A A V S O A B S T R A C T S

Edited by R. Newton Mayall

PAPERS PRESENTED AT THE 50TH SPRING MEETING, MAY 26 - 27, 1961

The 50th Spring Meeting was held in Ottawa, Ontario, Canada on 26 and 27 May 1961 at the kind invitation of the Ottawa Centre of the R.A.S.C. Only twice before in the long history of the AAVSO has it held its spring meeting outside the U.S. -- Toronto in 1940, and Montreal in 1957. This was a fitting beginning of our 50th year, for many members live in Canada. Dr. Millman, a long time member of the AAVSO (since 1934), is President of the RASC, and a member of AAVSO Council. Our meetings were held in the scientific laboratories of the Radio and Electrical Engineering Division of the National Research Council of Canada - a modern building in a campus-like setting, located about 3 miles east of Ottawa, on the Montreal Road. Nearby comfortable modern motels housed us.

We could not have held our meeting at a more pleasant time of year - the time of the Ottawa tulip festival. Ottawa is the national capital of Canada, and has its full complement of fine government buildings. The Peace Tower at the House of Parliament affords a pleasant view of the entire city. The outstanding feature of the city is its Rideau canal and Rideau River which flows into the Ottawa River; and Dow Lake. The falls at the confluence are a focal point. Sightseeing boats ply the waterways. The numerous parkways along the canal and rivers are pleasant at all times of year but particularly colorful at this time. Over a million tulips line the drives. At Major's Hill Park a gun signals noon. Ottawa is an interesting city and good weather made it more so, although on Friday morning, 27 May, we were greeted by a good snow fall. By noon it began to clear and the remainder of our stay was blessed by sunny skies.

Almost everyone had arrived in time for the Friday evening lecture. At 8 p.m. we met in the auditorium of the R. and E.E. building. Dr. B.G. Ballard, Director of Radio and Electrical Engineering, and science Vice-President of the National Research Council of Canada expressed the greeting on behalf of the NRC. During his remarks he pointed out that the amateur astronomer also made an intellectual contribution, and that the snowfall that morning was an all time record.

Dr. Ian Halliday, President of the Ottawa Centre of the RASC, expressed greetings on behalf of the Ottawa Centre, and urged everyone to take time to drive along the rivers and enjoy the vast tulip display, then at its height.

Dr. M.G. Whillans, Assistant Chief Scientist, Defence Research Board of Canada, gave a most interesting and informative talk on Bioscience and Space Research (See abstracts). Following Dr. Whillans' talk we were given the opportunity to visit the laboratories. Members of the staff were on hand to explain and demonstrate various parts of the work in which they were engaged. This was a rare opportunity for which everyone was grateful. From the laboratories we wandered down to the cafeteria in the basement where a sumptuous collation was served by the Ottawa Centre. There was plenty of time to meet old friends, make new ones, and just have a good social time.

Our session for papers on Saturday morning was enhanced by a description of the work being done at the various observatories that we would visit in the afternoon and evening (See abstracts). A buffet lunch was served in the cafeteria. After lunch we went first to Goth Hill Solar Radio Observatory about 15 miles south of Ottawa, and then to

Spring Hill Meteor Observatory farther along on the same highway and about 25 miles south of Ottawa. At both places members of the staff were on hand to explain and demonstrate machines and work. Of particular interest, at Spring Hill, was the meteor roof fitted up with "coffins" in which one can recline comfortably to observe the sky. The "coffins" are heated for comfort on cold winter nights -- only the head and shoulders being exposed. The main building is fitted with a small lunch room where we found coffee and cake awaiting us.

We arrived back in the city in time to sit down to an enjoyable dinner at the Eastview Hotel. After dinner we reconvened at the Dominion Observatory on the hill west of the city. We first enjoyed a commercial sound film in color, showing the making of a reflecting telescope, following which we visited the buildings housing the new mirror transit telescope, and the meridian transit, and observed with the 15" telescope. We are grateful to Dr. Beals, Director of Dominion Observatory for the opportunity to see what is going on there.

Sunday morning was bright and clear and we wended our various ways homeward. We were glad to have so many from the Montreal, Ottawa, and Toronto Centres come to our meeting, - a meeting which will long be remembered.

BIOSCIENCE AND SPACE RESEARCH, by Dr. M.G. Whillans

Dr. Whillans is a doctor of medicine who has been a member of the Space Medical Association for 9 years. He pointed out that the space flight of Alan Shepard gave a great boost to morale; and that the achievements in the American program are remarkable. Space is a vertical frontier and it creates its own special problems. The material benefits of space research are unknown. Putting man into space is an engineering problem and we can predict how man and machines can work together. Man is virtually in space at 50 to 60,000 feet in so far as pressures are concerned. A satisfactory space suit would be uncomfortable, so we must develop a multiple room space ship to allow freedom of movement.

