

THE AMATEUR ASTRONOMER

Before speaking of ^{The} Amateur Astronomer ^{of} to-day, I would like to remind you of an Amateur Astronomer of the 18th century.

Charles Messier was an amateur all his life. He observed what he liked, when he liked to and because he liked to. *He was attracted to comets by the return of Halley's comet.* On Christmas Day, 1758, Halley's Comet was sighted on its first predicted return. There was great excitement. Halley was vindicated. Comets were not messengers from heaven, they were members of the solar system following the laws of gravitation.

Halley had observed other comets besides the one for which he is famous. But he found that all the others had parabolic orbits. His summing-up was that at least one comet had an elliptical orbit, probably many had, and that all were moving under the influence of the sun's gravity.

The return of his comet was observed, as I have said, in December 1758.

But, on that return, it passed perihelion in March 1759, so that return is listed in catalogues of comets as COMET 1759 I.

Among the many intrigued by the return of Halley's comet was Charles Messier. He acquired a telescope to see if he could pick up any ~~other~~ ~~comets~~ of the other comets which Halley said were floating around. He discovered ~~COMET 1759 I~~ 1759 II. This was something of beginners luck, for he did not discover another for four years. But he stuck with it. During forty-three years (1759-1801) all he did, in the way of astronomy, ~~All he ever did was look for comets. Forty-two years after he discovered~~ was look for comets. ~~his first he discovered his 12th. After which he called it a day.~~ In order to illustrate a point, I would like to divide this period into two periods.

(1759-80 incl), of 17 comets discovered,
 In the first twenty-two years, he found 17 comets, but of these 8 had
 9 were definitely first found by Messier and were called after him.
 been found before him by others, or reported by others, before him.

Consequently only 9 of the 17 were called after him. In the next twenty-one
 years, of 26 comets discovered, only four were attributed to Messier.

Meanwhile, two changes had taken place. First: there were more comet-
 hunters, and second, the others had larger telescopes. Messier had a

telescope of a bout 5 centimeter diameter (or about 2 inches).^{2.5} In his last 22 years of observing
 He was
 From
 competing with such professionals as Olbers, among others, Bode, Encke, Zulu, and Pons
 1786 onwards, he was competing with Caroline Herschel with her brothers
 to say nothing of Caroline Herschel, who discovered her first comet in 1786
~~12 inch~~ who that year discovered her first comet with her brother's

12 in telescope.

Going back to 1759: before Messier started looking for comets, he had
 read something about them. He learned that ^a comets did not develop ~~tails~~
 a tail until close to the sun. That if ~~picked up~~ discovered early in
 its journey towards the sun, it looked like a fuzzy star, or if picked
 up very early, .like the glimmer of a tiny bit of nebula.

Therefore, when Messier started comet-hunting first, if he saw a nebulous
 object, he realized that it might be a comet, or, on the other hand, it
 might not be. He used, ^{he used just to} At first, just make a mental note of where he saw
 it, and then look the following night to see if it was still there. If
 it was in the same place, he wrote it off as a nebula. If it had moved,
 he adjudged that it was a comet. But as years went by, he found himself
 picking up a nebula, thinking it was a comet, only to realize afterwards
 that it a nebula which he had mistaken for a comet one or two years before.

So he decided, in the future to measure the position of any nebulous
 object, and keep a list of nebula to which he could refer, and so, perhaps,

be able the same night to recognize an object as a nebula, instead of waiting until the following night.

Messsier lived in Paris. After he was sure that he had observed a comet, he used to go over to the Paris observatory, and let the professionals take it from there.

In 1780, after he had discovered what was to be the ninth comet called after him, he went to the observatory. The director asked to see him. He wanted to congratulate Messier. He said that at the observatory not a few people came claiming to have discovered comets, and ~~more~~ oftener than not, they had seen a nebula. "But" said the Director "you never make a mistake. Wemmarvel." "There 's nothing to it" says Messier, "I have a list of nebulae, with their positions". "You have !" says the Director "I'd like to see it". So Messier brought over his list, and it was published, with his permission in the CONNAISSANCE DES TEMPS (-the equivalent of our observers handbook) "Catalogue des Nébuleuses et des Amas d'Étoile Observées à Paris" (C.de Temps, Paris, 1781)

The list was published as an aid to comet-hunters. It turned out to be of much more value. In December of the year in which it was published, it was put into the hands of William Herschel, by one Watson of the Royal Society, who ~~suspected~~ considered it significant. Herschel observed all ~~the~~ Messiers objects, and resolved about half of them into stars. Failing to resolve some of them, he became a nebula hunter, and birth was given to the theory of external galaxies.

