NOVA NOTES

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"AMATEUR". The French coined the term to denote a connoisseur of the polite arts, someone who selflessly pursued a private and intellectually enlightening hobby.

1977 Halifax Centre Executive

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UP COMING MEETINGS

Friday May 20, 8:00 pm at the Nova Scotia Museum

Star Gazing: A view of our cosmic neighbourhood.
R. Bishop & L. Bogan
A lecture and slide presentation designed to introduce the audience to the night sky. Obvious features of the sky, such as its darkness, the stars, and the constellations will be described. A larger perspective will then be presented to better enable the audience to appreciate the stellar "trees" in the galactic "forest". The presentation will close with a few tips on observing.

Following this talk, which is co-ordinated with our participation in the Society's Show, there will be an observing party on the Museum grounds (weather permitting). Please bring your telescope along--there are many people who would love a glimpse through it!

Observing Meeting: Saturday May 28 at the B-G Obs
The time will be changed to 9:30 for this meeting.

First, we're pleased with the large number of questionnaires returned, and the thoughtful answers to many of the questions. In a sense, this questionnaire had another purpose: to tell us how interested in the RASC you really are! At least half of the questionnaires returned contained very thoughtful responses and good suggestions for a better, more active Centre. We are pleased, and we thank you.

Second, I wish to give you some feeling for the overall results. To avoid long columns of mind-dulling statistics, I'll just give a short summary. Keep in mind that the numbers below came from 27 questionnaires returned.

I. Meetings
1. Lecture topics: 19 out of 27 preferred a mixture of practical, observational, historical and current astronomy.
2. 15 people favored continuation of meetings through the summer.
3. 15 favored a Centre dinner.
4. No one found the meeting times unsatisfactory.
5. 12 people felt the RASC should be advertised more.
6. 6 people wanted more time for discussion.

II. Publications
1. People used the following:

	Handbook	Journal	Nova Notes
little	7	14	6
some	9	4	14
much	11	6	7

2. 11 people already subscribe to Sky & Telescope.
3. 2 people were opposed to including an extra $7.00 in our regular membership fee for a club subscription to Sky & Telescope.

III. Observing Activities
1. 20 people favored summer observing sessions.
2. 16 people favored a picnic/observing session.
3. 11 people favored a camping/observing session.
4. Only 9 people indicated they had ever built a telescope. (7 more people want to build one now)

65 5. 9 people are interested in a mirror grinding workshop.

So there you have it. You may be sure that your comments have been noted, and we have already discussed implementing some of these ideas. For example, we plan several summer observing sessions and a picnic/observing session. Further ideas are always welcome; just write them down and let us have them.

David L. DuPuy

NEW SUBSCRIPTIONS FOR OUR CENTRE

The Executive has ordered several periodicals that we feel will be of interest to you. These are:

MERCURY; published by the Astronomical Soc. of the Pacific;appearing bi-monthly and containing articles on a non-technical level; in the past couple of years, numerous articles have appeared on our Galaxy, black holes cosmology and others--always illustrated with beautiful photographs and drawings. There is also a series entitled "Observing Astronomers"! The first issue of our subscription has arrived.

TELESCOPE MAKING TECHNIQUES; a new periodical appearing quarterly. We'll tell you more about this when Vol 1 No 1 arrives!

ASTRONOMICAL CALENDAR 1977; this is the third annual issue of Guy Ottewell's detailed and superbly executed calander of astronomical events. The format is large, with many sketches, tables, diagrams, glossaries--it's incredible. A two-page spread details happenings for each month, including an easily-useable star chart, planetary positions, asteroids, periodic comets, etc. ad infinitum. In addition, there are sections for beginners (unnecessary for RASCers), sections covering time, constellations, magnitudes, Sun, tides, Jupiter's satellites, comets, meteors and others. Even if you are quite familiar with the Handbook, you'll probably find new material in Ottewell's Calander.

Our policy for most library material is simple: check out one to 3 books from one meeting until the next. The Ottewell Calander is an exception: a sign-up sheet will be provided, and the Calander may be checked out for 2 weeks only and then mailed to the next person on the list.

This thing will be in demand! We hope you will enjoy the new library holdings.

David L. DuPuy.

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HALIFAX Centre Library Holdings

Astronomy--A brief text	Skilling & Richardson
Atlas Coeli	Becvar
--Catalogue	Becvar
Boy's Book of Astronomy	Moore
2nd Conference on Planetology & Space Mission Planning	
3rd " " " " " "	
4th " " " " " "	
Larousse Encyclopedia of Astronomy	
Lunar Atlas	Alter
Making Your Own Telescope	Thompson
Penguin Dictionary of Astronomy	
Photographic Star Atlas (Xerox copy)	Varenberg
Satellite of the Sun	Spilhaus
Skyshooting--Photography for Amateur Astronomers	Mayall & Mayall
Science Projects Handbook	
Stars	Zim & Baker
This is Astronomy	Motz
This Universe of Space	Millman

New:

A Guide to Earth Satellites	Fishlock

Missing:

Amateur Telescope Making (Book 1)	Ingalls
The McLaughlin Planetarium	King

Journals:

Journal of RASC (starting in 1908, incomplete)
Sky & Telescope (starting in early '60's, incomplete)
Journal for the History of Astronomy (1972, 1973)

Anyone having any other books out from the Centre's library are requested to return same when finished with them. We are always appreciative of receiving new books (or used ones for that matter) for the library. Our rapidly expanding student membership will particularly appreciate your donations!

MINUTES OF THE MARCH MEETING

The meeting convened at 8:00 pm, March 18 in the Nova Scotia Museum. Prior to the introduction of the speaker for the evening, the President, Dr. DuPuy made a number of announcements. First amoung these was an invitation for people to attend this year's General Assembly in Toronto. Some travel assistance is available, both from the National Office and from the Centre; interested members should contact one of the executive. Again this year the Centre will participate in the annual Societies Show sponsored by the Nova Scotia Museum. As usual, we'll welcome all offers of assistance.

The speaker for the evening was Dr. Charles Miller of the Mechanical Engineering Department, Nova Scotia Technical College. Dr. Miller, introduced by Mike Edwards, spoke on the general problem of Propulsion in Space. He began by giving a brief summary of the mathematical-physical formulation of thrust problems and continued by reviewing some of the basic properties of chemical, plasma and, to a lesser extent, ion rockets. Dr. Miller described in some detail the plasma jet he had worked on while at the University of Toronto.

After a discussion period which evolved into a coffee break, those of us who could stay longer were treated to a showing of the very excellent BBC film, The Crab Nebula. Due to the length of this film, the meeting adjourned rather later than usual, about 10:45 pm.

