THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

SASKATOON CENTRE

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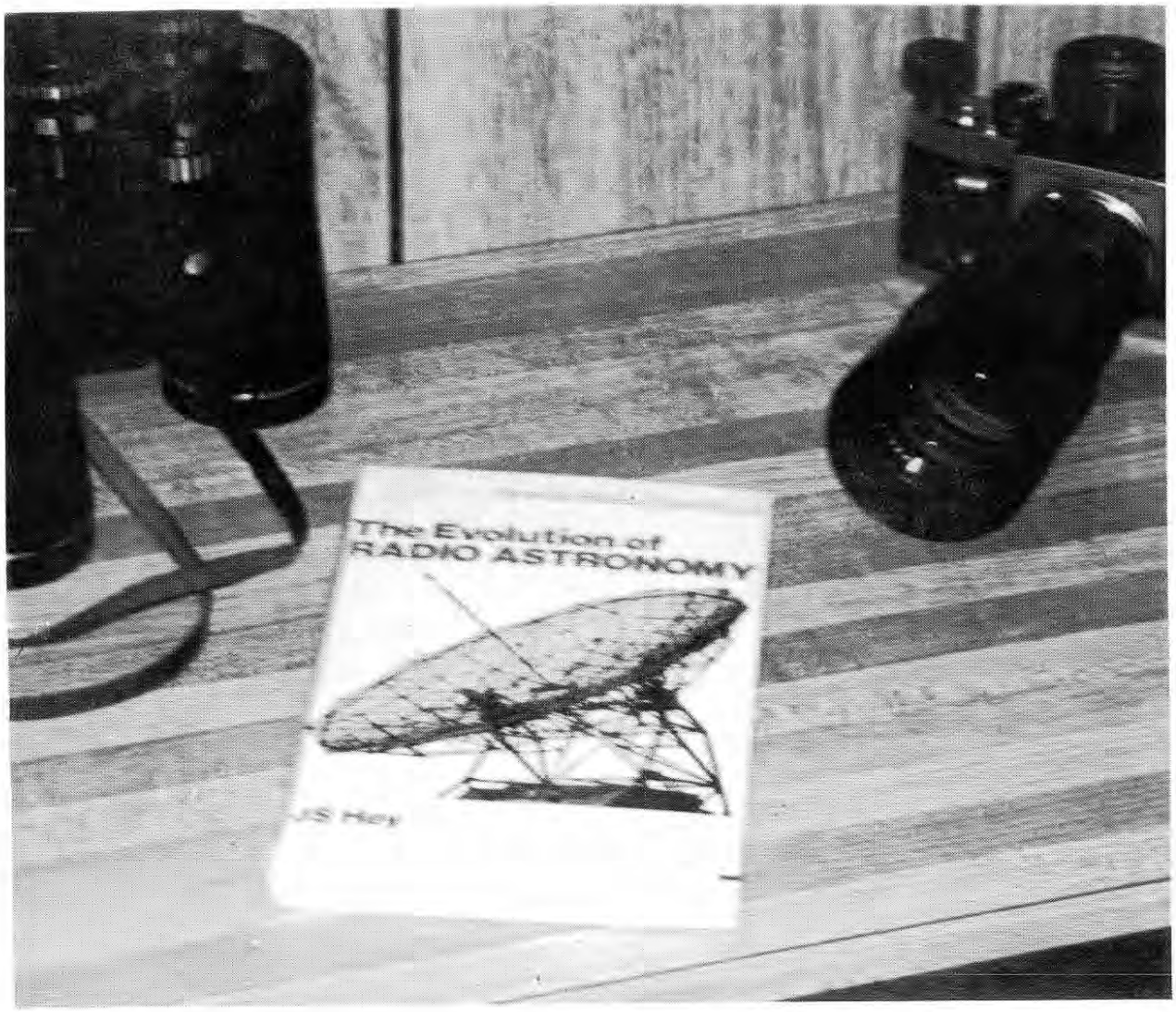
November, 1976

Vol. 6 - Copy 11

NEWSLETTER



Life levels all men:
death reveals the eminent.

