



SKY FACTS

An introduction to the wonders of Astronomy published by the **ROYAL ASTRONOMICAL SOCIETY OF CANADA (Toronto Centre)** for distribution at the Society's open-air meetings and Exhibition display, and at the Saturday public evenings at the David Dunlap Observatory

Members of the Society will set up Telescopes for
FREE PUBLIC OBSERVATION

of the Moon, the planets and other celestial objects, as follows:

TORONTO DAILY STAR SKY-GAZING PARTIES

with telescopes (if sky clear) and astronomical films (courtesy of The Star) from dusk until about 10.45 p.m., on the following nights:

Tuesday, May 28—Eglinton Park, Eglinton Ave. W. at Oriole Parkway

Thursday, May 30—Greenwood Park, Greenwood Ave. south of Gerrard St. E.

Thursday, June 27—Eglinton Park, Eglinton Ave. W. at Oriole Parkway

Monday, July 1 (Dominion Day)—High Park, southwest of main Bloor St. entrance.

Friday, July 26—University of Toronto Campus, near Convocation Hall.

Monday, July 29—High Park, southwest of main Bloor St. entrance.

(NOTE: Should clouds prevent use of telescopes, the outdoor film showings will go on during each evening unless it rains.)

CANADIAN NATIONAL EXHIBITION, AUG. 16 to SEPT. 2

Telescopes will be set up on the terrace outside the south entrance of the Province of Ontario Building each evening if the sky is sufficiently clear to observe. Hours: Approximately 8.15 to 10.20 p.m. Several of the telescopes are home-made by Toronto district amateur astronomers who will be pleased to discuss telescope construction with interested visitors.

For further information about the Society and its activities, see Page 6.

RAYMOND R. THOMPSON, B.Ed.

President

FREDERIC L. TROYER

Secretary

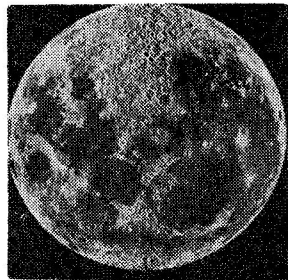
What Is Astronomy?

ASTRONOMY is the science which treats with the celestial bodies, their positions, distances, motions, physical condition and constitutions. It deals with stars (including the Sun), planets (example, the Earth), satellites (the Moon), comets and meteors, and the vast conglomerations of stellar matter known as galaxies and nebulae.

While "professional" astronomy is an exact science requiring use of a comprehensive knowledge of mathematics and physics, there is much of interest to the "amateur" astronomer, who needs no knowledge of higher mathematics to enjoy this study of the heavens as a most intriguing hobby.

The Moon, Our Nearest Neighbor

NEAREST of all the heavenly bodies to Earth is our satellite, the Moon—only 239,000 miles away. Earth has only one moon, Mars has two, while giant Jupiter has 12 and ringed Saturn nine.



Our Moon appears to be a dead world, without trace of air or water. It is seen by us only when sunlight, falling on its rocky surface, is reflected toward our eyes. Its phases change as its position relative to Earth and Sun while it revolves around Earth once in about four weeks (a month or "moonth"). Because the Moon rotates on its axis in the same period, it presents the same "face" to Earth at all times. With a diameter of 2,160 miles, or about one-quarter that of Earth, it weighs only about 1/80th as much as our world. The gravitational force on the Moon is one-sixth that on Earth.

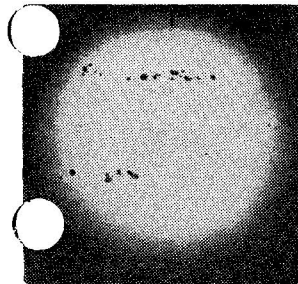
Seen in a telescope, the Moon's surface is revealed as extremely rugged, with towering mountain ranges and thousands of roughly circular craters, some more than 100 miles across. Then, too, there are vast dark plains which have the appearance of old sea basins. Seen with the naked eye, these varied lunar features combine to create what is really an optical illusion, the so-called "Man in the Moon."

Only the telescope can reveal the true grandeur of the lunar landscape, the massive ramparts of peaks which compare with Earth's loftiest mountains, despite the Moon's much smaller size. Perhaps the absence of air and water has allowed them to remain through the ages while similar features which have existed on Earth in distant ages have long since been eroded away by action of wind, rain and ice.

