

BRIGHTNESS FROM DUST

Here are the first photographs of Venus showing a glowing ring of light visible around the entire circumference of the planet. These pictures were obtained at Lowell Observatory at Flagstaff, Ariz. by Drs. E. C. Slipher and James B. Edson during the recent inferior conjunction of the planet, late in November. The white lines indicate the position angles of the line joining the cusps of the sunlit crescent. The arrow points to a cloud.

ASTRONOMY

Our Milky Way Extends For 60,000 Light Years

Most Distant Objects in Our Own Island Universe Are Farther Away Than Are Neighboring Galaxies

A NEW measurement of the dimensions of our own island universe, the Milky Way, was presented to the American Astronomical Society at New York by Dr. Harlow Shapley, director of Harvard Observatory.

By study of the useful cluster-type Cepheid variable stars, whose distances can be readily determined, Dr. Shapley found that the globe of stars surrounding the dense disk of the Milky way is more than 60,000 light years thick.

The most distant objects of this globe are farther away than the Magellanic Clouds, our satellite galaxy neighbors, Dr. Shapley said. "Thus, these external systems may, in a tenuous way, be said to lie within the globe of stars that constitute the outer fringes of the Milky Way."

Probably 95 per cent. of all known stars, whether variable or not, are within a thousand light years of the Milky Way plane, Dr. Shapley said. But the observed cluster-type variables extend outward from that plane to distances of 50,000 light years or more.

Evidence that the extremely distant Cepheids are part of the Milky Way

system lies in the fact that the "population density" of these stars, or the average number of stars per unit volume of space, falls off rapidly at greater distances from the Milky Way.

At a distance of 30,000 light years from the plane the density is about one-thousandth of that near the plane, Dr. Shapley said. Clearly then, the stars are members of our system, and do not represent a random distribution of stars through space.

Dr. Shapley studied the several hundred cluster-type Cepheid variable stars lying in the high galactic latitudes, that is, quite far from the Milky Way plane, and free from the low-lying absorbing clouds which make measurement of distances difficult. Most of the high latitude stars were found in surveys of faint variables carried on at Harvard Observatory.

Glow of Venus

THE BRILLIANT planet Venus owes its luminous splendor in the night sky to an atmosphere of tiny dust particles which scatter sunlight much more effec-

tively than do the air molecules of the earth's atmosphere.

This tentative conclusion was advanced by the Lowell Observatory scientists, Drs. E. C. Slipher and James B. Edson.

Taking more than 500 pictures of Venus over a period of eight days late in November, when the planet was at its nearest approach to the sun, the Lowell astronomers have photographed an entire ring of light extending around the planet when it was in its crescent phase like that of the moon at first or last quarter.

"Photometric measurements gave the ratio of brightness of the Venus twilight extensions to the brightness of our adjacent sky," reported the astronomers.

"Assuming the effective height of the Venus atmosphere as two miles, the brightness of the twilight extensions in the neighborhood of the theoretical cusps is between 35 to 40 times the brightness of our sky near the sun. Since the brightness of our sky in this region is probably about 4,000 lamberts, the brightness of the Venus atmosphere viewed tangentially appears to average more than 100,000 lamberts."

This extreme brightness appears to be due to fine dust particles scattered through the gaseous atmosphere of Venus, the astronomers explained. Observations through spectroscopes have never revealed the presence of water vapor in the atmosphere of the planet. Such water vapor particles would be the next most likely source of light scattering which could account for the amazing sky brilliance on the planet.

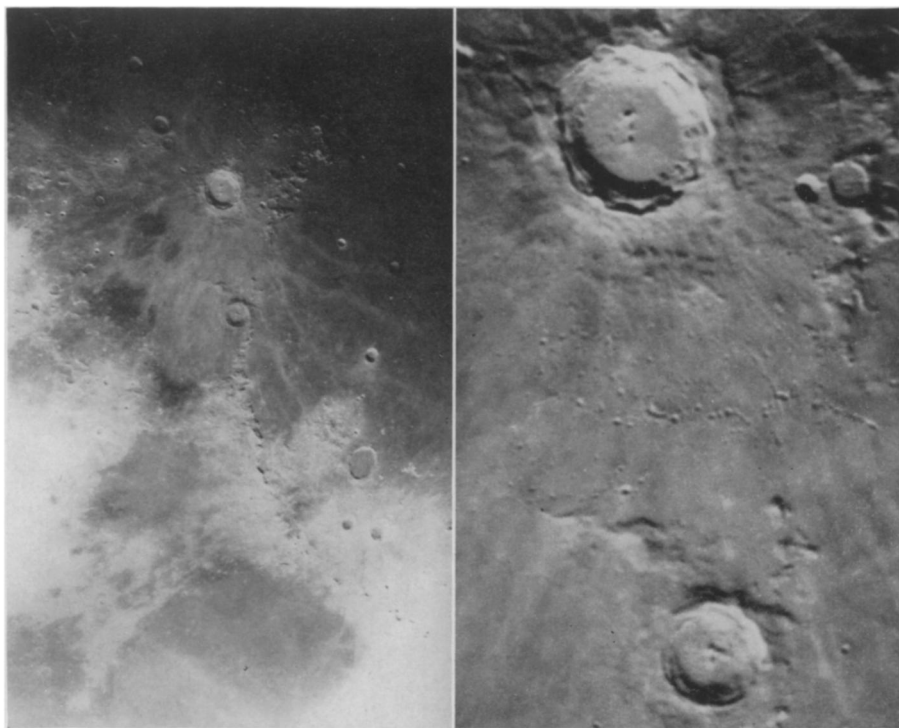
The actual surface of Venus, Drs. Slipher and Edson noted, is never seen because of the overlying dust-filled atmosphere with its light-scattering properties.