GEORGE BERNARD SHAW

IN MEMORIAM

Dr. J. F. Heard, Past President of the Royal Astronomical Society of Canada, a former Director of the David Dunlap Observatory, and Professor Emeritus in the Department of Astronomy at the University of Toronto died in Richmond Hill on 5th October, 1976. Astronomy and astronomers across this country have suffered a grievous loss.

Jack Heard served the Society well as President, as Treasurer, and as a long time member of the Board of Trustees, giving generously of his time to all the activities of this large and complex organization. His planning and careful scrutiny of budgets played a large part in bringing the Society into its present sound financial position.

Distinguished teacher and lecturer, highly respected research scientist, able administrator during his many years of service as Director of the Observatory, and as Department Head; these terms describe the career of this Past President of the Society. To its members, whether they were professional or amateur astronomers, Jack generously provided advice and assistance, and a continuing personal interest in their activities. And in recent years, as Editor of the David Dunlap Doings and of Cassiopeia, he has edified and delighted his readers with those excellent accounts, written with a sparkling wit, of his many and varied experiences as an astronomer.

The members of the Saskatoon Centre of the Royal Astronomical Society of Canada extend to his wife Margaret, and to his three daughters, their sincere expression of sympathy.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

SASKATOON CENTRE

As your new President, I would like to thank Halyna , our Past President, on behalf of all the members for her leadership for the last two years. At the same time I would like to congratulate all those elected to the executive council for the coming year.

This years activities are progressing well. The Observer's Group meets every Saturday night all year round at Gordon Patterson's, and begins about 8:00 PM. We hope to see one or more such groups started covering areas such as variable stars or occultations as exclusive objectives. The two major outings of the past summer were very well received, even though both attempts at Diefenbaker Park were clouded out. The outing at Auckland's farm more than made up for it. It was so clear one would think you would be able to read by the starlight from the Milky Way.

I am sure that the new editor of the Newsletter would appreciate some articles for future publication. I hope to see you all at the next General Meeting on November 16.

Jim Young

PRESIDENT

Book Review

by Dr. B.W. Currie

The Evolution of Radio Astronomy by J.S. Hey; Neale Watson Academic Publications, Inc., New York

This book, published in 1973 as one of a series of semi-popular science history publications, has been on my shelves for three years, - only recently read by me. It is now in the Library of the Saskatoon Centre of RASC. I recommend it to the members of the Centre as a book well worth reading about the astonishing advances in astronomy achieved by radio.

The beginning of radio astronomy came about more or less by accident. Radio performance depends not only on the sensitivity of the equipment, but also on conditions in the atmosphere governing the propagation of radio waves. Radio noise due to lightning flashes is a well-known example of radio static or noise. In 1932 Jansky, a Bell Telephone researcher, undertook the study of the direction of arrival of radio noise at 15-metre wave-lengths. He discovered a "hiss" in his receiver arriving in a direction from outside the Earth, the direction traversing the sky according to siderial time. Analyses of the data showed that it was coming from the centre of the Milky Way.

Grote Reber, a young graduate engineer, decided to pursue research on this source of radio waves as a hobby at his own expense, recognizing that Jansky had made a very important discovery. He built the first radio telescope, -

crude it is true. He discovered that the most intense noise was at about 1.87 meters wave-length and predominantly along the Milky Way, and attributed it in 1940 to interstellar electrons. At last the problem attracted the attention of astronomers. They turned their attention to the search for sources of radio waves out in space, like the sun, planets, stars and nebulae. Hey, the author of the book, was the first to report on radio waves from the Sun, observing them on February 28, 1942, when an active sunspot region was on the central meridian of the sun. By the end of World War II he had established that meteors scattered radio waves, and that radars would be used to study meteors penetrating the Earth's atmosphere. By 1945 a prediction was made that interstellar hydrogen should emit 21 cms waves, and this established a valuable method of studying the structure of the Galaxy.

Radar reflections from the Moon were observed in 1946, the time delay of the return of a radar pulse of about 2 1/2 seconds proving that it was from the Moon. A high-light of the official opening of the Prince Albert Radar Facility in 1961 by Mr. Diefenbaker (then Prime Minister of Canada) was a radio message by President Eisenhower reflected by the Moon and picked up by the 85-foot diameter "dish" on the Prince Albert radar.

