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THE MAGELLANIC CLOUDS

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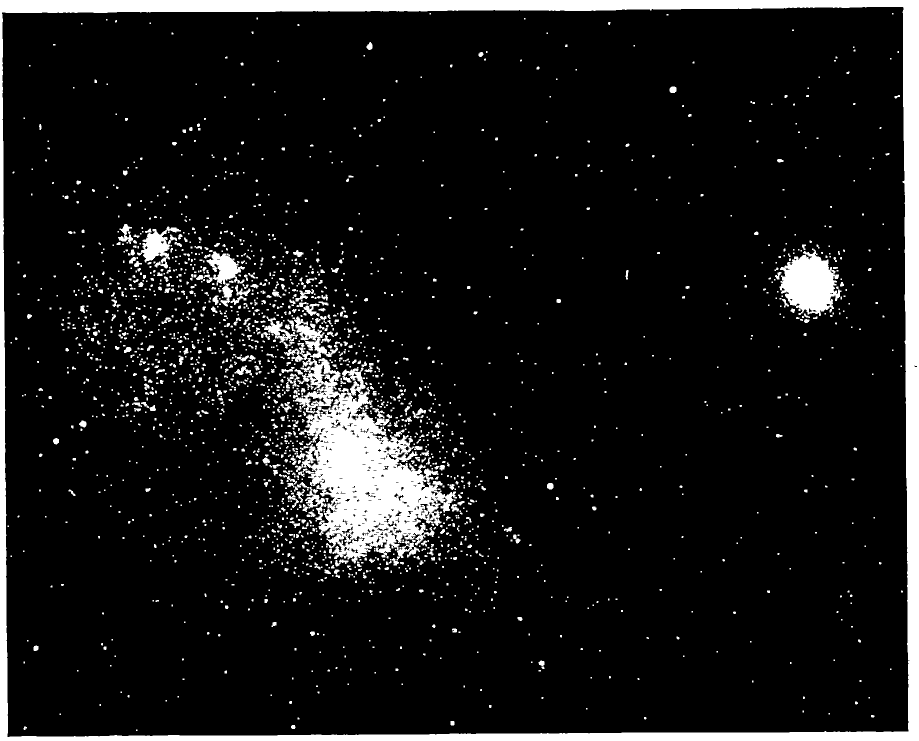

IN FAR southern circumpolar skies, invisible in the north temperate zone, are two of the most remarkable objects in the heavens. To the earliest navigators they were known as The Cape Clouds but later were named Nubeculae Magellani, Little Clouds of Magellan, in honor of the great navigator who observed and wrote a full description of them on his historic voyage. Today they are known simply as The Large and Small Magellanic Clouds or, occasionally, as Nubecula Major and Nubecula Minor.

To those who seek to solve the mysteries of the heavens the Magellanic Clouds have become veritable Treasure Islands of discovery in the depths of space. Though probably far exterior to the Milky Way they appear to differ little, except possibly in their remarkable richness, from typical star clouds of the Milky Way. Here exist vast diffuse nebulae, many of them far surpassing in size and

splendor our Great Orion Nebula. Here also are unnumbered supergiant stars so brilliant that if placed ten parsecs or thirty-three light-years distant from the Earth they would cast a strong shadow and far outshine the brilliant Venus, and so great in volume that at the center of our solar system they would fill the orbit of Jupiter and far surpass in size our greatest known giant stars, Antares, Mira and Betelgeuze.

During the past thirty-five years, at the Boyden Station of the Harvard College Observatory at Arequipa, Peru, a valuable collection of photographs of the Magellanic Clouds has been obtained with the 24-inch Bruce refractor and other telescopes. Spectroscopic observations of various objects in the Clouds have also been made by Dr. R. E. Wilson at the Southern Station of the Lick Observatory at Santiago, Chile. Pioneer work of discovery of objects in the Magellanic Clouds was done by Miss Leavitt of the Harvard College Observatory twenty years ago when she discovered on photographic plates then at hand 1777 variable stars chiefly Cepheids in the two Clouds. By showing the relation that exists between the period of light variations of these stars and their light-giving power she laid the foundation for the present valuable method of finding the distance of all far-distant universes in which such stars are found. In recent years Dr. Shapley, Miss Cannon, and other astronomers of the Harvard College Observatory have devoted much time to an extensive study of many objects in these rich fields including giant stars of various types, gaseous nebulae and open and globular star clusters. In the reports of these investigations some remarkably interesting and valuable results are set forth that reveal the exceptional richness and splendor of these far-away universes. Assuming the correctness of the distances assigned to them by the Harvard observers, we shall attempt to give here briefly a few of the outstanding facts about the Magellanic Clouds that have been gleaned from these reports and elsewhere, that may be of general interest.