P.H. Reynolds
Secretary

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GENERAL ASSEMBLY 1977

TORONTO

Thursday June 30 to Sunday July 3

EARTH SCIENCE FOR MARTIANS

Reprinted from Valley Skies, Martian Astronomical Society
Translated from the original Martian by Norm Sperling

For a few months before and after its closest approach each Mars-year, the double planet Earth-Moon may be watched in the Martian sky as it spins on its centre of gravity and speeds around the Sun. Watching this pair shuttle back and forth, changing its position in a full cycle every 27 Mars-days, is the first observation made by most beginning astronomers. Using simple figures, one can readily prove the laws of motion of celestial bodies, and Earth is 83 times as massive as the Moon. It is a test of eyesight to separate Moon from Earth as it approaches twice each cycle, or to see the little one at all through the glare of the Earth. At magnitude -2, Earth outshines any fixed star and usually dominates its sector of the sky. The Moon slightly dimmer than the stars of the Big Dipper at magnitude +2.5, is nevertheless quite visible at most times. By carefully measuring the Moon's change in brightness through its period, one can prove that its side facing Earth is dimmer than its side facing away. At greatest separation, nearly half a degree, the pair is a handsome sight.

In a small telescope, the 2 bodies have strikingly different appearances. The Moon is dark, patchy, with craters deeper than ours, devoid of atmosphere and polar caps. Also missing are surrounding energy fields. Dust is probably present after eons of surface rocks being bombarded by space particles. But since there is no air to move it about in a healthy manner, it could not sustain life as it does here. Also militating against life are the temperature--up to 375^{o}K--and complete absence of CO_2.

The Earth is a different matter entirely, and is quite unique amoung the planets of our Solar System. It is largest and densest of the smaller planets. The telescopic appearance is very dramatic, with thick clouds and multi-

coloured surface beneath, giving a kaleidoscopic change in patterns that viewers never tire of watching. Completely surrounding the several layers of atmosphere are alternating vacant regions and zones of low intensity charged rings arranged symetrically around the magnetic poles. It is actually a junior, rounded version of Jupiter's famous magnetic system. A bow-shock front results from the solar wind colliding with this magnetic envelope. Since very little of the energies so necessary to our life can get through the magnetic and gaseous envelppes, organisms on the surface could be no more than very primitive.

The atmosphere's basic appearance is of white swirling clouds with blue between. The cloud patterns are small and regional, not planet-wide as here on Mars or on Venus. Healthy dust storms are very rare, small and short lived, and greatly insufficient to supporting life as we know it. THe direction of swirl in the clouds reverses at the equator, just as in the Venusian vortex. The patterns are exceedingly complex and no one has yet successfully predicted a sequence of cloud patterns for Earth.

Our instruments reveal the Earth's atmosphere is utterly unlike anything else known. There is virtually no life giving CO_2. Traces are suspected in some measurements, but the amounts are tiny. Instead, poisonous nitrogen dominates the air, with a great deal of oxygen mixed throughout. Surface air is about midway between ours and Venus', and is thus overpoweringly heavy. The death dealing clincher is the abundance of water, present in all 3 forms (ice, liquid and gas). This would certainly drown any Martian not already burnt by the oxygen, poisoned by the nitrogen, suffocated by the lack of CO_2, baked by the heat and crushed by the pressure.

Below the atmosphere, Earth's surface is intermittently visible. Our better telescopes have found 3 types of surface. The first is white, featureless, mostly towards the poles, generally thought to be caps of water ice similar to our caps of dry-ice. Second is a featureless blue area, so smooth that when the angle is just right the Sun can be seen in specular reflection from it, covering perhaps 2/3 of the total non-white surface. Lastly, mottled multicoloured areas of great variety, the only places where we can see details down to the resolutions of our telscopes.

The parts of the mottled areas we can see most regularly are generally brown, though a few are grey. Healthy dust storms occur only in these areas. The zones are also freest from the vast amounts of water and have the most transparent atmosphere over them, so at least a little life-giving solar radiation can get through reliably. Despite their great daily heat, they cool off nicely at night. Should a Martian expedition ever visit Earth, it is sure to find the greatest habitability in these zones and would investigate other regions only at extreme risk.

Most of the mottled areas under more cloudy zones are blue green and tan, with some grey and a little white. Around the equator these regions seldom change appearance and near the poles only gross changes are observed with the seasons. Between these regions, however, there is profound seasonal variety. Generally, grey and tan predominate in cool seasons, blue-green during the hot ones. Colouration patterns change slightly every Earth-year and greatly over decades and centuries. The minor ones are probably atmospheric and water effects. No explaination is available for the longer ones.

This variability, with the over powering wetness, periods of heat, frequent interruption of solar radiation, lack of airborn dust, and other unhealthy features, make these areas certainly the least habitable on Earth.

On rare occasions Earth emits sudden flashes of light. Historic flashes are usually associated with the sources of major dust clouds, and may be small scale versions of Olympus Mons. Dim flashes are sometimes seen at the edges of clouds on the dark side of the terminator, and are presumed to be electric discharges. Recently, instantaneous flashes have been seen from the featureless blue and brown mottled areas, followed by transient clouds. These have only been seen in recent decades and are unexplained.

About 50 Mars years ago, perhaps because our infra-red instruments became more sensitive but probably a real effect, we started to observe tiny, intensifying hot-spots in and around the green-mottled areas. These maintain a virtually constant, very high heat level over a very small surface at all times and are thus thought to

result from crustal thinness that allows heat from inside the Earth to leak upwards. Most hotspots occur beneath parts of the atmosphere that we cannot see through clearly, a very frustrating phenomenon for astronomers.

The most peculiar feature of this odd planet has been reported by our radio astronomers in the last few decades. The same parts of the mottled areas as have hot spots seem to emit as fields, in discretely-channeled wavelengths and intensities varying with the angle of the Sun. In the VHF range, each of the discrete channels seems to carry exactly the same message over a given zone. In other wavelengths the signals are less coherent. The intensity is increasing in strength, number of wavelengths and number of areas emitting. Perhaps this results from some interaction of the solar wind with charged iron from the core that may approach the surface under the hot spots.

Earth thus presents a wide variety of very hostile situ ations. The only vaguely habitable ones are in the cloudless brown-mottled areas. All the rest are so unmartian they would demand outstanding efforts from our best technologists were they to design a space probe. But since the likihood of finding useful areas on Earth is so small it is generally thought that our efforts should be directed closer to home, toward rebuilding the orbiting resorts of the prosperous Fifth Era, that have been so heavily damaged by gas leaks in the last several Eras.

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STAR PARTY--May 20

Please Note: In connection with the Societies' Show and our May meeting, there will be an observing session in the Museum parking lot following the meeting. As this meeting will be pitched towards the public more than usual, we are asking all members to bring their telescopes and to help show the Public some celestial objects and to give them some opportunity to use a telescope first hand. REMEMBER FRIDAY MAY 20 , 8:00 PM.

THE PERSONAL EQUATION IN ASTRONOMY AND THE RISE OF EXPERIMENTAL PSYCHOLOGY

Part 4: Wilhelm Wundt and Psychometry.