The developments in radio astronomy following World War II became rapid. The first great radio telescope was constructed at Jodrell Bank in England, - a 250-foot diameter "dish" that could be rotated. This was one that received world-

wide publicity for its ability to track by radar the Russian Sputniks. Many other notable telescopes have been constructed during the intervening years, and some of these are described by Hey. The two major Canadian telescopes, one in Algonquin Park and the other at Penticton, are mentioned.

The resolving power of radar telescopes (the capability of distinguishing two objects subtending a small angle at the telescope) like that of optical telescopes depends on the ratio of the diameter of the dish to that of the received wave-length. In parallel with the development of telescopes with large diameter dishes, radio-type interferometers were being developed, first at Cambridge, England, and Australia. The simplest consists of two radio telescopes at the ends of a long-base line, the longer the base-line the larger the resolving power. The more complex uses a number of equally-spaced telescopes in a line or in the form of a cross. With these it became possible to identify discrete radio sources on the sun, radio stars, radio galaxies, pulsars and quasars. All the significant advances are described by Hey, and brought into proper historical perspective.

Hey's concluding chapter is well worth reading by itself. It is on the scope of radio methods in astronomy, summarizing the notable advances in our knowledge of the Universe within a brief period of about 40 years by applying radio technology as a complement to optical methods. The book is illustrated by excellent pictures of the pioneers in the field, and some of the more notable radio telescopes.

SOME ASTRONOMICAL TEACHINGS FROM ARISTOTLE

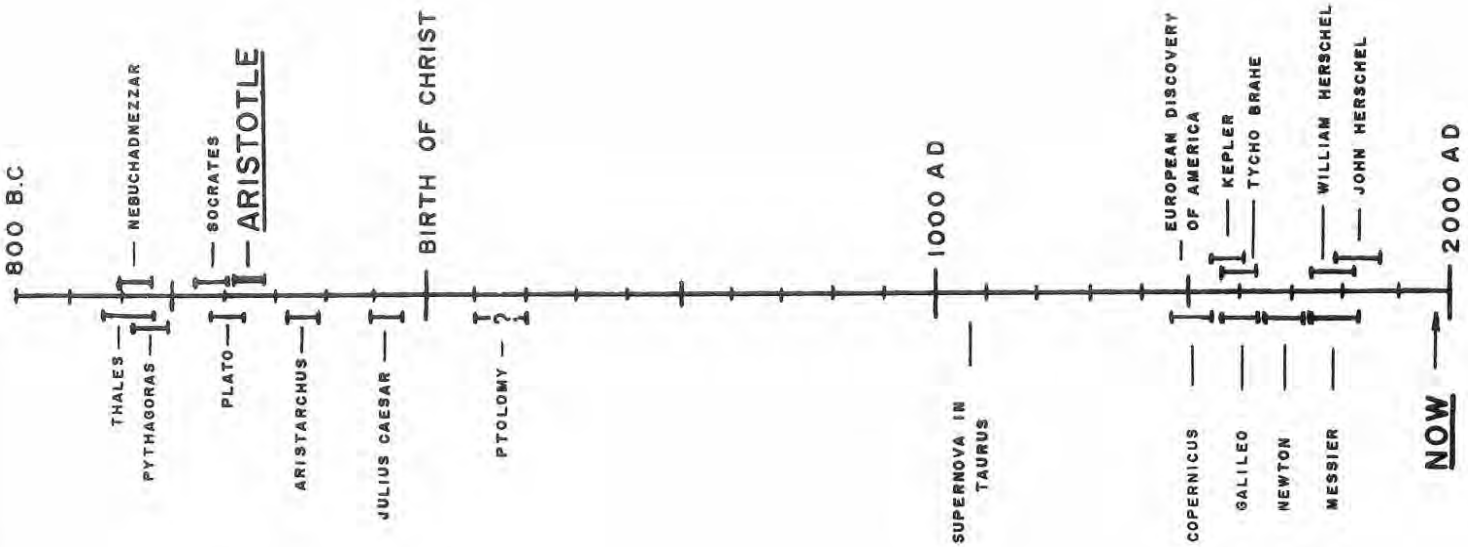
The first of a two-part serial by Halyna Turley

EDITOR'S COMMENT

The following pages are a reprint of an essay which Mrs. Turley presented to her philosophy class dated February, 1975. While perhaps not in the true spirit of amateur astronomy, it does make for interesting and informative reading.