Now let us turn to the OBSERVER'S HANDBOOK 1966. On page 90, we have a list of Star Clusters.

This is a list of the more conspicuous star clusters. There are 25 clusters in the list. Of these, 21 are from Messier's catalogue.

The clusters not in Messier's list are, first the two clusters in Perseus. These were obviously clusters, and Messier never mistook them for comets. Then there is the Hyades, which again, could not be mistaken.

It may be a bit of a surprise to find the Pleiades. This suggests to me that Messier did, now and again, see a glimmer of nebulosity in the Pleiades. *****

The fourth object in our list and not in Messier's is Omega Centauri. It is so far south, that Messier never saw it. Neither can we see it from Canada. One might argue that it ~~has~~ should not be included in this Canadian Observer's list. ✓ One of those which is not is the Coal-Sack nebula, in the Constellation of the Cross, 63° south of the Equator.

On page 891, we have a list of 25 Galactic Nebulae. Nine of these are from Messier's catalogue.

**** We have in Messier's list M.13 and M.22, which are both faintly visible to the naked eye, on a good night. Messier's telescope should have resolved, at least M.13 into stars. We believe it did, but he put it on his list, because on a bad night, it might not be resolved, and might be mistaken for a comet.

I may mention here that although Messier's Catalogue is most frequently spoken of as a Catalogue of Nebulae, it appeared in print with the title catalogue of Nebulae and Star Clusters.

The Coalsack nebula is ~~one of the best known~~ the earliest known of the dark nebula. It is often mentioned in Astronomical literature. It is probably included here to satisfy the curiosity of amateurs ~~as to~~ ~~where it is, or~~ who might be surprised ~~to find~~ not to find it in a list of galactic nebulae. This suggests that the inclusion of Omega Centauri in the list of clusters could be for the same reason.

Some of the galactic nebulae not in Messier's list are so large that they could not be mistaken for comets. Others may not have been reached by his telescope.

On page 92, of the HANDBOOK, we have a list of 25 External Galaxies. 17 of these are from Messier's Catalogue.

These 17 can be all picked up on a clear night, as a little wisp, much as Messier saw them, with the aid of a 7 x 50 binoculars. If instead of using binoculars, ~~you~~ a six-inch telescope is used, not much difference is made, except in size.

~~It took~~ photographs by the 100-inch telescope at Mount Wilson

To establish the fact that they are galaxies of stars. (cf. E. Hubble,

"The Spiral Nebula as a Stellar System- M. 33" Ap. J., 63 (1926), p. 19)

Nobody has ever seen the Andromeda Nebula as it appears on photographs from Mount Palomar. Our eye sees only an instantaneous picture. Photographic film keeps registering as long as it is exposed. A ~~photograph~~ time exposure photograph with a telescope registers details not seen by the instantaneous shot of the eye. In a ~~very true~~ sense, telescopic pictures of galaxies are photos of the invisible.

at Ottawa

Two years ago, I met an amateur astronomer, ~~at~~ who had set himself the project of photographing every object listed in Messier's catalogue. This, it seems to me, would be a nice souvenir, for ~~the~~^{like} man to have for himself. I do not see that it would be any contribution to astronomy. He had a 12-inch telescope. He could purchase better pictures made with larger telescopes.

What I do think might be a contribution would be an attempt to take pictures illustrating the objects seen by Messier as seen by Messier. This would be difficult. If I were to attempt it, I would start with the spiral nebulae, or external galaxies, and, I think that I would use a two inch telescope. With the minimum of exposure, one might get close to what Messier saw. A little over exposure would not make significant difference in these faint and nebulous objects.

When it comes to the galactic nebulae, some experimenting would need to be done. Some of them, notably the Orion Nebula, when ~~seen with the eye~~ ~~at~~ looked at through a good-sized telescope, show colour. Even though the colour may not be seen with a 2-inch telescope, the sensitive film might well record a picture different from what the eye sees.

