ASTRONOMY

Jupiter Seen Again

The giant planet is visible in the eastern sky late on October evenings. Two actors in the recent doubling of distances to other galaxies can also be seen.

By JAMES STOKLEY

➤ AFTER HAVING been gone from the evening sky since late last spring, the giant planet Jupiter is now with us again. At the beginning of October it will be visible late in the evening, and by the end of the month it will be seen at a somewhat more reasonable hour.

Its position, in the constellation of Taurus, the bull, is indicated on the accompanying sky-maps. These show the appearance of the heavens at about 10:00 p.m., your own kind of standard time, Oct. 1; 9:00 p.m., Oct. 15, and 8:00 p.m., Oct. 31.

Jupiter, when seen, will be low in the northeast and east, but it will be so bright that it should not be hard to identify.

Jupiter, a planet, shines by reflected sunlight, in contrast to the stars, which emit light themselves, like the sun. The brightest star visible these evenings is Vega, in Lyra, the lyre, high in the western sky.

Directly above it is Cygnus, the swan, with first-magnitude Deneb; while a little to the left we find Altair, in Aquila, the eagle. Still farther left and lower, not far, in fact, above the southern horizon, is Fomalhaut, in Piscis Austrinus, the southern fish.

Another star of the first magnitude is seen in the northeast. This is Capella in the constellation of Auriga, the charioteer, which is just to the left of Taurus, where Jupiter shines. In Taurus itself is first-magnitude Aldebaran, but in the low position at which it is shown, it is somewhat dimmed by atmospheric absorption.

First Magnitude Stars

Although it contains no stars as bright as these, another characteristic group of the autumn evenings is seen high in the south: Pegasus, the winged horse. Three of the stars in this group, plus one in next-door Andromeda, the chained princess, form the familiar "great square of Pegasus."

Going from Andromeda, which is high in the east, down toward the northern horizon, we come next to the W-shaped group of Cassiopeia, which represents the queen, Andromeda's mother. The king, Cepheus, is seen to Cassiopeia's left.

Just below him is Ursa Minor, the lesser bear, in which the pole star, Polaris, shines at the end of the handle of the little dipper. Still farther down, near the northern horizon, is Ursa Major, the great bear, of which the great dipper is part.

Although Jupiter is the only planet now easily seen in the evening, another is there earlier. This is Mercury, which is farthest east of the sun on Oct. 23, but it sets so soon after sunset that it will be very difficult to find. Mars and Venus both are morning stars, rising about two and a half hours ahead of the sun, so that they can be seen low in the northeast as dawn approaches.

Venus is much the brighter, even more brilliant than Jupiter, and is in Virgo, the virgin. Mars, of the brilliance of a second-magnitude star, is nearby. In the first few days of October Venus rises first, but she passes Mars early in the morning of Oct. 4, drawing closer to the sun and rising later.

Mars, on the other hand, is drawing away from the sun, and appears earlier each night. By next spring it will shine brilliantly in the evening sky.

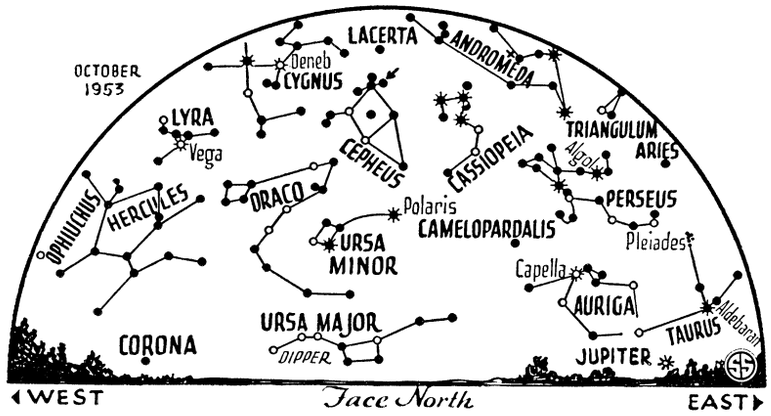
High in the northern sky in October appear two of the chief actors in one of the most important and dramatic episodes in the recent history of astronomy. One of these is in the position indicated by the small cross just above the letter M in the name Andromeda. Looking there, on a dark clear night, one may see a rather faint spot of hazy light, the "galaxy in Andromeda."