Astronomers, with the development of increasingly sophisticated automated measuring devices, had gradually lost interest in the personal equation after the 1870s; the general issues raised by the problem, however, had, by this time, become firmly ensconced among the concerns of physiologists. Among these was the ambitious Wilhelm Wundt, who, in 1857, had begun his career in physiology as a *Dozent* at the University of Heidelberg. During this period competition for the few senior posts available in physiology was intense. In Germany there were only twenty chairs in physiology by 1870, and advancement was particularly difficult since most of the chairs, "having been created at about the same time were filled with men of about the same age who held them for decades" (Ben-David & Collins, 1963, p.114). After unsuccessfully applying in 1871 for the Chair of Physiology at Heidelberg, Wundt apparently decided to change disciplines as a means of furthering his career. The most obvious choice for a new subject area was philosophy. A greater number of senior posts was available in that discipline than in physiology, although, significantly, in the mid-nineteenth century, German philosophy was generally considered to be a discipline of lower status than the field Wundt was leaving. In 1874 he applied for, and was appointed to, the Chair of Philosophy at the University of Zurich, a position often used as a stepping-stone to one of the more prestigious posts. Wundt was not to wait long for his chance; the next year, 1875, he was given the important Chair in the Department of Philosophy at the University of Leipzig.

One of the changes which Wundt made at Leipzig was the establishment of a laboratory, a step which he took in 1879 and which was to result in his name being familiar to successive generations of introductory psychology students. The predominant methods of philosophy are, of course, logical and rational, but Wundt had

been trained in the empirical and experimental methods of the science of physiology. It is interesting that despite his "conversion" to philosophy, Wundt should have continued to be interested in, and involved with, laboratory work. Ben-David and Collins (1963) were intrigued by this anomaly and, in the context of a more general attempt to investigate the social factors which were important in the development of the new field of psychology, have suggested that the comparative availability of senior positions in the fields of physiology and philosophy, combined with the relatively higher status of the former over the latter in Germany during the decades of the 1860s and 1870s, are important factors in understanding the rise of the new discipline. Wundt, having changed from physiology to philosophy, was getting a senior post--but in a field of lower status than the one in which he had been engaged for almost twenty years. Ben-David and Collins suggest that in an effort to raise the status of the field he was entering, Wundt more-or-less consciously decided to bring to bear on the questions and problems of philosophy the methods which had given physiology its greater status. These techniques were empirical and, more particularly, experimental, and experimentation, of course, presupposes measurement.

Even before Wundt changed disciplines formally, he had begun to think about the possibilities of an experimental study of mental processes, and he had written about that possibility as early as 1862 in his *Beiträge zur Theoree der Sinneswahrenehmungen*. Questions about the nature of perception and the processes of thought had, of course, been the concern of mental philosophers for many centuries. What Wundt was now suggesting was that these same problems should be tackled by new methods, specifically by experimentation. In his fusion of the problems of mental philosophy with the methods of the physiologist, Wundt took the final steps in the creation of a new and separate discipline, experimental psychology.

The greater part of the work done at the Leipzig laboratory during the first twenty years of its existence, involved studies of sensation and perception.

Pursuing Gustav Fechner's aim of examining the relationship between physical and mental realities, an area of investigation which had been labelled "psycho-physics" by that investigator, Wundt and his students were particularly interested in the quantitative relationship between the stimulus and the response, that is, in the changes in conscious awareness which accompany changes in the physical world. In addition, however, progress was soon being made on three other types of experimentation, all of which had their roots in the problem of the personal equation, and all of which involved the measurement of time as a variable (Flugel, 1945). These include: examining the variables which influence our ability to compare time intervals; the "complication experiment"; and, thirdly, the study of reaction time. As Misiak and Sexton (1966, p.72) point out, the importance of such studies may be gauged from the fact that Ribot, in his influential 1879 book, *German Psychology of Today,* devoted one chapter, of only seven, to the "duration of psychological states."

Of these three kinds of research carried out at the Leipzig laboratory involving the study of time relationships, the type which was the most straightforward was probably also of the least importance in influencing the development of psychology. Carrying on work of Mach and Fechner and adopting the latter's methods in a fairly straightforward fashion, the researchers in Wundt's laboratory spent considerable time in examining the "time sense," and, more particularly, the ability of individuals to compare intervals of time under different conditions.

> In this field quite a little host of problems revealed themselves as eminently suitable for experimental treatment, e.g., the ability to reproduce intervals of varying lengths, the influence on the estimate of an interval of the stimuli that marked its beginning and its end, the comparison of "filled" and "unfilled" intervals, of intervals "filled" in a variety of ways (by mental work, sensory stimuli, etc.). (Flugel, 1945, p.186).

While interesting in their own right, these studies did not lead to any particular methodological or theoretical advance.

Of greater significance was a kind of study which was based fairly directly on Bessel's early work and on which Wundt first "pinned his hopes" for an experimental psychology (Woodworth, 1938, p.303). Borrowing a term from Johann Herbart, a mental philosopher and educational theorist who had succeeded Kant in the Chair at Königsberg --the same city where Bessel had had his observatory—Wundt began work on the "complication experiment." Herbart had written, during the first decades of the nineteenth century, about complication as a "mental complex including processes from more than one sense modality" (Capretta, 1967, p.67), but it was Wundt who first studied the phenomenon experimentally. Bradley's eye-and-ear method, of course, had involved "complication," as the task required input from both visual and auditory modalities. Wundt's primary concern was with the amount of time required for different complications. In order to study these phenomena, in 1861 he devised a new piece of apparatus, "Wundt's Complication Clock." This mechanism utilized a pendulum which swung across a scale marked off in degrees; at a pre-determined point in its arc, it produced a "click." The problem for the subject was to determine where the pendulum was on the scale at the moment of the click.

Studies which utilized the Wundtian apparatus typically investigated the effects of two variables; the speed at which the pendulum moved, and the number of stimuli which were presented simultaneously-- extra sounds or even electric shocks being added to the sight of the moving pendulum and the sound of the clicks. The general findings were that when the pendulum moved at no more than moderate speeds, and when the accompanying stimulus pattern was simple, the subjects tended to indicate that the click had occurred at a point earlier on the scale than it had. As the speed of movement increased, and with more complex accompanying stimuli, the click was perceived to occur after it actually had.

Kirsch (1976), in a review of these studies, discusses the interpretations of these findings.

> Wundt explained these results on the basis of an adjustment of attention which he hypothesized to be necessary if the comparison between the position of the pointer and the occurrence of the sound was made. When the rate of the pendulum is slower than the rate of the adjustment of attention, then the sound could be anticipated before the actual occurrence. On the other hand, when the adjustment requires more time than is provided between cycles, either because the rate of the pendulum is increased or because the adjustment task is complicated and made more lengthy by additional stimuli, then the adjustment is made too late and the pointer is beyond where it was when the sound actually occurred. (Kirsch, 1976, pp.122-3).