In taking photographs of the Star Clusters one would have to be very careful not to overexpose, or one would definitely pick up detail not seen with the naked eye.

Here I may say if any of you would wish to experiment on the effect of exposure, a good object is M.13, the Globular Cluster in Hercules.

A ten minute exposure will photograph more stars in the cluster than you see with the eye through the same telescope. Twenty minutes will show more, and half an hour still more. Of course for ~~any~~ photography of stars, or Messier objects one needs an equatorial mounted telescope and a clock drive.

While on the subject of photography and how it differs from what we see, I think that I should mention the photographs of comet Ikeya-Seki which appeared in the Sky and Telescope for December 1965. On the cover was a beautiful photograph taken with ten seconds exposure. Inside, there were photographs taken with various exposures, - one was taken with 18 minutes exposure. What is to be remembered is that ~~nobody saw the~~ none of the photographers saw the comet as it is depicted in these pictures .

~~A~~ Branch of Astronomy which is generally supposed to afford scope for amateurs is the observation of variable stars. In our OBSERVER'S HAND*-BOOK there are two pages devoted to them. ~~In~~ In each issue of the JOURNAL of the RASC there ~~is~~ are always variable star notes.

The story of variable stars often begins with the story of John Goodricke (1764-86) who first observed Algol when he was 18 years of age, had his observations published when he was 19, and when he was 20 discovered the variability of Beta Lyrae and the famous Delta Cephei. Unfortunately, he then became ill and died when he was 22. He was an Amateur's amateur. What may make one wonder is that the variability of Algol had not been studied earlier.

One clue is the fact that the Greeks had no name for it. The name Algol is a corruption of the Arabic word for THE DEMON.

We Maritimers, and inheritors of a British tradition of the sea, think of navigation and familiarity with the stars in past centuries as a prerogative of sailors. We do not give much thought to the fact that for five centuries, the Arabs were masters of the middle East and North Africa and of Southern Spain. There were Arabs who travelled the width

of Africa by camel or by mule. They would rest by night in the desert. They had an opportunity to be more familiar with the stars than a sailor. The seeing ~~from the~~ through the dry~~x~~ air of the desert is better than the seeing from the sea. And the desert does not rock and roll and pitch like a ship.

The Arabs were perplexed by Algol. Night after night it would be there, a bright second magnitude star, and then some night it would be a faint third magnitude star.

The variation of Algol is something which can be watched with the naked eye. To get the exact minute of its minimum a telescope is required, but roughly its variations can be watched.

Goodricke, like the Arabs was perplexed by it, and decided the record ~~to be times when he saw it~~ its magnitude night by night. He saw it as a second magnitude star for as many as 22 nights in succession. He never saw it fainter than about 3.3 magnitude. He looked over his records to see what interval of times elapsed. Once the interval was 22 days, 23 hrs., twice it was 20 days and 2 hrs, three times it was 17 ^{days} hrs and 5 ^{hrs} mins once it was 5 days 17hrs and twice it was 2 days and 21 hours. His crucial observation was his study of these records. He noticed that 5 days 17 hrs was twice 2d 21^h, that 17^d 5^h m was three times 2d 21^h, and so on.

Having noticed this, he then made the daring speculation that the cause of the dimming was "the interposition of a large body revolving around" the bright star.

It was not until 106 years later that his hypothesis was verified by spectroscopic examination.

$$2d \cdot 21h = 69h$$

$$2(69) = 138$$

$$6(69) = 414$$

$$7(69) = 483$$

$$8(69) = 552$$

In THE OBSERVER'S HANDBOOK 1966, on pages 32 to 55, we have "The Sky Month by Month".

The times of the minimum of Algol are given for each month (in Eastern Standard time, to which we have to add one hour to get A.S.T., or, in Summer time, two hours to get A.D.T.)

Algol starts to decline in ~~brightness~~ apparent brightness about three hours before the times given. For instance: on January 1, at about 3 A.M. EST, it began to decline, and reached its minimum at about 6 AM. It was back at maximum about 5 hours later, that is at 8 ZAM EST.