Dr. Whillans said that disturbance of organs of balance would not bother space travel. The structure of our anatomy is based on stresses and our growth pattern is based on 1 g. What happens at 0 g? We don't know how gravity affects the nervous system. It has been found that a wheel rotating at a desired speed can provide the proper gravity at the periphery. A wheel 125 feet in radius rotating at 2.73 rpm produces a reasonable gravity. However, troubles and side affects occur. Dr. Whillans has found that plants may be disorganized in the wrong gravity. He tried rotating the plant container to offset the effect of gravity. How does magnetic force affect us? Mice exposed to magnetic force showed better growth.

Radiation has a fundamental effect on body cells. It may be possible to take a daily dose of a chemical to protect the vital enzyme system. For the man in space travel, food and water present tremendous problems. Algae could grow on human waste to produce oxygen. Algae have protein and other useful items. Some foods may even provide a radiation shield.

The question of the decade: Is there life on other planets? If life is found it may be based on a carbon molecule. The great race is to answer the question, where does life begin? How dependent are we on radiation? Space navigation poses its problems. Why or how does a blinded homing pigeon home? Why is a homing pigeon sensitive and an

ordinary pigeon not so sensitive? How do eels navigate back and forth across the Atlantic?

Dr. Whillans extended his own enthusiasm for his work and supplemented his talk with appropriate slides.

RZ CASSIOPEIAE, by John Ruiz

Mr. Ruiz showed the results of his photoelectric observations of RZ Cassiopeiae, carried out in accordance with a program suggested by Dr. Ashbrook, Technical Editor of Sky & Telescope. RZ Cas is a star of the Algol type with a period of about 28 hrs. It has a very shallow secondary minimum so that only the primary minimum is observed.

Dr. Ashbrook obtained a good response from several amateurs from Massachusetts to Mexico. The results appeared in the April 1961 number of Sky & Telescope. One amateur submitted photographic observations, two submitted photo-electrical, and the rest were visual. The average of the visual and photographic observations agreed exactly with the photo-electric although the scattering was greater. This shows that for this particular type of work the visual observations are useful if a sufficient number of them are obtained.

Mr. Ruiz had his PEP equipment on exhibition and demonstrated its use. (The members will be interested to know that John Ruiz travelled to Cambridge in the Spring of 196 with his equipment, which he demonstrated on a live TV program on Science sent out over Channel 2, an educational radio and TV station. John appeared with Red Stong of Scientific American. Both gave an outstanding performance, which was taped and is available to more than 100 stations all over the country.

A SOURCE OF STANDARD TIME SIGNALS, by Lewis J. Boss

A time standard which is readily accessible and available 24 hours a day is of prime importance to the serious amateur observer. Such a standard is provided by Radio Station WWV and WWVH operated by the U.S. National Bureau of Standards for time and frequency broadcasts. Anyone having a radio receiver capable of being tuned to the frequencies radiated by either of the Bureau's transmitters has available very accurate time intervals, time signals, precise audio and radio frequencies, and radio frequency propagation notices.

Transmitter WWV is located at Beltsville, Maryland, Latitude 38° 59' 33" North; Longitude 76° 50' 52" West. It radiates signals on frequencies of 2.5, 5, 10, 15, 20 and 25 megacycles.

Transmitter WWVH is located on the island of Maui, State of Hawaii, Latitude 20° 46' 2" North; Longitude 156° 27' 42" West. It radiates signals on frequencies of 5.0, 10.0 and 15.0 megacycles. "Tick" pulses are spaced precisely one second apart. Each pulse from WWV is made up of 5 cycles of a 1000 cps. note. The WWVH "tick" consists of 6 cycles of a 1200 cps. signal. The one-minute points are indicated by the omission of the "tick" at the beginning of the last second of each minute and by beginning-of-minute intervals with 2 pulses spaced 0.1 second apart. Observers having access to an oscilloscope may want to see the interesting patterns and compare the visual pulses to the audible "ticks".

Requirements for analysis of satellite information and the necessity to locate these objects accurately in their orbits about the earth has led the National Bureau of

Standards to retard the time signals sent out from both WWV and WWVH by five milliseconds; and these transmitters, as of 1 January 1961, have also resumed transmitting on WWV a special code which gives, in Universal Time, the day, hour, minute and second coded in binary form. This retardation brought the time signals of WWV/WWVH into better agreement with other frequency standard signals transmitted by foreign stations throughout the world.

The United States and the United Kingdom began the coordination of their frequency and time transmissions early in 1960. This was jointly announced at that time by the Astronomer Royal of Greenwich Observatory, the Director of the National Physical Laboratory and the Director of the United States National Bureau of Standards. In addition to the United States stations WWV and WWVH, other transmitters in the coordination plan are GBR and MSF at Rugby, England, and NBA, Canal Zone.