The relevance of these findings and of their interpretation to the problem originally posed to astronomers by the apparent inaccuracy of Bradley's method of determining stellar transits is apparent.

Wundt was also curious about the effect of changing the focus of the observer's attention, and it was in this form that the complication experiment was to survive to become a part of experimental psychology. It was found that if the subject fixed his attention visually on the pendulum's pointer, he would report that the click had occurred later than it, in reality, had; if he were to attend, instead, to the sound of the click, he would report that it had occurred earlier than it, in actuality, had. Wundt's interpretation of these results, again involving the accommodation of attention, was substantially the same as his explanation of the findings related to the speed of the pendulum's movement and the complexity of the presented stimulus pattern.

While complication studies were to remain only a secondary interest for psychologists, they were to form

a "determining influence upon Wundt's psychological system" (Kirsch, 1976, p.123), and through him, on scientific psychology more generally. Kirsch argues that the complication experiments, related to attempt to understand "the personal equation, became the first purely psychological experiment" (1976, p.123). Despite the significance of Fechner as a forerunner of psychology, his psycho-physics had a place only at the periphery of psychology. "Psycho-physics was concerned with the mapping of correspondences between physical and mental events. The central concern of psychology, however, was the investigation of the mental event itself" (Kirsch, 1976, p.123). While the astronomers had begun the study of the personal equation, their main concern was in nullifying its influence. "Wundt, on the other hand, used the complication experiment to measure a purely psychological process: the accommodation of attention" (Kirsch, 1976, p.123).

Among the other offspring of the personal equation, and perhaps the most fruitful of them all, was the study of "psychological time" or, as it came to be called by Exner, "reaction time." From Bessel to Helmoltz, to Donders and Exner, the problem had been passed, although these early investigators "gave but little attention to the psychial factors which might influence the times observed" (Fearing, 1964, pp.211-2). The reaction experiments, unlike the complication studies, were to become an important and continuing topics for consideration by experimental psychologists. The issue in both kinds of study, however, was similar—the measurement of the duration of mental processed, or as it came to be called, psychometry. Eventually surpassing in popularity even the psycho-physical studies, which had, in any case, never been considered to be "purely" psychological, reaction time experiments, utilizing methods developed by Donders, came to comprise "nearly half the researches undertaken in the Leipzig laboratory" (Cattell, 1888, p.45). Flugel (1945, p.186), has suggested that "in the early days it appeared to be the greatest triumph of the new psychology."

Reviewing Donders' work, Wundt concluded that the earlier researcher had been mistaken when he claimed that the c-reaction included no choice or motor selection. Wundt devised another situation, the d-reaction, in which two or

more stimuli are presented, and a single motor response is to be made in each case--but not until the correct stimulus has been presented. This situation was supposed to differ from the simple reaction only by the insertion of discrimination. "Wundt's conception was that in the simple reaction [the observer] signaled as soon as he became aware of a stimulus, while in the d-reaction he signaled when he recognized or identified the stimulus" (Woodworth, 1938, p.304). It seemed to Wundt that this was the same situation as that of the astronomical observer whose task was to signal when he saw the star right on the meridian.

Even the simplest reaction, it seemed, includes three processes, and these, Wundt felt, could not be measured independently. First the observer became conscious of a sensation; this impression enters the *focus* of attention; and, finally, there is a "voluntary release of the signaling movement" (Woodworth, 1938, p.304). Complicating this simplest reaction slightly is the d-reaction. Subtracting the time taken for "a", the simple reaction, from "d" would give the time required for discrimination. Donders' b-method included discrimination and then choice, so subtracting "d" from "b" would give the time taken by choice.

The entire procedure seemed clear and logical, but as Woodworth noted, "everything depended on the d-reaction" (1938, p.304). The first studies, published in 1883 by Friedrich and Trautscholdt, were positive, but very soon other investigators (Tischer, Kraeplin, and Cattell) found that the d-reaction often took no longer than the simple reaction. Cattell found that for his own observation there was either no difference in time between the simple reaction and the d-reaction or that he delayed too much.

> Berger (1886) put his finger on the source of the trouble. The motor response, in the d-reaction, is not dependent on the identification of the stimulus, for the response is the same for all stimuli. In the b-reaction each stimulus calls for a different motor response; and in the c-reaction one stimulus calls for a movement and the others for no movement; in both these forms the reaction will often be false

> unless held back until the stimulus is identified. There is no such check on the d-reaction. (Woodworth, 1938, pp.304-5).

There is no guarantee that discrimination takes place when the motor reaction is made, without some kind of a check. Considering the complexity of the brain, there is no reason whatsoever that the processes of discrimination and of motor response could not be carried out simultaneously. While Wundt was never entirely convinced of the validity of the criticism, the d-reaction was soon largely discarded.

Of more promise was the work at Leipzig of Ludwig Lange, who graduated with a doctorate done under Wundt in 1886 (Tinker, 1932). Apparently staying on in the laboratory, Lange published work in 1888 which ushered in a new, and more specifically psychological era of studies on reaction time. Lange distinguished between two types of reaction, the basis of distinction being the object toward which attention is directed. In the "muscular" or "shortened" reaction, the subject directs his attention towards the response he is supposed to make, for example, moving a finger as rapidly as possible; in the "sensory" reaction, attention is directed towards the stimulus to which one is to respond, e.g., a light, allowing the response to occur more or less automatically. "The muscular type of reaction is of much briefer duration; Lange found it to be in the neighbourhood of 125 sigma, while the sensorial reaction was approximately 225 sigma" (Fearing, 1964, p.212). Wundt assumed that the difference between the two reactions, in favour of the attention to the required response, was due to "the time required for the full perception of the stimulus (the time of apperception...)" (Flugel, 1945, p.187). Using Donders' subtractive method, it seemed for a time as if the mental processes of discrimination, will, and association, were all soon to be measured. As so often happens, however, later work did not quite live up to the expectations generated by the early results. Nevertheless, despite some disagreement, "later investigators have usually found the muscular response quicker than the sensorial, but the difference has ranged from 10 to 50 ms, in relatively untrained [observers], and has not approached the 100 ms which Lange regarded as normal" (Woodworth, 1938, p.308).

Beginning with Donders' pioneer studies of the duration of mental processes, the assumption had been made that as psychological processes change from the very simple to more complex, the new processes are added to the old, and the time required by the additional activities are merely added on top of those required for the simple reaction. The earlier studies from Leipzig had similarly employed this "subtractive" procedure (working this time from the more complex down to the simpler).

The subtractive procedure was called into question, however, due to the large variations found in such measurements. Psychologists were no happier with individual differences than had been the astronomers, and like them, considered the variations as "errors" rather than as true individual differences to be considered as a topic of interest in their own right.