On the night of Jan 1, it was at its brightest and on the night of the 2nd, and on the night of the 3rd until midnight, (3 hours before the given time of minimum).

This evening Jan 26, Algol is at its brightest until 10.30 PM EST or 11.30 AST.

On Saturday next its decline can be observed from 8.30 PM to 11 30 PM, AST and so on.

On page 89 of THE HANDBOOK, we have details about variables.

In the second list theregiven, entitled "Other Types of Variable Stars", Algol is the 3rd on the list.

In this same list, the third on the ~~list~~ fourth from the end of the list is Beta Lyrae, which was discovered to be variable by Goodricke in 1784. Its range, from 3.4 to 4.3 magnitude is not as great as that of Algol. The smaller and fainter star (of mag 7.8) only partially obscures the brighter when in front of it. The minimum is then 4.3. Four days later the two are side by side with a maximum of 3.4, but they are so close together that the smaller one starts immediately to be partially obscured. Two and a half days after max, a secondary minimum of 3.88 is reached after another two and a half days max is reached again, and after four days minimum again. Turning to page 83 of the HANDBOOK we see that the faint star is of mag. 7.8, and their separation is 46" of arc.

~~Spex~~ Beta Lyrae has been in the news in recent years since spectroscopic evidence shows that gases stream from one star to another. And in still more recent years, it has become an exercise in magnetohydrodynamics to compute the exchange of material.

Observation shows that the period of variability, given as 12.93 in the Handbook is increasing at the rate of 10 seconds each year. (The rate of revolution of the smaller one is increasing).

On page 89, the last variable in the second list is Delta Cephei. This was observed to be a variable by Goodricke in 1784.

Its period is about 5.4 days. T_p consists of about 1.5 days from min to max and 3.9 days from max to min.

In the 5th column of this list is given the spectral class. For Algol, Beta Per., this is given as B8 plus G, which means that the brighter one is B8 and the other G.

For Delta Ceph. we have in the fifth column what looks like F5 minus G2. This is read F5 to G2

As it fades, its spectrum changes from F5 to G2

(In general a cepheids spectral class is closer to the blue when brightest) **

** Delta Ceph. is not a binary, but an apparent double inasmuch as there is a 6th mag star about 4.1" (AE, 1952)

The importance of the Cepheid variables was accidentally uncovered by Miss Leavitt of Harvard when she was ~~working on variables in Small~~ at the Jamaca Station of Harvard University. The Small Magellanic Cloud had been reported to be rich in Cepheids, and she investigated. After she had discovered 25, she prepared a paper on her findings. In doing so she arranged her findings in order of the periods of the variables, and found that they were also in order of apparent magnitudes. She reported "the brighter variables have longer periods". This had not been noticed before, and furthermore it was not, in general true. It was Shapley who put his finger on the explanation. Stars in Small Magellanic Cloud are equidistant from us. The order of their apparent magnitude, is also ~~xxxx~~ the order of their absolute magnitude. This was checked with other Cepheids close enough to have their parallax measured. Their periods were greater for brighter absolute magnitude or intrinsic brightness. The pulsation theory was excogitated. If the stars were expanding and contracting, the intrinsecly brighter ones would do so over a longer period.

It is not the theoretically explanation of why that is of importance, but the fact. From the period the absolute magnitude could be determined and so the distance.

It would be lengthy and tedious for me to go through all the observations suggested for AMATEURS in our HANDBOOK.

So I would like to turn now to those which are indicated as useful.

On page 61, we are told that successive observations at the same times on successive nights are useful, and may be reported to Dr Millman at HRC , Ottawa.

We did have an auroral group here. But I can understand how interest would wain during time of sunspot minimum (which we are now at) when aurora are few and far between. Also, here in Halifax, we are at a considerable distance from the magnetic north pole. Northern Manitoba is one of the better places, and the number and intensity of northern lights diminish as we come East and South.

It is both interesting and helpful to correlate the observation of sunspots with aurora. Anyone with a telescope can observe sunspots by getting the sun's image on a white plate of board. If one has ~~and~~ a Unitron telescope, one will have a sunspot plate provided.