Aristotle lived a long time ago. The table below was prepared to help visualize his place in time as related to other well-known persons and events down through the annals of history.

Unlike the instructors of today delivering in lecture theatres, Aristotle lectured mostly while strolling about in the Lyceum, a park-like grove near Athens.



CHRONOLOGY

now read on....

SOCRATES: Shall we make astronomy the next study? What do you say?

GLAUCON: Certainly. A working knowledge of the seasons, months and years is beneficial to everyone, to commanders as well as to farmers and sailors.

SOCRATES: You make me smile, Glaucon. You are so afraid that the public will accuse you of recommending unprofitable studies.

PLATO
Republic VII[1]

"Wonder," said Aristotle, in the first chapter of his book on metaphysics, "the origin of all life is wonder." It was a word the Greeks loved to use, and it had the same twofold meaning for them as it has for us--admiration and awe, coupled with curiosity.[2] And it was through wonder that man began to marvel at the place in which he found himself, and began to construct theories about the form of the universe and its origins. Aristotle was no exception.

Aristotle's programme on astronomy resulted in his treatises The Meteorlogica and De Caela. His general principles may have been superseded, yet any of his most criticized results are sound enough if looked at in the context in which he presented them. And with this, we shall join Aristotle as he paces the groves of the Lyceum and begins his discussion in astronomy:

Aristotle: Let us begin by reviewing the history of Astronomy to date and investigate the major principles upon which we will build our theories.

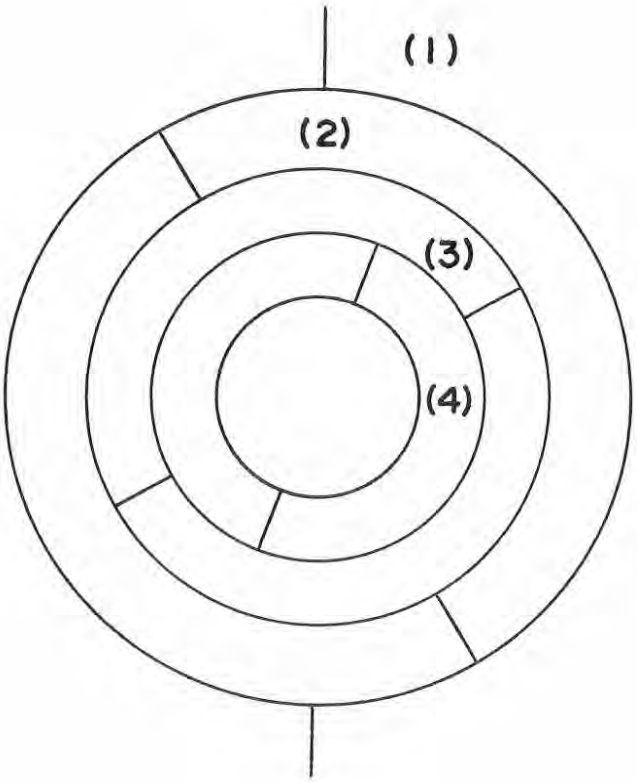
Babylonian astronomy was essentially piecemeal, and devoid of general theory. The early Ionians and Pythagoreans had been ready enough to speculate in a general way but they never succeeded in giving their ideas any substantial foundation in fact. Eudoxus' geometrical spheres at last seems to offer a really solid basis for a theory about the mechanism of the Heavens, a theory we will build upon.