The Small Magellanic Cloud, which is the brighter of the two, may be seen even in faint moonlight. Visually and in small telescopes it appears as an elongated patch similar in appearance to a bright portion of the Milky Way. Long exposures with more powerful telescopes show, however, that both clouds are practically circular in form.

The Large Cloud has an average diameter of 7.2 degrees and covers an area of about 40 square degrees. It would about fill the space included within the bowl of our Big Dipper. The Small Cloud has a diameter half as great and so covers an area about one-fourth as large, or ten square degrees. The Large Cloud lies in the constellation of Dorado at a distance of about 20 degrees from the south pole and the Small Cloud in Tucana near the boundary between Tucana and Hydrus about 15 degrees from the pole. The two Clouds form with each other and the south pole a nearly equilateral triangle and they are often made use of to locate approximately the position of the south pole.

The latest estimates of the size and distance of the two Clouds indicate that the Large Cloud has a diameter of 14,000 light-years and is distant from the Earth 112,000 light-years. The Small Cloud has a diameter of 6,500 light-years and is distant 102,000 light-years. Both Large and Small Cloud are receding from the Earth at high velocity. From spectroscopic observations of gaseous nebulae in the Clouds made at Arequipa and Santiago it is estimated that the Small Cloud is speeding through space at the rate of 105 miles per second and the Large Cloud at the rate of approximately 170 miles per second. The two clouds are separated from each other by a distance of 40,000 light-years or about three times the diameter of the Large Cloud.

To all appearances the Magellanic Clouds are far-flung clouds of the Milky Way. Were they at some time in the distant past a portion of our own Milky Way system and, if so, in what way they escaped its control are interesting questions. Dr. Shapley has estimated that if the present velocity of 105 miles per second of the Small Cloud has been maintained in the past it would have been in or near the Milky Way about 190,000,000 years ago, which seems not so long ago when one considers that 1,000,000 years is but a brief period in the life of a star or even of our own planet.

Both Clouds are remarkable for the great size and luminosity of the stars which they contain. At the distance assigned to the Small Cloud our Sun would be a star of the twenty-third magnitude far beyond the reach of the most powerful telescopes. There are in the Small Cloud about 260,000 stars that are more than one hundred times

brighter than our Sun and about 300 stars that at a distance of ten parsecs or 33 light-years would shine with a luminosity exceeding that of the planet Venus fully fifteenfold and would cast shadows on the Earth. It has been estimated, moreover, that there are in the Small Cloud more than 500,000 stars brighter than the eighteenth magnitude and within reach of the most powerful telescopes.

Though visually the Large Cloud is less brilliant than the Small Cloud it is known to contain at least 20 or 30 stars brighter than the most luminous stars in the Small Cloud, including the most brilliant known star in the heavens, S Doradus, and a vast, diffuse, gaseous nebula, 30 Doradus, that is by far the largest and brightest known. S Doradus, like so many of the supergiants is a deep red, variable star and lies in a nebulous field in an open star cluster. It is estimated to be more than 500,000 times brighter than our own Sun and to have a diameter of the order of a thousand million miles so that it may far surpass in size any known giant star in our Milky Way system.

The great gaseous nebula, 30 Doradus, which is of a peculiar looped form, has an entire diameter, including outlying wisps and loops of nebuolsity, of approximately 560 light-years. The brighter nucleus has a diameter of 65 light-years with loops and extensions of fainter luminosity that makes its total diameter 130 light-years. It is estimated that this magnificent nebula is ten or eleven magnitudes brighter than our Great Orion Nebula. Were it at the distance of the Orion Nebula or 650 light-years from the Earth it would cover almost the entire constellation of Orion and its light would cast a shadow on the Earth. Were it at a distance of ten parsecs or 33 light-years our solar system would lie on the outskirts of its central nucleus and would receive from it a light several fold stronger than that of the full Moon.

If our solar system were transferred to either one of the Magellanic Clouds it is doubtful if any corner could be found where the heavens at night would not be ablaze with the lights of many stars surpassing in splendor our most brilliant stars and planets. For in their richness of treasures of supergiant stars, globular and open star clusters and vast and brilliant diffuse nebulae these distant universes seem to far excel that particular field in the Milky Way through which our Sun with his planets is now passing.