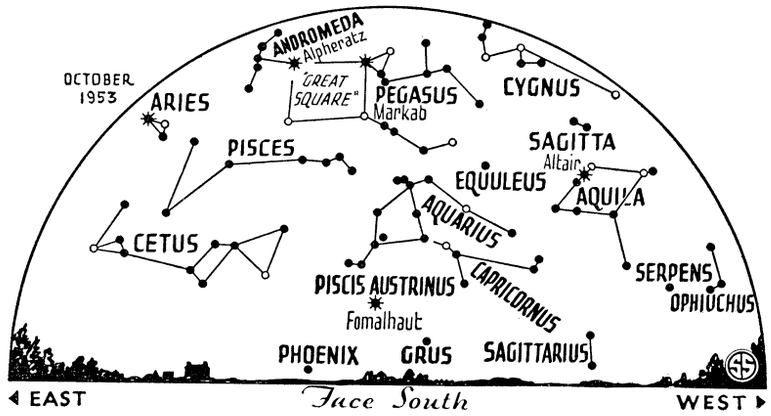
All the stars that we ordinarily see in the sky make up a system shaped something like a grindstone. When we look toward the edge of the grindstone, we see the stars much more thickly clustered than toward the side, and this concentration is what we call the Milky Way.

This whole system, our galaxy, contains about a hundred thousand million stars. It is so huge that light, traveling 186,000 miles a second, takes about a hundred thousand years to go across it.

Scattered around the universe, outside our galaxy, are millions of other such systems, and the one in Andromeda is among the closest. Its distance is about 1,600,000 light years, i.e., its light takes that many years to reach us.

Possibly some keen-eyed reader of these articles will recall that on past occasions when we have referred to this object, a





☼ ✷ ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS

figure about half as large has been given for its distance. Therein lies the story, for for about a year ago astronomers first heard about some new researches which show that the distances of these outer galaxies are about twice what they were formerly thought to be.

This important conclusion was based on the work of many astronomers at observatories throughout the world, particularly studies of the Magellanic Clouds by Harvard College Observatory astronomers and photographs of the heavens made with the new 200-inch Hale telescope at Mt. Palomar, the largest in the world.

When that instrument went into operation a few years ago, it was thought that it could reach out into space a maximum of a billion light years. Now we know that it can observe out to two billion light years, and smaller telescopes, down the line, can also see twice as far.

Cepheid Variable Stars

Another actor in the story is a star in the constellation of Cepheus, known as delta Cephei. It is indicated on the map by a small arrow. Like many other stars it is a variable; its light changes over a regular cycle, taking about five days to go from one maximum to the next. This is the prototype of the class of "Cepheid variable stars," which are believed to pulsate, shining most brightly as they expand and most dimly as they contract.

Some forty years ago it was found that the longer a Cepheid takes to vary, the greater is its average luminosity, or candlepower. This enabled the stars' relative distances to be found. Then the actual distances of a few were obtained by other means. Since their relative distances were known, the distance of any could be found in light years.

This afforded astronomers a powerful tool. When photographs made at the Mt. Wilson Observatory in the early twenties with the 100-inch telescope, then the world's largest, showed individual stars in the Andromeda galaxy, some of them Cepheids, its distance was determined as about 800,000 light years.

Two Cepheid Groups

With the 200-inch telescope, astronomers looked for some of the fainter, short-period, Cepheids that should be in the stars clusters around the Andromeda galaxy, as they are in similar clusters around our galaxy. These stars were too faint to be detected with the 100-inch, but the new instrument should have revealed them.

When the telescope failed to show them, it was apparent that something was wrong. It looked as if the Andromeda galaxy was twice as far as formerly thought, and that these cluster-type Cepheids were too far away to be seen, even with that powerful instrument.

In several ways astronomers have now confirmed that this is indeed the case. It

turns out that there are two groups of Cepheids, corresponding to the two great classes, or "populations," of stars in general. The cluster stars, and some of the others, fit in with the old figures, but the rest, including those in the Andromeda galaxy used for determination of distance, are four times as bright for the same period of variation.

This means that they are twice as far away as we used to think, for if you move a light to double the distance, it looks a quarter as bright as it did before.

Many other findings also fit in better with the revised distances. For instance, in order to cover the angle in the sky which it is observed to cover, the Andromeda galaxy must be twice as big as formerly supposed, if it is twice as far away. This makes it about the same size as our galaxy. Previously it seemed much smaller, and this bothered astronomers who did not like to think that ours was in any way exceptional.

So, although they have had to alter some of their accepted theories, astronomers welcome the new data. This is the way science advances; step by step, as we acquire new knowledge, we approach closer and closer to the truth.