These time and frequency signals broadcast on radio frequencies are maintained as nearly constant as is possible with reference to the atomic frequency standards which make up the United States Frequency Standard supported and controlled by the National Bureau of Standards. These signals are normally held stable to 1 part in 10^9 at all times. Deviations per 24 hours are normally less than 2 parts in 10^{10}. When and if adjustments become necessary, and these do not exceed 5 parts in 10^{10}, these are made at WWV at 1900 hours Universal Time. Adjustments of frequency at WWVH rarely exceed 3 parts in 10^9.

To receive these time signals, almost any good radio receiver which is capable of being tuned to the frequency of one of the WWV/WWVH transmission bands may be employed and high precision time and frequency measurements accomplished. If reception proves to be exceptionally poor over an extended period of time, the effort to erect a good antenna will be well worthwhile.

For those who wish to build their own receivers, an excellent article appeared in "Electronic Industries" magazine in August 1960, which gave the circuit diagram and all component values for a 5 megacycle transistorized receiver. This can be built into a 1"x3-1/4"x4" case and is easily carried in the coat pocket. A 2-inch speaker is used and room volume of the signals can be obtained at most locations. Power is supplied by a single 1.34V mercury battery.

For additional information on time signals, NBS Miscellaneous Publication #236 is recommended. This is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at a price of 10 cents. (Some observers use similar time signals sent out from CHU Dominion Observatory Ottawa, Canada, which operates on frequencies of 3330Kc, 7335Kc, and 14670Kc. A voice announcement is made each minute. ED).

INTERESTING CURRENT LIGHT CURVES, by Margaret W. Mayall

Mrs. Mayall exhibited and discussed the light curves of R Coronae Borealis (1845-1961); detail plot of minimum of R Coronae Borealis in 1960: Nova Herculis 1960 brought up-to-date; and recurrent Nova RS Ophiuchi. The similarity in the curves of Nova Her and RS Oph was apparent. The curve of the interesting semi-regular variable W Cygni was shown. Mrs. Mayall again urged observers to make special effort to observe the semi-regular variables. A long series of observations by each observer is especially important, so that the personal equation of each observer can be obtained thereby making it possible to reduce all observations to a common scale. See the April 1958 issue of the Journal of RASC; and the August 1961 issue which contains a light curve of W Cygni.

DOMINION OBSERVATORY, by Ian Halliday

Stellar physics, Radio, Meteor, and Solar astronomy are major projects at the Dominion Observatory, Ottawa. Its radio astronomy station is in British Columbia; the meteor station in Alberta; and solar at Ottawa. The radio station is in a valley(elevation 1800 ft.) in a semi-desert region. It is equipped with an 84-foot dish, and a T-shaped array for 22mc. The meteor station is north of Alberta and is equipped with various instruments including a super-Schmidt camera. Dr. Halliday illustrated his talk with color slides.

POSITIONAL ASTRONOMY, by Malcolm M. Thomson

The determination of stellar positions is under the Division of Positional Astronomy at Dominion Observatory, where Mr. Thomson is Chief of its time service. Ephemeris time is determined and the instruments used are a meridian transit and a new mirror transit telescope. Four cameras photograph the setting of the meridian transit. Time service similar to WWV is given by CHU in Canada, with voice announcement every minute, operating on 3330, 7335, and 14670kc.

GOTH HILL, by A. Carrington

Since 1946 the National Research Council of Canada has had a radio Astronomy station at Goth Hill, about 15 miles south of Ottawa. It was a war radar station that was converted to radio astronomy. There are several small dishes and a 600' linear array (Compound radio interferometer). Solar radio emission from undisturbed areas, sunspots, and layers are being correlated with American Relative Sunspot numbers. Although Goth Hill is using AR, Dr. Carrington pointed out that the importance of the Zurich sunspot numbers lies in the fact they begin in 1749. He also suggested that the relative numbers may be replaced some time by one observatory using radio emission. There are plans on foot to move this station to Algonquin Park, 150 miles to the north, where a 33-foot parabolic reflector is under construction.

SPRING HILL, by Peter M. Millman

The Spring Hill Meteor Observatory is about 25 miles south of Ottawa and almost 10 miles farther along on the same road as Goth Hill. This station was set up at the beginning of the IGY. Observations are made visually, photographically, and by radio. A signalling system connects each visual observer with the radar recording unit. By pressing a button the incidence of a visual meteor may be recorded on the radar film. There is a small but adequate administration building, the famous observing roof with its "coffins", and two large radio mats that give uniform response over the whole sky from 15° above the horizon. The exhibition room has on display many meteorites gathered from various parts of the world, and a particularly interesting exhibit showing the structure of the Barringer Meteor Crater in Arizona, with material collected by Dr. Millman. The meteor radar operated at 200-400kw in 1947; but today it is being stepped-up to 4-5 megawatts of power.

Dr. Millman is engaged in Upper Atmosphere Research. The results of his work were on display at Spring Hill and at NRC Laboratories in Ottawa.

++++++++++