A serious blow came in 1891, when Kulpe, Wundt's rival at Wurzburg, demonstrated that the entire underlying theory of the subtractive procedure was not really justified, "since when the conditions of reaction are complicated, there is no simple addition of one mental process, the other process remaining unchanged. Rather, the whole conscious task is changed throughout its course" (Flugel, 1945, pp.187-8). If there is a change in the task required of the subject, if he is to judge rather than to perceive, for example, there is a change in the observer's attitude and in his entire conscious process. "You do not add apperception to perception, you substitute it for perception" (Boring, 1963, p.149). The grand dream of measurement was soon in tatters, and in Flugel's words, "the disappointment at the breakdown of the purely mental analysis was naturally a somewhat bitter one"(1945, p.188).

Despite the understandable disappointment, by this time the foundations of the new experimental discipline had been so firmly grounded that the collapse of one area of investigation did not seriously threaten either the separate existence of psychology or its continuing development. One of the waves of the future was apparent almost immediately. James Cattell, one of a small army of Americans studying psychology in Germany (the

first American Ph.D. not being awarded until 1879 to G. Stanley Hall who had worked at Harvard under the illustrious William James), had been one of those whose research had cast doubt on the validity of the d-reaction. Cattell was one of the tiny minority of those interested in individual variations of response for their own sake--perhaps as a result of the variability in results obtained around him in the Leipzig laboratory. Rather than the exception, such variability seemed the rule, and, indeed, perhaps even the most significant feature of many of the experiments.

Nevertheless, the German researchers were generally both disinterested in, and unsympathetic to, the study of individual differences. Like the astronomers, German psychologists adopted the position that "differences between subjects or within a single subject on different occasions were errors which reduced the precision with which...events could be observed" (Tuddenham, 1966, p.474). Cattell stood out against this stance, disagreeing in particular with the insistence of its leader, Wundt, that the task of the psychologist, as for other scientists, was the search for general laws, and that individual variability is "error" standing in the way of our grasp of the general and universal principle. Braving Wundt's displeasure, Cattell did a thesis on individual difference, although, interestingly, he used the reaction method in his studies. His concern with individual variability was reinforced by spending the year 1887 at Cambridge which afforded him the opportunity for contact with Sir Francis Galton who was interested in every sort of difference among people, from sex difference to those of age and race. Returning to his native United States, Cattell published in 1890 an important article, "Mental Tests and Measurements", apparently using in it the phrase "mental test" for the first time. While Cattell's specific measurements turned out not to have the hoped for validity as a measure of intelligence, the publication of Cattell's proposals was followed by a great deal of interest in mental testing (Tuddenham, 1966, p.477). This, of course, became a dominant interest of psychologists, and has only begun to subside within the past decade or so.

In addition to the role of the reaction time experiments in leading to the measurement of intelligence and other types of abilities, these studies also resulted in a good deal of information being discovered about the processes involved in reaction time itself. The research also led to the discovery of such processes as set, predisposition, and attention, and to the recognition of the practical significance of reaction time for astronomy and for other areas. But these findings, no matter how important, were not necessarily the most significant results to stem from the decades of work initiated by Bessel in his attempt to understand the personal equation.

> Historically speaking, the most significant effect of the discovery and experimentation with reaction time was on psychological theory. It was demonstrated that, contrary to existing beliefs, mental events were not instantaneous but temporal and measurable. The idea of an experimental psychology concerned with such processes as reaction time was thus reinforced. Reaction time remains a significant area of psychological investigation, which today is still being explored in new situations and new applications. (Misiak & Sexton, 1966, p.73).

Improbable as it may seem, the firing in 1795 of an assistant by the Astronomer Royal at the Greenwich Observatory had as an eventual outcome the founding of a new discipline. In an attempt to explain the reasons why Maskalyne and Kinnebrook had differed in their timings of stellar transits, and more generally to account for individual differences in perception, astronomers and then physiologists and finally psychologists had successively tackled the problem, each advancing different explanatory theories. None of this was to help the unfortunate Kinnebrook, who was apparently never heard of again, and a totally satisfactory answer to the original questions has yet to appear. But the tens of thousands of psychologists now involved in research and application all owe a debt to astronomy for the very existence of their discipline.

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FROM THE CENTRES

Ed. Note: Although this doesn't strictly fall under the heading From the Centres, I think you may be interested to hear about the experiment in planetarium presentation being carried out in Alberta. This is taken from NORTH STAR, the publication of the Planetarium Association of Canada and the author is John Hughes. If I am not mistaken, John was at Dal several years ago.

ALBERTA MOBILE PLANETARIUM

Canada's first mobile planetarium was opened officially on May 27, 1976 in St. Paul, Albt.

The heart of the mobile is a Spitz Nova III projector. It projects (by brute force) about 950 stars down to the 5th magnitude, and has optical projectors for the Sun, Moon and 5 planets. Diurnal, annual and latitude motions are motorized and reversible. Precession is accomplished by manually turning the small ball. Brute force projectors for meridian, equator and ecliptic are individually controlled. A geo-centric earth projector is also included and it participates in latitude motion. Sunrise and sunset projections are done with small plastic domes lit from within. Glass dye was air-brushed on by an artist at the provincial museum, and the effect is very realistic. A cassette tape deck provides background music and a single carousel projector supplements the star ball. All shows are done live which places obvious limitations on the complexity of shows, but it certainly can be worked with.

The 14' 8" fiberglass dome was also supplied by Spitz. It is in 8 sections which bolt together quickly. A perforated zenith plate allows air circulation. For additional light proofing, the dome was painted on the outside.

Since the unit is meant to be set up in existing buildings (the original idea was to have a truck in which the whole thing could be transported and set up, but that was later shelved), the supporting walls had to be strong, yet lightweight, easy to move and set up. The Provincial Museum

display departmentdesigned and built a component-type wooden wall, consisting of three stacking, curved wall pieces. The wall sections are held in place by 8 upright I-beams which also support the dome. The distribution of these sections allow two doors to be created to suit the room or to direct traffic flow.

Seating is 'on-the-floor', with the audience (20 adults or 25 small children) leaning back on the carpeted, fiberglass wedge backrest. It is dropped into place after the base ring and first layer of wall pieces have been installed. Then the upper layers of wall are added and topped by an upper retaining ring and the dome itself. Although it sounds complicated, in practice it is quite easy after it's done a few times. It took 2 people 3 hours to load the disassembled unit into a truck and once there was set up in less than 15 man-hours labour. The slowest part is buildingthe dome as the 8 sections require 176 bolts. The hardest part is lifting the dome onto the walls which takes at least 10 people. The assembled dome weighs 250 lbs. The Museum is presently working on the design of a hydrolic 'tele-post'. around which the dome would be assembled,then lifted by the tele-post.