"Atomic Governor" in Sun

A NEW theory of radiation pressure in the solar atmosphere explaining the motions of the great flaming prominences which are projected thousands of miles into space from the sun, was presented by Dr. Donald H. Menzel, Harvard astronomer.

A strange atomic "governor," Dr. Menzel stated, may control the speeds at which the giant flames are shot into space.

Apparently defying the laws of gravity, the prominences have been observed to move with uniform velocities. Whether spurting out or falling back, a flame moves for a period at one speed, then



PHOTOGRAPHY LIMITS ASTRONOMY

Ability of telescopes to reveal the detail of heavenly objects is limited by the grain of photographic plates. The photograph of the moon at the left is clear and sharp, but when greater magnification is attempted as in the section shown on the right, the result is fuzzy on ordinary photographic plates.

suddenly may accelerate or decelerate, and then moves for a while at the new speed. The best observations of this phenomenon have been made by Dr. Edison Pettit, of Mount Wilson Observatory, who has recently been collaborating with Dr. Robert McMath at the McMath-Hulbert Observatory in Michigan.

By the Menzel theory for the first time the peculiar speed characteristics and levitation effect may be explained in terms of radiation pressure alone, without conjecture as to possible action of other forces, magnetic or electrical.

As is well known, light impinging on any substance, will exert a pressure, provided the energy is absorbed. The atoms of the solar atmosphere are singularly transparent to light of most colors. But in the far ultraviolet are found strong absorptions arising from the element hydrogen. According to Dr. Menzel's theory, if, in addition, there are bright emissions of hydrogen light, the solar hydrogen atoms suddenly impelled up or down by excess pressures are subjected to a control which tends to equalize the gravity and radiation pressures, or in other words to make the new velocity constant.

The controlling bright hydrogen emission line would probably possess a dark absorption line running through its center, Dr. Menzel said.

If the energy for the prominence movements originates from such a source, then by the Doppler effect the steady speeds of the atoms can be explained. An atom subjected to excess radiation pressure will be accelerated and will absorb in the "wing" of the emission line, where the radiation pressure is diminished; conversely, an atom subjected to excess gravity pressure will tend to move into an energy range where the radiation pressure is increased.

Because the earth's atmosphere is opaque to these radiations, we cannot observe them directly, but only infer their existence from studies of the sun's atmosphere.

A temperature in the sun of from 12,000 to 15,000 degrees Centigrade would be required to supply the ultraviolet radiation pressure necessary to control the prominences, as visualized in this theory, Dr. Menzel said. There have been recent observations tending to confirm such a high temperature, although past estimates have ranged as low as 6,000 degrees.

Dr. Menzel pointed out that an earlier theory of solar prominence energy proposed by Dr. E. A. Milne, British scientist, where the supporting radiation was assumed to arise from an absorption instead of an emission line, led to calculations of steadily increasing speeds of atoms subjected to excess pressures. These calculations do not agree with observations of prominence behavior, Dr. Menzel said.

Grain Size Limits

THE GRAININESS of photographic plates is a limiting factor of the ability of telescopes to resolve the detail of stellar and planetary objects, Dr. Keivin Burns of the Allegheny Observatory, Pittsburgh, Pa., reported.

For telescopes having aperture F18 (focal length 18 times the diameter of the aperture of the telescope) the full resolving power of the instrument will separate detail of objects only 100th of a millimeter. Ordinary process plates are too coarse in graininess to obtain this limit, Dr. Burns said. However, new special plates of finer grain are now available which will just do the job.

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SEISMOLOGY

Changes in Gravity May Warn of Earthquake

CHANGES in the force of gravity, hitherto supposed to be constant at any one point, may provide scientists with a means of warning of imminent earthquakes.

This possibility of predicting the frequently destructive movements of the earth's crust was advanced before the Geological Society of America by Prof. George W. Bain of Amherst College.

"Compression precedes the violent expansion and results from active and essentially continuous earth movement," Prof. Bain explained in describing occurrences preceding and accompanying earthquakes.

"While compression is increasing, rock compressibility must be diminishing and rock density and likewise the force of gravity must be increasing. The magnitude of the change in either compressibility or the force of gravity indicates the earthquake imminence," he declared.

Scientists can measure these changes in the force of gravity, he pointed out.

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An epidemic of cholera in northern India recently took 17,000 lives.