On the Moon, where day and month are equal in length, there are 14 earthly days of daylight, when the temperature goes as high as 275 degrees F., far above the boiling point of water, and then another 14 days of night, when it drops to 243 degrees below zero.

The Sun is a Star!

BECAUSE it emits its own light and heat, the Sun is classed as a star, one of fairly average size and temperature. Only because it is so close—a mere 93 million miles—does it occupy such an important place in our lives, the source of Earth's life and energy. The Sun's light, travelling 186,000 miles a second (or six million million miles a year), takes eight minutes to reach Earth. The light of the next nearest star requires more than four years for the trip. Most stars seen with the unaided eye are upwards of 100 "light-years" distant, and the telescope reveals objects so far off that the light which left them millions of years ago is only now reaching our eyes.



Sunspots on Solar Disc

The Sun is one of an estimated 200 billion stars in our galaxy (the Milky Way) and our own galaxy is just one of 150 millions of these great star-systems known to exist in the universe. Analysis of starlight by the spectroscope indicates all the bodies

in the universe are made of the same chemical elements known on Earth.

The Sun, with a diameter of 860,000 miles (compared to Earth's 7,900 miles), has a volume 1,300,000 times that of our tiny world. But because the matter is mostly in a gaseous state, the Sun's mass or weight is only 330,000 times that of our planet. Surface gravity on the massive Sun is so great, however, that a person weighing 150 pounds on Earth would weigh more than two tons if he could stand the 11,000-degree temperature and land on the solar surface.

The Sun's Family

THE EARTH is one of nine planets, dark solid bodies which revolve in elliptical (roughly circular) orbits around the Sun. Even in ancient times five of these planets or "wanderers" among the stars were recognized because of their changing positions among the "fixed" stars which form the constellations. Planets give out no light of their own but shine only by reflected sunlight.

Mercury and Venus are closest to the Sun. Earth is third. Beyond Earth, in order, come Mars, Jupiter and Saturn (all sometimes visible as bright "stars") and Uranus, Neptune and Pluto (seen only in telescopes). Between Mars and Jupiter lie the orbits of hundreds of minor planets or asteroids, possibly the remnants of a 10th large planet which in the distant past became disintegrated.

MERCURY, innermost and smallest of the planets, is usually too close to the Sun to be seen but occasionally, as it swings around the solar orb in its year of 88 days, it is visible for a few days just after sunset or just before sunrise. We may see it as an "evening star" in the western sky for a few days at the times of its greatest elongations east of the Sun on April 25, August 24, and December 18, 1963, and April 7, 1964; the elongations in April being the most easily observed. Greatest elongations west of the Sun, when Mercury is seen as a "morning star," occur on June 13 and October 5, 1963, and January 26 and May 24, 1964, that in October being most favorably observed.

Earth Has a Twin

VENUS, second planet from the Sun, is in size and weight almost a twin to Earth. About 67 million miles from the Sun, it has a year of 225 days. With the exception of the Sun and Moon, Venus is the brightest object in the sky when suitably placed for observation. The brilliance is due largely to its day atmosphere and cloud blanket, which, while it reflects sunlight well, prevents astronomers on Earth from ever seeing the Venusian surface itself. Because of its nearness to the Sun, Venus receives about twice as much light and heat as we do.

A brilliant object seen for two hours or more before sunrise during the early part of 1963, Venus during the spring months gradually moves in closer to the Sun which it passes on August 29. A few weeks later it may be seen low in the west as an "evening star" but it is poorly placed for observation until spring of 1964. It reaches its greatest separation from the Sun on April 10 and attains greatest brilliancy in mid-May after which it closes in quickly to the Sun, passing it on June 19, 1964, and again becoming a "morning star."

Mars, the Red Planet

NEXT beyond Earth is Mars. With an average distance of 140 million miles from the Sun, it sometimes approaches within 35 million miles of Earth, while at its farthest point it is 234 million miles away. W nearest it is a conspicuous fiery red color, but w farthest it is no brighter than the Pole Star. Unlike Venus, Mars' atmosphere is very thin and the features on its surface are distinctly visible. Its diameter, 4,200 miles, is little more than half the Earth's. The Martian day is about the same as ours, but its year is equal to 687 earthly days. Mars has two tiny moons, only 18 and 23 miles in diameter.