Over the summer, a new pedestal, modified for our specific needs, will be built and a second set of I-beams ordered. The pedestal will have a removable storage cabinet as a base. The new I-beams will be shorter allowing the dome to be erected in rooms only 13' high whereas it presently requires 14' 6". The interior of the theater is almost all blue--2-tone carpeting, carpeted blue seats and blue curtains. The outsides of the walls are covered in two shades of blue vinyl. The insides are painted black, but are covered by the curtains. The dome (outside) is painted ....you guessed it, blue. The overall effect is quite pleasing, and the interior colours are light-absorbing enough without being so dark as to be oppressive.

Now that the whole thing is built, you might ask what is going to be done with it? Its prime objective is to move about the rural parts of the province, providing easy access to the people of these areas, most of whom can't afford, or won't take the time to drive to the city to see a planetarium show. School children make up bulk of

our audience, as they do in most planetariums. In a six week test run in Hinton, over 1350 children saw shows designed to compliment the curriculum. This represents almost the entire population of the 2 elementary schools and a bit of the high school. Another 300 people attended evening shows. Omitting repeat visitors, 1300 - 1400 people, most of them first time visitors to any planetarium, saw planetarium shows.

Since the idea of a mobile planetarium is not new, many of you may have suggestions, comments, etc. in regard to this project. We will be glad to answer questions about any aspect of the unit or its operation. Correspondence should be sent to the Director, Mobile Planetarium Project, Provincial Museum of Alberta, 12845 -102 Avenue, Edmonton, Albt., T5N OM6.

John R. Hughes

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OBSERVING MEETINGS

The second observing meeting of the year took place on Sat., Feb 26. For the second time overcast conditions resulted in a small turnout. As is always the case, an alternative program to telescope use was prepared in the case that cloud prevailed. On this evening the film,"The Crab" was "observed" (rather than the cloud). It was decided that this film should be shown at a regular meeting. Therefore those who were at the observing meeting were able to get another look at this fine film.

The third observing meeting, March 26 was little different from the first 2. Overcast conditions again resulted in a small, though increasing, turnout. At this meeting one member brought a Newtonian reflector with which the process of collimation was described and performed. Later a series of the latest Viking slides was viewed. These excellent slides were taken by the Viking 1 &2 craft. This was followed by a 'discussion period' pertaining to our participation in the Societies Show. Some discussion on the Observing Display Competition at the GA in Toronto (Suggestions welcomed!) took place. Also some time was devoted to the possible locations for an observing camping weekend.

Michael P. Edwards
Observing Chairman

TELESCOPE RAMBLINGS

Knowledge versus Perception

It is very difficult to perceive familiar phenomena in a new, clear way. Our view of the world differs less than we may like to admit from that of our ancestors. The terminology has changed: to some extent, UFO replaces the older term ghost, parapsychology replaces witchcraft, and for most people astrology replaces astrology; however, even for the small fraction of mankind that is scientifically literate, the perceived Universe is usually bounded by the ground beneath and the dome of the sky above. Language mirrors man's pre-Copernican outlook: heaven is above and hell below; the Moon rises, and the Sun sets. Even astronomers have difficulty in removing this cloak of comfortable prejudices.

When specifically asked, an astronomer will admit that we live on a planet; but, catch him off guard and he is likely to slip back to the older view in which the planets exist only in the night sky. As in early times, today's astronomer labels these wanderers with proper names: Mars, Jupiter, et cetera; and also he will likely refer to our abode as "the earth", a term which seems appropriate for Aristotle's lowly dirt beneath our feet, but not for a distinct and lovely member of the Solar System. Is the largest planet "the jupiter"? Except in table headings and diagram labels, few writers today refer to the third planet as "Earth". Some authors, perhaps feeling a vague uneasiness, manage to write "the Earth",

but most cannot resist the older, comfortable term.

A similar lapse is often revealed in treatments of our Sun. Once again, if specifically asked, today's astronomer will insist that, of course, that bright disc in the noon sky is a star! He may even go on to talk confidently of spectra and fusion, of Huggins, Hertzsprung, and Eddington. However, catch him with his guard down, as is often the case when he writes a text for mere freshmen, and he will usually lapse again into the comfortable universe he absorbed as a child. An appropriate place to look is in his lists of the nearest and brightest stars.

Here is a table which indicates how well several astronomers have avoided the Earth-centered complex. The information is taken from introductory astronomy texts published since 1971.

AUTHOR(S)	3rd PLANET	NEAREST STAR	BRIGHTEST STAR
Abell	Earth	α Centauri	Sirius
Baker & F.	the earth	Sun	Sirius
Berman	the earth	Sun	Sirius
Clotfelter	the earth	α Centauri	Sirius
Hodge	the earth	α Centauri	Sirius
Hoyle	the Earth	α Centauri	Sirius
Pasachoff	the Earth	Sun	Sirius
Smith & J.	the Earth	α Centauri	Sirius
Wyatt	the earth	Sun	Sun

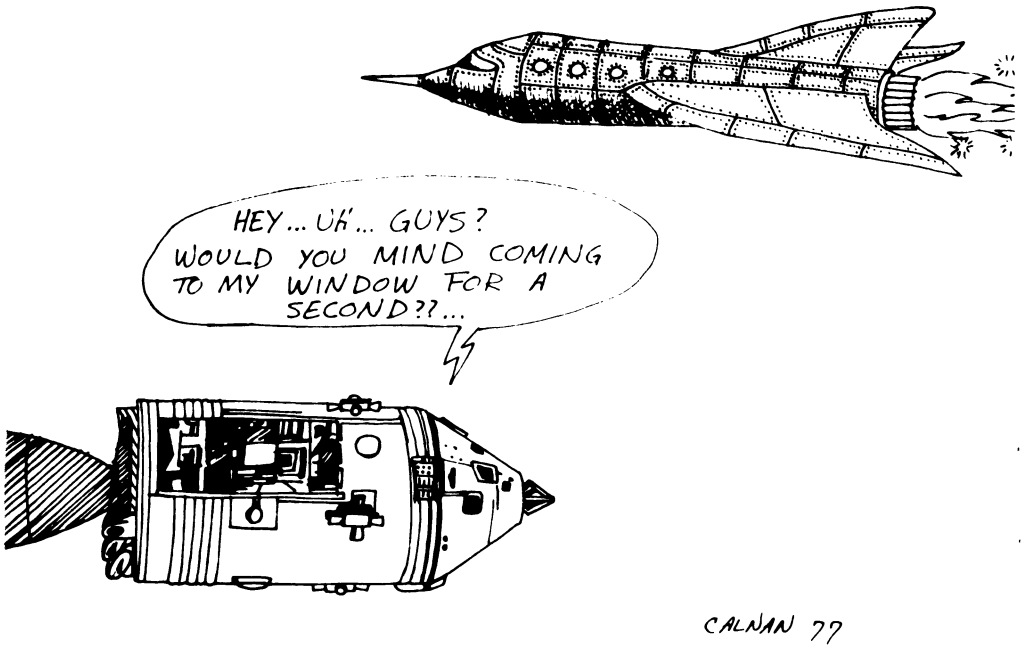
Only Abell uses "Earth", but not consistently; "the earth" is much more frequent in his text.