Shortly after sunrise is a good time to look for sunspots. If, ~~here in Halifax~~ you see a large sunspot just coming on to the sun, you may predict that in a day or two there will be an aurora. It would be worth while keeping a watch. When an aurora is observed. It is good to watch the following day about the same time, and to note the change. Here in Halifax, if you happen shortly after sunrise to see a sunspot coming onto the sun's eastern edge, you may be the first in North America to see it. The time of its first observation, and the time of the following magnetic storm (and aurora) add to our knowledge of the time lag between the two.

In the HANDBOOK'S ~~NOTE~~ on the observation of the moon (pages 61-62) no explicit mention of the usefulness is made. However, there is squeezed on to the end of the note in the 1966 edition, the statement: "Two areas ~~xxxx~~ suspected of showing changes are Alphonsus and Aristarchus".

This was not in previous editions. I take it to have been inserted because of an appeal for observations of the moon made by the Goddard Space Flight Center, and printed in our JOURNAL for October 1965 pages 219-220. The Flight center would like amateurs to keep their eyes especially on Alphonsus and Aristarchus and to report any sign of activity. Signs have been reported on a number of occasions in the past hundred years. Unfortunately, they have always been isolated reports. If it should happen that the Flight Center receives reports from two or more observers reported the same facts at the same time, that would be useful.

This is a task for visual observing. If any activity takes place it will be unpredicted, and before a camera might be affixed to a telescope the activity might be over.

On page 71 of the Handbook is an appeal for Fireball Observations. These ~~xxx~~ of course may be chance observations, but they are more likely to be made by meteor observers.

The best time for meteor observations are at the time of showers. In the list of principal showers on page 71, there are no showers listed for February, March, June or September. There are two major showers in both November and December.

The most comfortable time for viewing meteors is in July and August.

The Ottawa Center of the RASC used to have a very active meteor group.

I gather the observing was as sociable as it was useful.

It is good to have at least three in a party. One for observing one for recording and one for timekeeping. Also, turns can be taken at each job.

Multiples of three are better. A party of 12 can be veru efficient, with eac taking a quarter of the sky.

This brings me lon to say something about the RASC. The early history of it is told by Jim .Low (of the Montreal Center in the December issue of the JOURNAL. In 1965, it celebrated its 75th year. It had its origin in Toronto. Since then it has been faithful to ~~its constik~~ the article of its constitution which says that "Membership is open to anyone interestd in astronomy". Since ktsfoundation it has spread to 16 cities. The story in every city has been the same. A number of persons interested in astronomy came together, and after a while asked to be joined to the RASC.

I notice that there is the innate odesire of those interested to meet others with mutual interests.

In the latest reoprt of the Society that is available, that of March 1965, we are told that there are 2,200 members. Of these 581 belong to the Toronto centre, 337 are an the Island of Montreal, 149 belong to the Ottawa centre and 79 to the Hamilton centre.

In Toronto last year, I enquired how many turned up to their monthly meetings: I was told an average of about 100. You will notice that that is less than one-fifth,-nearly oneisxth. If In the Montreal English speaking section, they had 220 members according to the last report. My enquires elicited the fact that 40 or 50 showed up to monthly meetings. That is one-fifth or at best one quarter.

Jan 26 1966

The attendance at the meetings of the Halifax Centre are often a disappointment to us. But, I would like now to submit, that our average attendance is as good as at any other centre.

If one takes up astronomy as a hobby or if one is just interested in astronomy, one cannot be expected ones duties in order to attend a meeting of the Society.

I have talked with members of other centres and heard them talk. I may say that their problems are not essentially differnt ^{from} ~~than~~ ours.

However, I must admit that the list of officers in the current issue of the Galaxy is as thin as I have seen.

The paucity of offivers ~~m~~akes the work of our secretary more laudable. We are indebted to him and to the NovaScotia Museum of Science for the ~~Galaxy~~ resurregence of the Galaxy. I hope that this is a sign of a renaissance.

I would like to urge that none ~~be~~ discouraged. Times will ~~ca~~hange.

The Toronto centre is 75 years old. In another 70 years we may have 500 members,- if we hold on. If that should come about, then in the year 2,030, they will be saying of ~~the next ones~~ ~~and~~ us: "Never was so much owed to so few".

This reminds me, of course, of our gallant Air Force, and of his motto: Per ardua ad astra: the way to the stars is not easy.