Visible in the evening sky during all of 1963, Mars will be fairly prominent during the spring but by summer is quite low in the west after sunset. It continues to close in toward the Sun until it reaches conjunction with the Sun on February 16, 1964, and moves into the morning sky. (On the night of May 31-June 1, 1963, Mars will pass within one degree—about two moon-diameters—north of the bright star Regulus in the constellation of Leo.)

THE DAVID DUNLAP OBSERVATORY of the University of Toronto

at Stop 23A Yonge St., south of Richmond Hill, is open to visitors without charge Saturday evenings from April to October. If weather permits, the 74-inch telescope is used to observe the heavens. Telephone Richmond Hill, TUrner 4-2112 for schedule of open hours and reservations.

**Astronomy Hobbyists Can Keep Up to Date on
Developments in This Fascinating Science
Through Reading**

"With the Stars"

The Toronto Daily Star's Weekly Column on Astronomy

written by

Helen Sawyer Hogg, Ph.D.

Research Associate, David Dunlap Observatory
and Professor of Astronomy, University of Toronto

"With the Stars"

appears every Saturday in

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ROYAL ASTRONOMICAL SOCIETY OF CANADA

THE SOCIETY, organized in Toronto in 1890, now has Centres (branches) in 16 cities across Canada. The Toronto Centre holds regular lecture meetings, usually twice-monthly, from October to April. Members of the Centre have the privilege of joining, without extra fee, the **Telescope Makers Group** which meets separately (also twice monthly), and the **Observers Group** whose members carry on various types of observational activity, much of it of considerable value to professional astronomy. Members receive the Society's bi-monthly **Journal** and the annual **Observer's Handbook**. A well-stocked Library is available to Members at the Society's National Headquarters at 252 College Street in Toronto.

Membership in the Toronto Centre is open to any person interested in Astronomy, either professionally or as a hobby. There are no academic requirements and no minimum age limit. The annual dues are \$5.00 for the membership year which begins on October 1 (and which includes subscription to the publications for the following calendar year). **Student membership** at \$3.00 is available to those under 16 years of age, and to full-time students in secondary school or university above 16.

In addition to the original Centre at Toronto, the Society also has Centres in Ontario at Ottawa, Kingston, Hamilton, Niagara Falls, London and Windsor.

Non-members may obtain the **Observer's Handbook** for \$1.00, or full information about the Society, on application to: F. L. Troyer, Secretary, Toronto Centre, R.A.S.C., 53 Woodlawn Ave. East, Toronto 7.

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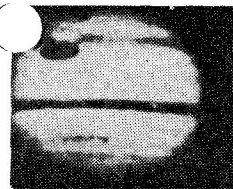
Application For Membership — Royal Astronomical Society of Canada

Given Names (one in full)		Surname		Leave Blank	
Mr. Mrs. Miss					
Mail address			City	Zone	
Occupation (If student, state so)		Name of employer (firm or institution) If student, name school, state grade		Age if under 16	
Academic Degrees (if any)		Telephones		I wish to apply for: <input type="checkbox"/> Ordinary membership <input type="checkbox"/> Student membership to start Oct. 1, 19—	
				<input type="checkbox"/> Check here if you wish membership in the Telescope Makers Group	
If you are acquainted with a Member of the Society, have him sign as sponsor		Fee enclosed: \$ -----		Note: Cheques drawn on banks outside Metro Toronto require 15 cents additional for exchange	

Send application, with fee, to: F. L. Troyer, Secretary, Toronto Centre R.A.S.C.
53 Woodlawn Avenue East, Toronto 7, Ont.

Jupiter, the Giant

JUPITER is the giant of the Sun's family. With a diameter of 87,000 miles, it has a volume about 1,300 times that of Earth, but weighs only 318 times as much.



This is still nearly three times as much as all the other planets together. It revolves around the Sun in just under 12 of our years, and spins on its axis in less than 10 hours; hence its day is much shorter than ours, and there are 10,494 days in the Jovian year. The velocity of rotation at Jupiter's equator—27,800 miles an hour—is more than 26 times as fast as Earth's. Jupiter's dense atmosphere contains deadly methane and ammonia gases. Because of its distance from the Sun, an average of 483 million miles, Jupiter receives only about 1/27th

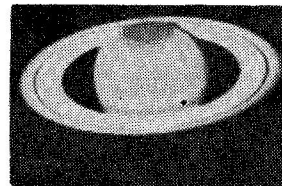
much light and heat as Earth, and its surface is intensely cold.