Six authors ignore our own star in their lists, and to four others our Sun is the nearest star but not the brightest!

More than a century ago Henry David Thoreau, that perceptive naturalist-philosopher, concluded his classic book, WALDEN, with a simple and profound statement, a message that is not yet real for most of us:

"The Sun is but a morning star."

Roy L. Bishop
Maktomkus Observatory



ASTRONOMICAL CALANDER

Diane Brooks

MAY/JUNE

1 May 1951--Ralph Wilson retired from staff of Mt. Wilson and Palomar

2 May 1780--William Herschel discovered that Xi Ursae Majoris is a double star

1925--Death of Johann Palisa, who discovered 120 asteroids.

3 May 1921--Death of William R. Brooks, a noteable comet discoverer (at least 22)

4 May --Maximum concentration of Northern Aquarids, debris from Halley's Comet

5 May 2000--Next noteable conjunction

6 May 1852--Announcement that 11 year sunspot cycle coincides with geomagnetic cycle

1918--First spectrogram obtained with 72" DAO telescope, then the largest in the world

1960--Death of Canadian astrophysicist, Andrew McKellar, known for work on comet spectra at DAO

8 May 1795--Neptune first seen by Lalande who did not recognize it as a planet

9 May 1571--Tycho Brahe's father died and he and his brother, Steen, inherited the joint lordship of Knudstrup

1960--Death of Pieter van Rhijn, outstanding for galactic structure

11 May 1871--Death of Sir John Herschel

1956--Death of Walter Adams, director of Mt. Wilson Observatory from 1923-1945

12 May 1706--First documented "dark day" in North America; beginning of scientific accounts of eclipses and systematic observation of prominences

91 1866--John Birmingham discovered 2nd magnitude nova in Northern Crown

15 May 1618--The true motion of the earth suddenly occured to Kepler after 17 years of work

1836--Francis Baily observed "Baily's Beads" during annular eclipse

16 May 1934--Death of Aristarch Belopalsky, Russian astrophysicist

1969--Venera 5 soft landed on Venus

17 May 603 BC--Thales used solar exlipse to predict total solar eclipse on May 28, 585 BC

1969--Venera 6 soft landed on Venus

18 May 1910--Tail of Halley's Comet reached 105° in length

1969--Earliest crew exchange around moon--Apollo X and LEM 4

19 May 1780--Black Friday--the most outstanding "dark day"

1877--Hermann Klein observed a seemingly new lunar crater which became famous as Hyginus

1910--Earth passed through Halley's Comet's tail

20 May 1960--Longest range achieved in ground-to-surface rocket test by U.S. Atlas (9000mi)

21 May 1860--Arthyr Auwers detected a nova, T Scorpii, in globular cluster M80

1897--First observations with Yerkes 40" refractor

22 May 1886--Brooks found his last 3 comets in 5 weeks

23 May 1614--King Mathias of Bohemia acknowledged in writing a debt of 15,000 thalers to Tycho Brahe's 6 children in payment for his instruments sold to Rudolph II for 20,000 thalers. Only a small part was ever paid to them.

24 May 1543--Death of Nicholas Copernicus

1822--First predicted return of Encke's comet to perihelion

28 May 585 BC--Eclipse occurred while Medes and Lydians were fighting. It caused them to make peace after

30 May 1933--Death of W.L. Elkin, a meteor specialist

1 June 1898--James E. Keeler became director of Lick

2 June 1858--G.B. Donati discovered Donati's Comet

3 June 1769--Transit of Venus. Le Gentil waited 8 years in India for this only to have clouds ruin his view

1948--Dedication of 200" Hale telescope

4 June 1946--A prominence rose to +million and a half km above sun's surface

1961--Death of G.A. Davis Jr., expert of Arabic star names

1964--Comet Encke reached naked eye brightness

5 June 1819--Birth of John Couch Adams, codiscoverer of Neptune

6 June 1761--Transit of Venus

2012--Transit of Venus

7 June 1918--11th magnitude Nova Aquilae suddenly exploded and shot to magnitude 6. The next night it reached magnitude 1.

8 June 2004--Next transit of Venus; maximum concentration of Orionids.

9 June 1803--Sir William Herschel announced existence of binary stars

1901--Death of M. Gaudibert, French selenographer

1918--Maximum of Nova Aquilae, magnitude -1.4

1920--First of 23 letters between Curtis and Shapley pertaining to their debate

Maximum concentration of ζ Perseids

10 June 1952--Test photos with Hale telescope showed stars of magnitude 23

11 June 1844--William R. Brooks born

12 June 1675--Warrant for building an observatory at Greenwich was signed

13 June 717--Longest recorded solar eclipse in ancient times

14 June --Mean solar time agrees with apparent solar time

15 June 763 BC--Earliest recorded eclipse by Chaldean astronomers; probably the one referred to in the Bible, Amos 8:9

885--Solar eclipse lasted almost 5 minutes

1770--Charles Messier discovered Lexell's Comet that was only 363 terrestrial radii from Earth on July 1

16 June 1963--Valentina Tereshkova launched in Vostok VI

18 June 1799--Birth of William Lassell, English amateur who built a 48" reflector

20 June 1943--The New Quebec (Chubb) crater first spotted

21 June 1633--Galileo's final hearing for the charge of heresey; summer solstice

24 June 1633--Galileo moved to Grand Duke's country-house near Rome in lieu of imprisonment

1778--First well observed eclipse in British Colonies in America, by David Rittenhouse