Eudoxus of Cnidos invented a remarkable geometric hypothesis

for explaining the irregular movements of the planets. His problem was to find the necessary number of circular motions by which their combinations would produce the motions of the planets as actually observed and in particular, the variations in their apparent speeds, the retrograde motions and their movements in latitude. It is most important to note that the motions involved are circular. Circular motion must be primary. For the perfect is naturally prior to the imperfect, and the circle is a perfect thing. This cannot be said of any straight line--not of an infinite line, for if perfect it would have a limit and an end; nor of any finite line, for there is something beyond it, since any finite line can be extended.[3]

And so, with this in mind Eudoxus endeavored to combine the motions of several concentric spheres one inside the other, and revolving each about a different axis. Each sphere was then revolving on its own account but also was carried round by the revolution of the next sphere encircling it. Eudoxus supposed that the motion of the sun or moon involved in either case three spheres, and that the motion of each of the planets involves four spheres, giving a total of twenty-six in all.

Let us recapitulate briefly the theory as applied to the planets by referring to this figure:[4]



Sphere (1), the outermost sphere, rotates from east to west on its axis every twenty-four hours to account for the daily rising and setting of the planet. The poles of sphere (1) lie on a north-south axis. The rotation of sphere (2) accounts for the encirclement of the planet from west to east through the Zodiacal band; its axis is accordingly inclined to that of sphere (1) in about the same angle as the zodiacal band is inclined to the celestial equator (i.e. the equator of the first sphere.) The third and fourth spheres rotate in equal times but in opposite directions. Together they account for the looping movement of the planet (i.e. for retrograde motion) and for some movement in latitude. The poles of the third sphere lie in the zodiacal (ie. in the equator of sphere two). The axis of the fourth sphere is inclined at an angle to the axis of the third sphere

that varies for each planet, just as the speeds of spheres (3) and (4) vary for each planet.

Eudoxus' system of concentric spheres was improved upon by Callicles who added two more spheres for the earth and the moon and one more in the case of each of the three major planets, Mercury, Venus, and Mars. The two additional spheres in the case of the Sun were introduced in order to account for the unequal motion of the Sun in longitude and the same purpose for the moon.

You know have the historical background and the information we will use to build our theories. I shall continue tomorrow . . . .

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(There is a buzz of activity as Aristotle is late for lecture. His mind is busy with so many things . . .)

Student: Aristotle, before we begin today, there is something that several of us have been discussing, and we would like you to resolve it. Since beginning these lectures in astronomy, we have heard talk of a school of people convinced that the earth is moving.

Aristotle: (I must interrupt for) it is plain and obvious that the earth does not move or we should feel it. (We Platonists used to say that the earth moved but I think we were wrong.) Something must stand still, and certainly the heavens don't. Why, when a stone is thrown upwards, it falls back to its point of projection and not off to the side as

it would on a moving earth. The stone falls at precise right angles to the earth, and not obliquely or along parallel paths. This is only intelligible if the earth is a sphere and all the bodies fall towards its centre. This idea that the earth is moving is perfectly ridiculous!

Since you have started me on this topic of the earth, let us continue by describing its shape: a sphere and the the evidence of this from astronomical observation.

The shape of the earth's shadow is observed on the moon's face during an eclipse. The edge of the earth's shadow falling upon the moon is always circular so that the body which casts the shadow, i.e. the earth, must also be circular. For how else could eclipses of the moon display segments shaped as we see them? Furthermore, the moon itself displays every month shapes of several different kinds--straight-edged, convex, concave--but in an eclipse the boundry between the light and dark area is always curved.[5] Since the eclipse results in the interposition of the earth, the shape of this line will correspond the the shape of the earth surface, which is therefore round.

Again, our observations of the stars will make this clear, not only that the earth is spherical, but if I may go one step further, that it is a sphere of quite moderate size. For if you travel quite a small way to the north or south, the effect of the horizon is easily detected. The stars directly overhead change and different stars are visible.

Some stars can be seen in Egypt and around Cyprus which are not visible further north and others which in the north never go out of sight, rise and set in Egypt. All of this goes to show not only that the earth is spherical but also that it is of no great size, otherwise so slight a change of position would not have such an obvious effect. For this reason, one should not be too ready to dismiss as incredible the idea that the region beyond the Pillars of Hercules to the west are continuous with those beyond India to the east and in this way the oceans join up. People quote as further evidence in favor of this view the fact that elephants occur in both these extreme regions--a similarity suggesting continuity. Furthermore, mathematicians who have calculated the size of the earth from these observations have arrived at the figure of 400,000 stades.[6] Evidently, the matter of the earth not only forms a sphere but also one not all that large as compared with the stars.

