gould's recent retirement after 16 years as executive editor of Mathematical Reviews, and his acceptance this year of the position of general editor at the Institute of Mathematics, Academy of Sciences, in Taipei, Taiwan. The article refers to Gould's competence in both classics and mathematics and also chronicles his remarkable accomplishments in modern languages. In 1933 and 1934 he spent the summers in Munich and Paris perfecting his German and French, and, during the academic year between, he was doing archeological research in Athens and became fluent in modern Greek. By the 1950's he had mastered Russian, developed "a working knowledge of most Western European languages" and had begun to study Chinese. He produced dictionaries in Russian-English and Romanian-English and wrote a Report on Chinese-English Dictionaries and a Manual for Translators of mathematical Russian. In 1962 he was appointed head of the translations department of the American Mathematical Society and represented the Society frequently on visits to the Soviet Union and the Far East.

Ed.

M. M. Thomson

Malcolm Thomson, former Chief of Position Astronomy at the Dominion Observatory and now of the Time Service at N.R.C., is retiring Dec. 29 after 42 years service in Government Astronomy in Canada. He has written to request continuance of his "subscription" to DDD, and says that he will retain desk privileges at NRC and will continue a project of recording the history of time-keeping in Canada. He continues to turn up curious little odds and ends, for example, he discovered recently that at Kingston between 1852 and 1864 there was an official Keeper of the City Clock who was paid \$40 p.a. But it was not this worthy's duty to supply the time; that duty belonged to Rev. James Williamson who had a transit instrument and made the necessary observations and computed the local time for the Keeper. This was the same "Prof." Williamson who took part (successfully) in the Canadian 1882 Transit of Venus effort.

DDD wishes old friend Malcolm Thomson a happy and busy retirement.

### Annual Wassail

Dr. and Mrs. MacRae entertained the staff and students and their families at their customary Christmas party at Observatory House during last Sunday afternoon. There were 110 guests and this writer blushes to realize that, his extended family accounted for ten per cent of these! Anyway it was a good party.

### New Appointments

As of Nov. 20 Miss Esther Salve, formerly in the Department of Chemistry, has replaced Jaye Thackeray as assistant secretary in the Department, and Warren Magill, formerly of the McLaughlin Planetarium, has replaced Anson Moorhouse as photographic Technician at the Observatory.

### Fall Convocation

At the Dec. 1 Convocation David MacRae, eldest son of Dr. and Mrs. MacRae received the degree of Ph.D. in Chemistry. David has been working for some months with Colgate Palmolive in Toronto.

David DuPuy also received his Ph.D. at the Fall Convocation.

Receiving M.Sc.'s in astronomy at the same convocation were Emmanuel Davoust, Blake Kinahan, Kayll Lake, Michael Shara and Philippe Teillet.

### Christmas Countdown

The time-honoured Christmas Countdown was held on Dec. 12th, following the less hilarious but very interesting seminar by Dr. John Hutchings of DAO on "Synthesis of Close Binary Light Curves". Sandwiched between the events was a magnificent spread of Christmas fare supplied by the ladies of the Observatory in the suitably decorated library. As is customary, copies of the "David Dunlap Droppings" were distributed.

The Countdown performance leaned towards the musical this year, with Gretchen Hagen on the bassoon, Dave Hanes - trombone, Phil Teillet - triangle, Chris Pritchett and Roslyn Shemilt - violins; as well as a barbershop quartet with tenors Gretchen and Chris, baritone Martin Duncan and bass Bill. Despite the usual hamming there was evidence of real talent.

The customary skits included a slide show with some of the old slides (e.g. the 74-inch dome in Phillips' Square) and a few good new ones (the 74-inch and the 150-foot radio telescope atop the Burton Tower, presaging a move to the campus). Dr. Racine presented the staff's contribution with a demonstration of the role of error boxes in X-ray astronomy.

Ph.D. Thesis - On Friday December 15 Hugh Ross successfully passed his final oral examination and the defence of his thesis, which was entitled "Radio Sources with Low Frequency Cutoffs".

Generals - Also on Friday, Bill Herbst passed his Ph.D. generals.

# Canada to join France in Hawaii telescope

Special to The Globe and Mail

OTTAWA — The federal Government has given Canada's astronomers the "go" to start negotiations with French officials on the construction of a \$17-million joint Canadian-French telescope in Hawaii.

The National Research Council was told of the Government's approval late last week. Terms of the final agreement between Canada and France, to be worked out between the NRC and the Centre National de France, will have to be ratified by Ottawa before funds for Canada's half of the telescope cost are released.

The planned 150-inch optical telescope (which will also be used for measurements in the infra-red spectrum) will be the first telescope financed in large measure by Ottawa since 1913, when the 72-inch Victoria telescope was built.

An NRC official yesterday confirmed the Government's decision on the joint telescope project and said that negotiations between NRC and the CNRS in France would begin "as soon as possible in the new year."

Discussions at the technical level will also take place between representatives of NRC's associate committee on astronomy and the Institut National d'Astronomie et de Geophysique, an agency of CNRS.

If all goes well, the negotiations would be concluded by the end of February or the beginning of March, the NRC official suggested.

Canadian officials probably will negotiate for Canadian industry to receive as many contracts as French industry as a part of the 50-50 shared-cost project, the official added.

The site of the planned telescope is the almost flat top of Mauna Kea, a mountain on the main island of Hawaii. The site will offer astronomers all but the lower 30 degrees of the southern sky, an area less explored than northern skies.