25 June 1960--Death of Walter Baade

2150--Next 7 minute + eclipse

26 June 1949--Baade discovered Icarus

29 June 1971--Three cosmonauts died in Soyuz XI after the longest manned space flight

30 June 1861--Earth passed through the tail of a great comet

1908--Tunguska event

1973--Last 7 minute + eclipse

--Maximum concentration of Taurids

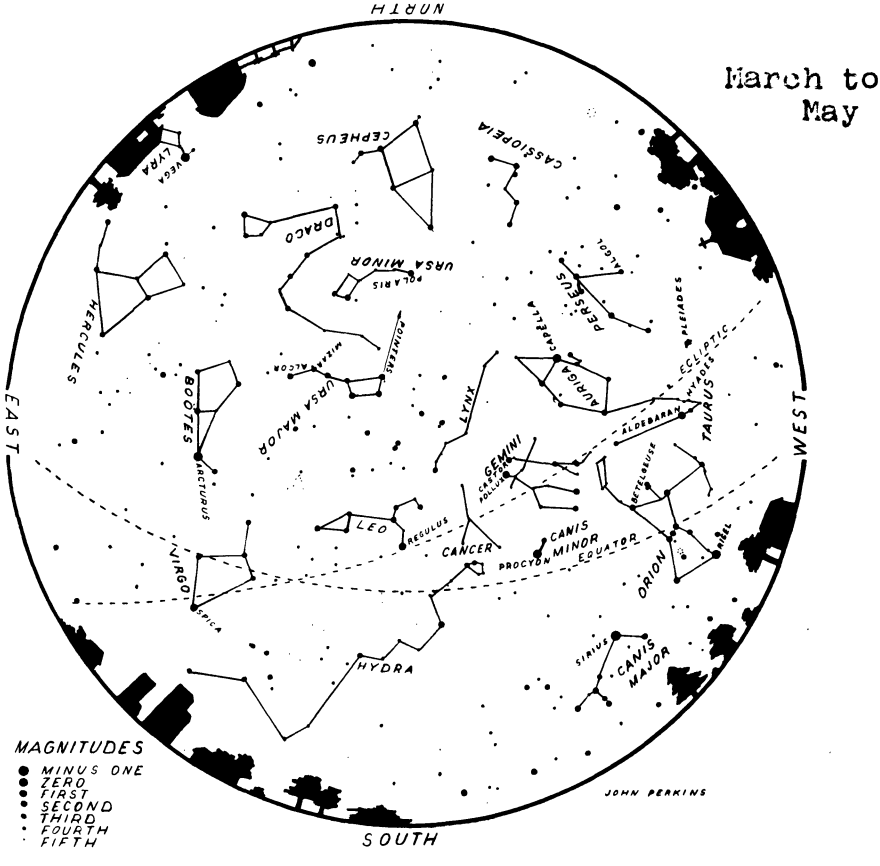
May 1962--Detection of smallest known white dwarf,LP 327-186

FUMBLING THROUGH THE SPRING SKIES

Mike Edwards (OC)

With the approach of warmer and hopefully clearer weather, we should be brushing off the dust from our telescopes which have probably stood still for the winter. This past winter seemed to offer little opportunity for we eagerastronomers to look at the skies. It is not for reason of cold temperatures, as we are a hardy group. Only cloud, fog or rain, snow storms, etc. could discourage us from taking our equipment to the great out-of-doors.

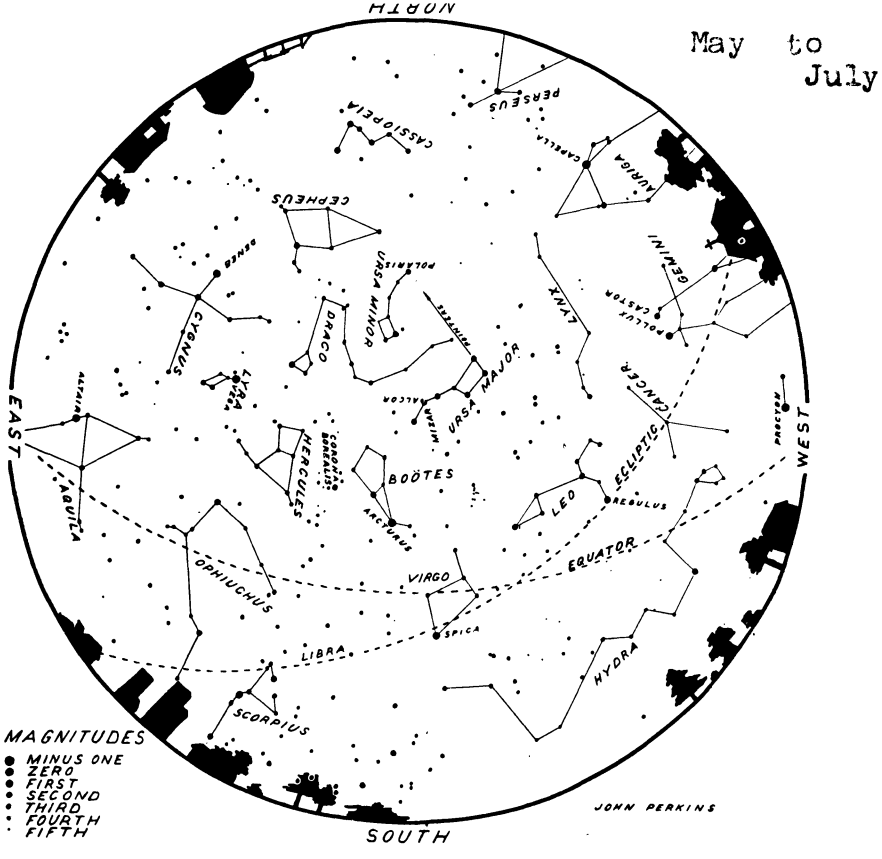
In my own case, the night following the last college examination signals the time to keep a closer watch for clear weather. This year, this night was spent by getting re-aquainted with the positions of the stars and constellations. Whether you ramble or fumble



through the spring skies, it is truly an awesome, but rewarding experience. It is "one of the biggest bargins of our time".

For this exercise of star or constellation hopping, there is no better equipment than a good set of binoculars. This provides for ease of transportation (around one's neck) and the ability to scan from one location to another without the bother of right ascension declination or tripod locking screws.

So on the next clear night (moonless) with the charts below (taken from the Observer's Handbook) set out the lawn chair, dress warmly and with good eyes or good binoculars (and maybe a transistor radio) settle back and become re-aquainted with the heavens. It is more rewarding than watching the one-eyed monster.....no advertisments but perhaps the odd meteor.



OBSERVING REMINDERS

Fri 13 May — Asteroid Juno is at opposition. Mag. is 10.1 and will be found at RA 15^h35^m, Dec $-2^\circ 23'$ (Serpens) and is 2.37 AU's away

Sat 14 May — possible occultation of Venus by Moon for North American early risers.

Fri 27 May — again early risers will be able to view Mercury at greatest western elongation when it will be 25° from Sun but not one of year's best. Diameter--8".3 and mag. +0.8

Sun 5 June — grazing occultation of 9 Beta Cap for a narrow band just north of Halifax. This star is a spectroscopic binary and with a mag. of 3.2 some serious observations are in order. Anyone for a group effort?

Neptune at opposition. Mag. +7.7 and is at a distance of 29.27 AU's (4.38×10^9km). A large telescope is required to observe Triton.

Wed 15 June — Greatest western elongation of Venus, again for the early risers. 46° from Sun.

Tues21 June — Summer Solstice at 9:14 ADT

Tues 5 July — aphelion for Earth, distance from Sun = 94,505,000 mi.

Fri 8 July — appulse of asteroid Pallus and star SAO 99401. This is of no particular scientific interest, but may be useful in locating the asteroid. The appulse occurs at 18:39 (during daylight) but will be close enough for the minor planet to be located later.

This time of the year is of course the most comfortable time to observe and seems to be about the best time to search for planetaries and globulars. The following are some which you might check out. M13 is easy and well known to most amateurs, but M14, M56 and M92 are almost as bright and easily found globular clusters. M57, the Ring Nebula is also well known, but M27 often known as the Dumb-bell has a higher surface brightness and being slightly larger than M57, should be an easy object.

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