Of Jupiter's 12 moons, the four largest—Io, Europa, Ganymede and Callisto (all except Europa being larger than Earth's moon)—may be seen readily in small telescopes, and their changing positions in relation to the planet make an interesting study for the amateur. Some nights all four are on one side, sometimes three on one side and one on the other, sometimes paired. At other times they are eclipsed by the planet or are seen passing across Jupiter's disc, casting a tiny shadow on the cloudy surface.

Visible in the morning sky during the spring of 1963, Jupiter rises a few minutes earlier each night until by mid-summer it will be rising in the east by midnight. By October, when it reaches opposition to the Sun, it will rise at sunset and then will appear a little earlier each evening until by the year-end it will be found in the southern sky at sunset. It continues to move closer to the Sun during the early part of 1964 and will reach conjunction with the Sun on April 22, after which it again becomes a "morning star."

Saturn's Rings Unique

SATURN, with its unique ring system, is one of the most interesting objects for the amateur astronomer with a small telescope. Saturn, at an average distance of 886 million miles from the Sun, takes nearly 30 years to complete one revolution. Second only to Jupiter in size, it is 72,000 miles in diameter and weighs about 95 times as much as Earth. Like Jupiter, it spins on its axis very swiftly, its day being about 10¼ hours long. Of Saturn's nine satellites or moons, only one, Titan, is readily seen in a small telescope. Saturn's exquisite ring system, astronomers believe, be the remnants of one more moons which have disintegrated.



Seen in the morning sky during the early part of 1963, Saturn reaches opposition to the Sun in mid-August, rising at sunset and being visible all night. In the constellation of Capricornus all year, it will be found in the southwest after sunset toward the end of the year, gradually closing in toward the Sun with which it is in conjunction on February 15, 1964, and again becoming a "morning star."

Comets and Shooting Stars

COMETS are visible briefly, sometimes for a few weeks, often for months, as they swim by in space, the bright nucleus usually surrounded by nebulous material often extended as a "tail" in the direct away from the Sun. Some are periodic, returning at regular intervals and known to be permanent members of the Solar system; others make only a single appearance and pass off again to distant space. Few comets attain enough brightness to be seen with the naked eye.



METEORS are much more common. A few may be seen almost any clear night, but at certain times of the year they come in "showers." Ordinarily, shooting stars are very tiny bits of matter, like grains of sand which are rendered visible briefly as they are drawn toward Earth by its gravitational pull and burned up by the heat generated as they swiftly pass through our

upper atmosphere. Usually they are completely melted and transformed into a briefly lingering streak of vapor. Very rarely a larger meteoric body enters Earth's atmosphere and partially survives the fiery ordeal, and a portion of the solid mass falls to Earth. Two notable meteor showers are the Perseids (about Aug. 12 each year) and the Leonids (about Nov. 16).

Beyond the Sun's Ken

UNDER exceptionally good conditions, the naked eye may see as many as 2,000 stars at one time, but the larger telescopes reveal there are billions of these distant suns in our galaxy. Many stars are twins — known to astronomers as "binaries." Other stars appear as doubles merely because one lies behind the other in the line of sight, although they are separated by vast distances. Albireo or Beta Cygni, the star at the foot of the Northern Cross (not far from the bright star Vega), is an especially interesting binary, one of the twins being whitish-blue, a very hot star, and the other a beautiful golden or orange color, a star of lower temperature.

Star clusters, such as the highly condensed conglomeration of suns to be seen in the constellation Hercules, or the widely separated group, the Pleiades, are examples of interesting

Other telescopic objects of beauty are the nebulae—of which one is the huge chaotic mass of glowing gas to be seen in Orion's belt and the other the galactic nebulae or "island universes" such as that in Andromeda. The latter, although nearly two million light-years distant, is sometimes visible to the unaided eye as a fuzzy patch, the farthest thing the naked eye can see—more than 10 million million miles off in space.