Student: All this is fine and well, Aristotle, but as it is we spend all our time on the earth and now you spend all your time telling us about this place. Can you not continue onto those spheres of interest above us?

Aristotel: Perhaps you are right, but before we continue upward I must insist that we understand the notion of the "natural order" of things. Here on the earth I believe that the four elements have the natural tendency to place themselves in the order: earth, water, air and fire, with

increasing distance from the earth. After all, it is a matter of everyday experience that earth and water fall downwards while warm air and fire rise upwards. Heavy things like the earth and its parts "naturally" move towards the centre of the universe, while light things move in the opposite direction.

Student: But Aristotle, how does this fit into the scheme of things?

Aristotle: Ah, the impatience of youth! Everything on the earth is composed of combinations of the four elements on which operate the principles hot, cold, dry and moist. It appears that earth and water have natural tendencies to go down towards the centre of the world. Hence they make up our motionless globe. Air and fire, then, possess the principle of levity and naturally rise, when nothing impedes their movement. They can of course be moved in either direction as when a heavy object is hurled into the air. Such a movement is not natural, but enforced: it requires a propelling agent, unlike the natural movement of a flame rising or of a heavy object falling. But the circular motion of the heavenly bodies, being eternal, cannot be enforced. It must then be natural. And these bodies move in a circle so they cannot be of the terrestrial elements or a compound of them. Our elements' movements are upwards or downwards, and if they are moved in a circle, as when a stone is whirled around in a sling, this motion is at least,

in part, enforced. And so we come naturally to the final conclusion. There must be something, a fifth element, which moves objects naturally and continuously in a circle. We shall refer to it by the name "aether" and it will enable us to account for the eternal, unvarying, circular movements of the heavenly bodies.[7]

Student: You have presented the case for the existence of this aether quite well, but can you give us proof?

Aristotle: Consider this situation. If either air or fire, for example, had been the constituent of the vast space between the earth and the outermost stars, the earth itself would long ago be destroyed. The four terrestrial elements are either dry or wet, hot or cold. For these to continue to exist, there must be an approximate balance between them. The immense space of the heavenly region must then be filled but some other element which is not characterized by these opposite qualities, for otherwise the four elements would be destroyed.[8] And so the sun itself is composed of aether.

Student: But how can this be? Are you denying the fact that the sun emits light and heat?

Aristotle: The light and heat of the sun are produced by the friction of its movements. The sun itself does not become hot, but its movements do cause a portion of the air in the region below it to become ignited.

Now we are entering an entirely different realm of discussion. Next, we shall begin again from where Eudoxus

left off.

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Student: We do not mean to delay your teachings, but several of us are still curious about this aether. Could you tell us more?

Aristotle: I am sure the notion of aether is clear to you but that you are still curious as to its nature. In discussing aether previously, we recognized that revolution is both uniform and eternal as well as natural, for the circle of its travels has no beginning and no end, and aether is constantly not moving to or from a natural goal. For the same reason aether is neither heavy nor light. Since there is no motion in contrary opposition to circular motion there is no body contrary to aether and hence aether is ungenerated and indestructible.

The sphere of the fixed stars is also indestructible, impassive and susceptible neither to growth nor alteration. This can be seen by studying the star patterns and constellations year after year: they are eternal and unchanging. Their motion is only that of rotation from east to west since this is the most honorable direction. Since the sphere carries the stars with it, they themselves have no independent motion and must be spherical in form. They appear as points of light due to their great distance. In fact, it is the great distance that causes them to twinkle: our vision wavers as we look at them. Planets do not.

TO BE CONTINUED NEXT MONTH

OBSERVERS CORNER

NOVA VULPECULA 1976

I.A.U. Circular No. 2997; quote "S.W. Milbourn, British Astronomical Association, reports that G.E.D. Alcock, Peterborough, has discovered a nova.....": the discovery being dated October 21.764 UT. The magnitude given at this time at 6.5, and a spectrogram obtained at Lick Observatory indicated that the nova was near maximum. My latest Circular, dated Oct. 29, gave the magnitude at 7.3 however there are now marked short-term fluctuations.