The site has an elevation of 13,600 feet and should offer astronomers 2,800 clear viewing hours each year. Under the proposed arrangement, Canadian and French astronomers would each receive a total of 42.5 per cent of the viewing time. The University of Hawaii, which is supplying

the site and support facilities, would receive 15 per cent of the viewing time.

Dr. J. L. Locke, head of the astrophysical branch at the NRC, noted yesterday that Canada would receive as much viewing time with the Hawaiian telescope as was expected with the Queen Elizabeth II telescope (which was to be located on Mount Kobau in the Okanagan region of British Columbia and was cancelled in 1963 by the federal government), but at half the cost.

An added bonus of the Hawaiian site is that recent

studies have revealed it to be perhaps the world's best-known site for infra-red observations, in part because of the high elevation and in part because the air above the site is so dry (and therefore so transparent to infra-red radiation).

Canada and France would share the cost of constructing the telescope half and half—about \$8.4-million each, according to the latest estimates. The annual operating costs of the telescope estimated at \$1-million, would also be shared equally by Canada and France.

The telescope is planned for completion in 1977.

Canada was originally invited by France to participate in construction of the Hawaiian telescope last February. At that time, Canadian astronomers were preparing a proposal for NRC for Canada to build an all-Canadian, \$18-million telescope somewhere in the southern hemisphere.

Late in the summer, the Government decided it preferred the Canadian-French joint telescope proposal. It rejected, for the time being, the all-Canadian telescope proposal.

## SKY CONDITIONS

Both Mauna Kea and its sister peak, Mauna Loa, 30 miles distant, rise high above the cloud deck that normally shrouds their lower slopes. During the daytime, the trade-wind inversion is typically between 2,000 and 3,000 meters altitude, but cumulus often caps the summit during the afternoon. By sunset, however, the rapid cooling of the barren terrain induces downslope winds that quickly dissipate the summit clouds and bring in clear, dry air from above.

One of the most useful criteria by which to judge site quality is the fraction of photometric nights. To be photometric, not only must the sky be free of clouds, but changes in atmospheric transparency must not exceed about one percent, as indicated by the repeatability of measured stellar brightnesses over a period of several hours.

By this definition, an average of 63 per cent of the nights were photometric on Mauna Kea from 1969 through 1971. An additional 10 to 12 percent of the nights were useful for spectroscopic observations,

## HIGH-ALTITUDE EFFECTS

Mauna Kea is the highest major astronomical observatory in the world, more than a mile above Kitt Peak in Arizona, Cerro Tololo in Chile, or Palomar Mountain in California. Much of the excellence of our site derives from this altitude, but there are penalties, both in accessibility and in physiological and psychological effects on persons working at over 13,600 feet altitude.

In comparison with other mountains of similar altitude, Mauna Kea experiences remarkably mild weather. The minimum Fahrenheit temperatures are typically in the low 20's in midwinter and the mid-30's in midsummer. Though snow and freezing rain can fall at any time of the year, it is only from December to March that there is more than a transitory accumulation.

Normally, the winds are less than 15 miles per hour, but infrequent severe winter storms can blow at 75 miles per hour. On occasion, drifts have blocked access to the summit for several days, but new improved road-clearing equipment should prevent losing any clear nights.

Human response to high altitude varies from one individual to another. Upon first arriving at the summit directly from sea level, visitors usually feel lightheaded, and sometimes they later develop a headache and exhibit lethargy. Hence, before starting work the observers acclimatize for a full day, either at the summit or at the observatory's living quarters 4,000 feet lower.

By the second day, most persons are able to function normally, although for a few some discomfort persists until the third day. In order to minimize the effects of altitude, we make a special effort to avoid heavy exercise, to eat moderately, and to get a normal amount of sleep.

Working on Mauna Kea can also result in some loss of judgment, due to the reduced supply of oxygen available to the

A further characteristic of the site that is important for many photometric and deep-sky research programs is the darkness of the sky. Preliminary measurements made at a zenith angle of 20 degrees indicate a sky surface brightness in blue light equivalent to one 23rd-magnitude star per square second of arc, as dark as any major site in use for astronomical observations.

By any standard of astronomical quality, Mauna Kea has proved second to none in the Northern Hemisphere. Here on the Island of Hawaii, the University of Hawaii has, with support from the National Aeronautics and Space Administration, the National Science Foundation, and the U. S. Air Force, placed in operation an 88-inch and two 24-inch telescopes.

The observatory is about 200 miles from Honolulu, the state metropolis, on an island almost as large as Connecticut but with a population of less than 70,000. It is four kilometers above the Pacific Ocean, on a desolate group of old volcanic cinder cones, as described in SKY AND TELESCOPE for September, 1968, page 140.

Measurements carried out during the past year with a water-vapor meter provided by J. A. Westphal of California Institute of Technology indicate on clear days an average nighttime content of less than one millimeter of precipitable water in a vertical column above the summit. (For comparison, at sea level on a clear day the value is typically 10 precipitable millimeters.) Because of the diurnal wind pattern on the mountain, we expect the nighttime values to be even lower.

Several times each night with the NASA-Lowell 24-inch telescope, Mauna Kea has consistently produced excellent pictures; fully a third of the 1971 Lowell Mars Map was based on our photographs (SKY AND TELESCOPE, November, 1971, page 262). From this evidence and from our own records, we estimate that the seeing disk, taken as having 75 percent of a star's light, is typically one second of arc in diameter, with 0.5 second not too infrequent in both the 24- and 88-inch telescopes.

The infrared transparency of the atmosphere above Mauna Kea has been of con-

Hawaii's Mauna Kea C

DAVID MORRISON and JOHN T. JEFFERIES, Institut

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