Celestial Time Table for October

Oct.	EST	
4	1:00 a.m.	Venus passes Mars.
5	8:13 a.m.	Moon passes Mars.
	10:04 a.m.	Moon passes Venus.
6	1:38 a.m.	Algol (variable star in Perseus) at minimum.
	1:00 p.m.	Moon farthest distance 252,600 miles.
7	7:40 p.m.	New moon.
8	10:26 p.m.	Algol at minimum.
11	7:15 p.m.	Algol at minimum.
15	4:44 p.m.	Moon in first quarter.
21	11:00 a.m.	Moon nearest, distance 222,600 miles.
22	early a.m.	Meteors visible radiating from constellation of Orion.
	7:56 a.m.	Full moon (Hunter's moon).
23	11:00 a.m.	Mercury farthest east of sun.
	4:00 p.m.	Saturn in line with sun.
26	6:56 a.m.	Moon passes Jupiter.
29	12:08 a.m.	Algol at minimum.
	8:09 a.m.	Moon in last quarter.
31	8:57 p.m.	Algol at minimum.

Subtract one hour for CST, two hours for MST, and three for PST.

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• Books of the Week •

For the editorial information of our readers, books received for review since last week's issue are listed. For convenient purchase of any U. S. book in print, send a remittance to cover retail price (postage will be paid) to Book Department, Science Service, 1719 N Street, N. W., Washington 6, D. C. Request free publications direct from publisher, not from Science Service.

AFRICAN LANGUAGES AND ENGLISH IN EDUCATION: A Report of a Meeting of Experts on the Use in Education of African Languages in Relation to English, Where English is the Accepted Second Language, Held at Jos, Nigeria, November 1952—*UNESCO's Education Clearing House,* 91 p., paper, limited number of copies free upon request to publisher, 19, Avenue Kleber, Paris 16e, France.

AMAZON TOWN: A Study of Man in the Tropics—Charles Wagley—*Macmillan,* 305 p., illus., $5.00. The readable story of small town life along the colorful Amazon River, based on data collected while the author made a survey for UNESCO's International Hylean Amazon Institute.

BAILEY'S TEXTBOOK OF HISTOLOGY — Revised by Philip E. Smith, Wilfred M. Copenhaver, and Dorothy D. Johnson—*Williams and Wilkins,* 13th ed., 775 p., illus., $9.00. A text primarily for first year students in medicine and dentistry.

A BRIEF COURSE IN SEMIMICRO QUALITATIVE ANALYSIS—William E. Caldwell and G. Brooks King—*American Book,* 163 p., paper, $2.10. An introductory course; only the more common cations and acid radicals are included.

CALIFORNIA JOURNAL OF MINES AND GEOLOGY, Vol. 49, No. 3—*California Division of Mines,* 74 p., illus., paper, $1.00. This issue includes an article on the flotative properties of titanium minerals in oleate solutions.

CHROMITE DEPOSITS IN THE NORTHERN SIERRA NEVADA, CALIFORNIA — Garn A. Rynearson — *California Division of Mines,* 150 p., illus., paper, $2.00.

THE COMPLETE BOOK OF BULBS—F. F. Rockwell and Esther C. Grayson—*American Garden Guild and Doubleday,* 352 p., illus., $5.95. Whether or not you are a bulb enthusiast, you will enjoy looking at this beautifully illustrated garden book.

THE CONSUMER'S GUIDE TO BETTER BUYING —Sidney Margolius—*New American Library,* 224 p., paper, 35 cents. A new and revised edition of the author's "How to Buy More for Your Money." Advice on purchasing commonly used articles.

EARTH SCIENCE: The World We Live In — Samuel N. Namowitz and Donald B. Stone—*Van Nostrand,* 438 p., illus., $3.96. A generously illustrated high school text on man's physical environment.

EVERGLADES NATURAL HISTORY: Volume 1, Number 1—Joseph C. Moore, Ed.—*Everglades Natural History Association,* 38 p., illus., paper, $2.00 per year. Interesting articles about the animals and plants of our youngest national park, where tropical plants meet their temperate neighbors. The editor is park biologist.

THE EXTERNAL MORPHOLOGY OF THE DRAGONFLY ONYCHOGOMPHUS ARDENS NEEDHAM — Hsiu-Fu Chao — *Smithsonian,* Miscellaneous Collections, Vol. 122, No. 6, 56 p., illus., paper, 60 cents. Intended to apply the knowledge of the most recent morphological interpretations and to serve as a foundation for future taxonomic studies.

FARWELLIANA: An Account of the Life and Botanical Work of Oliver Atkins Farwell, 1867-1944—Rogers McVaugh, Stanley A. Cain and Dale J. Hagenah—*Cranbook Institute of Science,* Bulletin No. 34, 101 p., illus., paper, 75 cents. The contributions of a scientist who was botanist for a Detroit pharmaceutical house for 41 years.

INSECTS CLOSE UP: A Pictorial Guide for the Photographer and Collector Featuring 125 Photographs and Drawings — Edward S. Ross — *University of California Press,* 80 p., illus., paper, $1.50. The photographer will get ideas for nature photography from the remarkable pictures in this small book; the student of nature will delight in their portrayal of insect life.

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