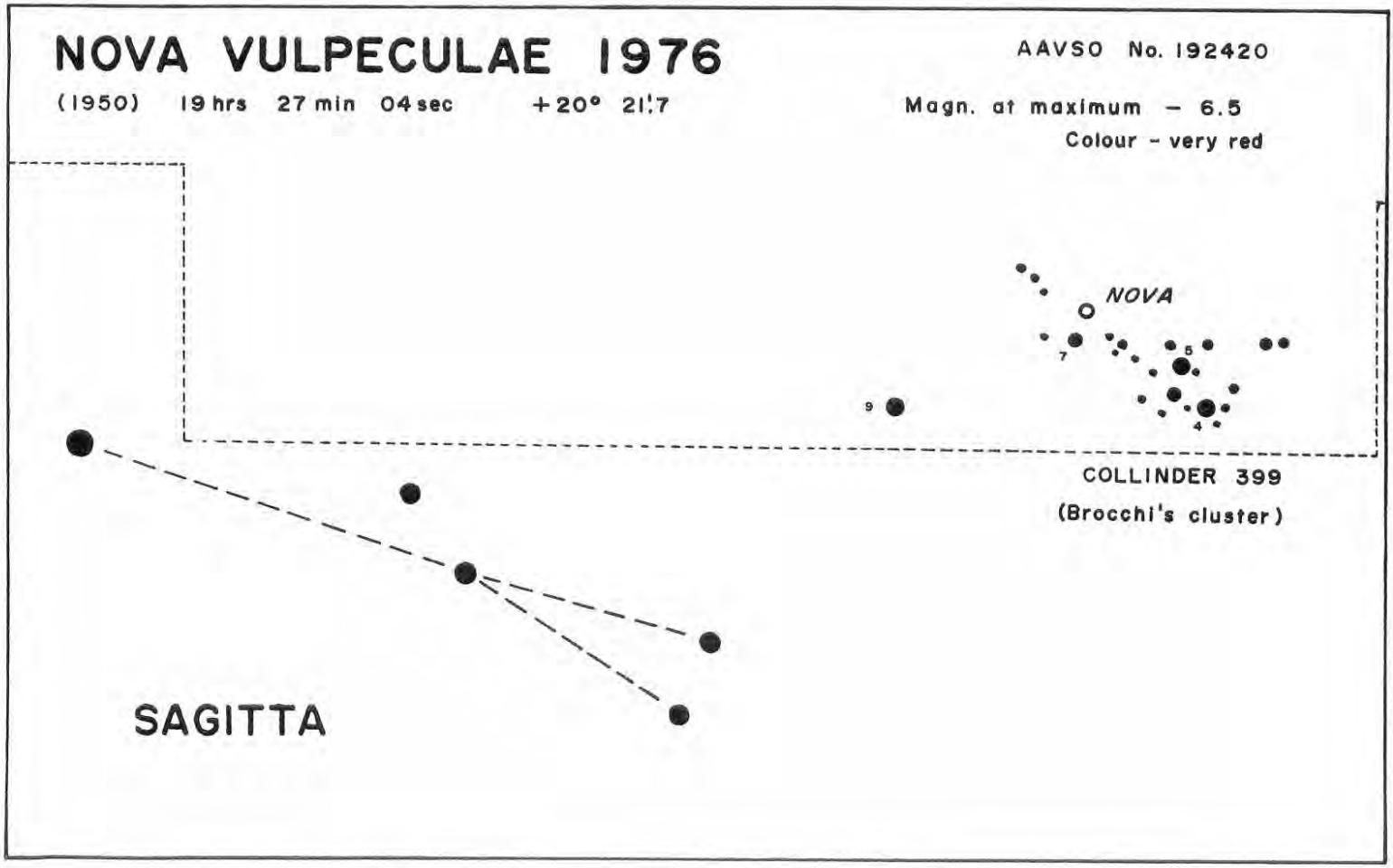
I have not seen this nova yet myself; my chief excuses being -

(a) a bad cold,

(b) cloudy skies,

(c) production of this newsletter.

