

"Super-Universes" Largest Objects

Astronomy

Following are further reports on papers in astronomy, presented at the New York meeting of the American Association for the Advancement of Science.

Large as our galaxy, or "universe" of stars, is—perhaps fifteen hundred million million miles across—there are still larger things scattered around through space. These are the "super-universes," or galaxies of galaxies, said Dr. Harlow Shapley, director of the Harvard College Observatory.

Outside our own galaxy, there are thousands of independent ones. Some of these appear as spiral nebulae, with a definite pin-wheel-like structure. Others, like the two Magellanic clouds, visible to the unaided eye from southern countries, are more irregular. Dr. Shapley himself has demonstrated that the two Magellanic clouds are at vast distances, so far that they are definitely outside our own universe. At the Mount Wilson Observatory Dr. Edwin Hubble has made measurements of the distance of two of the closest of the spiral nebulae. He has proven that they also are outside our galaxy, and are made up, like our own, of a vast number of stars.

"The measures of dimensions show that our own galaxy appears to be from ten to twenty times the diameter of any of the others with which we are acquainted," said Prof. Shapley, "with the exception of the Andromeda nebula, which may be a fifth as large as our system. In the oceans of space, our galaxy appears to be a continent, whereas the hundreds of thousands of extra-galactic nebulae may be called 'island universes,' as Herschel and others termed them a hundred years ago."

But these "islands" are not isolated, Dr. Shapley has discovered.

"They are organized into higher systems—into galaxies of galaxies," he said. "These greater organizations are enormously larger than our own galaxy."

Prof. Shapley told of the studies that he and one of his associates, Miss Adelaide Ames, have been making for the last four years on one of these super-galaxies, the one in the constellations of Coma and Virgo. They studied an area in these constellations of about a hundred square degrees. This is approximately the area contained in a square equal to the apparent distance in the sky between Betelgeuse, the northernmost star in Orion, to the middle of the three stars

that form the warrior's belt. "An analysis of this region has shown that the Coma-Virgo group itself is composed of between two hundred and three hundred galaxies. Lying in the same general direction, though much more remote, are at least three other clouds of galaxies, indicating a scattering of such systems through space as far as we can fathom.

"In analyzing the Coma-Virgo region we hit upon the major discovery of all our work—the apparent proof that inter-galactic space is effectively transparent. This gives us the assurance that the distances we are measuring are correct and that veils of meteoric dust and of electrons cannot obscure the light of remote systems and lead us to false conclusions concerning their distances.

"This will permit us to say with more confidence than we have heretofore admitted that the remotest galaxies we study are more than a hundred million light years distant; that the great Coma-Virgo galaxy of galaxies is ten million light years away and extends throughout two million light years of space; and that the individual systems in this organization have diameters from five to twenty thousand light years (our own galaxy probably much exceeds two hundred thousand light years in diameter). It is possible that an enormous galaxy such as ours may result from the condensation or amalgamation of many smaller galaxies—for instance, from the concentration into one system of a hundred or so of the members of a super-system such as that in Coma-Virgo."

Electric Eye Sees Stars

How the electric eye, the photo-electric cell that makes television possible, can be used for measuring the light of stars was explained by Dr. Joel Stebbins, of the Washburn Observatory at Madison, Wis.

"A star image is focused on such a cell by the telescope lens," he said. "and the resulting electrical current gives a measure of the amount of light received.

"One of the interesting objects studied is the star Epsilon in the constellation of Auriga, known to consist of a bright body and a larger faint companion which revolves around the main star in a period of

twenty-seven years. During the six months since last June the darker body has been slowly moving in front until the bright star is now entirely obscured and we get only the light of the faint component.

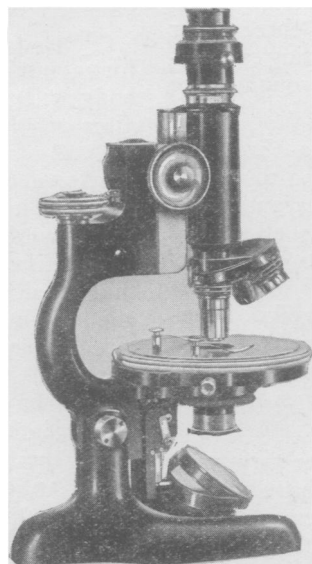
"This total eclipse will continue for about a year, when the bright body will again begin to emerge, and after another six months the system will be of normal brightness. From the long intervals involved in these changes it follows that the companion must be an unusual body; it is a planet larger than its sun, so diffuse that its density cannot be more than one one-hundred-thousandth that of air, and yet it shines like a star. Some of the facts concerning this system have been known heretofore, but it is hoped to secure new data from the present eclipse which affords an opportunity not to be repeated for twenty-seven years."

Tides May Cause Sun Spots

Tides on the sun, caused by the pull of the planets Jupiter and Saturn, may be responsible for the approximately eleven-year period in which the sun-spots wax and wane. This theory, presented about thirty years ago by Prof. E. W. Brown, of Yale University, finds support in evidence presented by Prof. Dinsmore Alter, of the University of Kansas. The sunspot epochs for the past thirty years have almost exactly followed the course predicted in Prof. Brown's paper, he stated.

As the moon revolves around the earth, its gravitational pull attracts the ocean areas to a considerable extent, which is evidenced as the tides. As the mass of the sun is so much greater than that of the earth its own gravitational attraction is very great. With the planets so much farther away than the moon is from the earth, the planetary tides would be very feeble. However, spectrum observations have shown that the atmosphere of the sun is almost in perfect equilibrium. The gravitational force pulling it inward is compensated for by the force of the light pushing it outward. In a body as large as the sun, this radiation pressure is very great. With such an equilibrium, said Prof. Alter, a very slight tidal effect would produce large results. (Turn to next page)

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A.A.A.S. Astronomy—*Cont'd*

The poorest radio reception for many years may be expected during the latter half of 1929 because of the large number of spots on the sun due at that time, Prof. Harlan T. Stetson of the Harvard Laboratory of Astronomy predicted when he described three years of researches connecting radio receiving conditions on earth with changes in the atmosphere of the sun.

One of the reasons that radio broadcasting developed so rapidly is that at the time of its rapid growth, about 1923, sun spots were at a minimum and at no time since has radio reception been so favorable, Prof. Stetson explained. Equally good receiving conditions will not return again until the present sun spot cycle terminates in 1934.

The popular impression that radio reception is universally poor in summer and good in winter is "completely unfounded," Prof. Stetson declared. If shortened days and decreased daylight which aid radio were the only factors, the popular idea would be correct, but during the winters of 1926 and 1927 increased activity on the sun made the cold seasons better radio periods than the summers. Decreases in sun spots during the last two months of this year have improved receiving conditions greatly. Prof. Stetson explained that static due to thunder storms in summer causes the average radio listener to decrease his set's sensitivity and thus appear erroneously to get low signal intensity in warm weather.

A definite fourteen to fifteen month period in both radio and solar activity was discovered by Prof. Stetson's researches conducted in cooperation with Greenleaf W. Picard of Newton Center, Mass. One of these secondary maxima falling due next September or October and coinciding with the longer sunspot cycle of about eleven years will probably make the sun more spotted and the radios more unhappy than they have been for years.

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A remarkable looking experiment in modern architecture is a church built in Cologne, Germany, made entirely of steel, copper, and colored glass.

A German engineer is planning a huge indoor beach, with sand, an "ocean", a boardwalk, and lamps furnishing artificial sunlight.