I have a copy of the AAVSO magnitude sequence chart (to mag. 9), but cannot reproduce it due to instructions to the contrary typed across the bottom; however anyone wishing to see it should attend the Saturday night observer's meeting at Gordon Patterson's. See you there.



MINUTES OF AN EXECUTIVE MEETING, SASKATOON CENTRE, RASC,

HELD IN THE OBSERVATORY, U of S, 7:15 PM, TUESDAY 19 OCT. 1976

Present:

Halyna Turley..... President	Mrs Lillia Wilcox.. Secretary
Mr Jim Young..... Vice President	Mr Merlyn Melby.... Activities
Mr G.N. Patterson..... Centre Rep.	Mr Greg Towstego... Editor

Absent:

Mr Allan Blackwell.... Treasurer	Mr Hugh Hunter..... Librarian
Mr Doug Beck..... Councillor	

ITEM	DETAIL	ACTION
137	Meeting called to order 7:15 PM.	H. Turley
138	Minutes of National Council letter discussed.	G. Patterson
139	"Sky and Telescope" is requesting Centre Newsletters.	H. Turley
140	Membership fees taken by secretary at General Meeting due to treasurers absence.	L. Wilcox
141	Slate of candidates will be presented at meeting as published in Newsletter.	G. Patterson
142	Membership requirements were discussed. (esp. minimum age)	G Patterson
143	Money is needed for cards to re-index library books.	G. Towstego
144	Meeting is adjourned at 7:45 PM.	J. Young

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MINUTES OF A GENERAL MEETING, SASKATOON CENTRE, RASC,

HELD IN ROOM B-110, HEALTH SCIENCES BUILDING, U of S, 8:00 PM, 19 OCT. 1976.

Present:

Halyna Turley..... President	Mrs Lillia Wilcox.. Secretary
Mr Jim Young..... Vice President	Mr Merlyn Melby.... Activities
Mr G.N. Patterson..... Centre Rep.	Mr Hugh Hunter..... Librarian

Absent:

Mr Alan Blackwell..... Treasurer	Mr Doug Beck..... Councillor

ITEM	DETAIL	ACTION
145	Meeting called to order 8:00 PM.	H. Turley
146	September minutes were adopted as published. Carried -	M. Wesolowski R. McAllister
147	Gordon Patterson was thanked for a fine interview on a local television station this morning.	H. Turley
148	The members of the Saskatoon Centre extended a one-minute silence in commemoration of Dr. Jack Heard, who passed away on October 5, 1976.	Dr. B. W. Currie
149	Slate of executive members presented and voted on. Carried -	R. McAllister
150	Our Centre's new President, Jim Young, was introduced.	H. Turley
151	It was mentioned that the membership fees cover - monthly Newsletter - Observers Handbook - Journal of the R.A.S.C. (National Office)	J. Young
152	Observers Handbooks have been ordered.	G. Patterson

MINUTES OF A GENERAL MEETING - continued

ITEM	DETAIL	ACTION
153	General meetings held every third Tuesday, Monthly. The Observing Group meets at Gordon Pattersons, 79 Baldwin Crescent, Saskatoon, every Saturday night, 8:00 PM.	J. Young G. Patterson
154	Halyna Turley, our immediate Past President was presented with a suitably engraved gavel.	J. Young
155	Anyone having neglected to return books borrowed from the Observatory library "please" do so as soon as possible.	G. Towestego
156	Slides were shown which were used during Gordon Patterson's T.V. interview.	G. Patterson
157	The Saskatoon Centre is available to give lectures at all times.	G. Patterson
158	Meeting adjourned to Observatory at 9:00 PM.	R. McAllister H. Turley

Minutes prepared by Lillia Wilcox; Secretary

THE ROYAL ASTRONOMICAL SOCIETY 1968
SASKATOON CENTRE

MEETING NOTICE

Place ROOM B-110, HEALTH SCIENCES BLDG.

Date NOVEMBER 16, 1976 - Tuesday.

Time 8:00 PM, C.S.T.

Purpose NOVEMBER GENERAL MEETING.