

PHOTOGRAPHS OF TWO GREAT SOUTHERN GALAXIES

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On the night of Sunday, September 2, 1945, conditions on Mount Wilson were remarkably favorable for astronomical photography. Saturday night had been partly cloudy, and on Sunday morning there was an unseasonable shower. At sunset on Sunday the sky was largely overcast and a rain squall was visible near the coast, 35 miles west; but the clouds had begun to disperse by nine o'clock, and during the remainder of the night, although there were occasional clouds, the sky between them was very clear and the seeing was superb. The Observatory had just received from the Eastman factory a consignment of new 103aO plates which combine high speed with remarkable fineness of grain. On this favorable night, with these excellent plates, and with the 100-inch telescope, the photographs reproduced in Plates XIV and XV were made, showing two great nebulae in Sculptor, near the south galactic pole, which rise to only a moderate altitude for observers in the United States. The exposures, though much shorter than has been customary for such faint objects, could not have been much longer at that low altitude without accumulating a detrimental amount of sky fog.

NGC 55 (α $0^{\text{h}} 12^{\text{m}} 5$, δ $-39^{\circ} 30'$, 1950.0; gal. long. 295° , gal. lat. -77°), Plate XIV, *b*, was described by Sir John Herschel in his *Observations at the Cape of Good Hope* (1834–1838) as “very bright, very large; very much elongated; at least 25' long and 3' broad a very long irregular crooked ray the following part is faint; the preceding and shorter, trinuclear. A strange object.” Herschel's drawing is reproduced in Plate XIV, *a*. Shapley and Miss Ames¹ classify this nebula as a spiral, of total photographic magnitude 7.8, and they agree with the dimensions given by Herschel. On the original negative (Plate XIV, *b*), I find the dimensions $3' \times 29'$. The spiral character seems doubtful to me, and from this photograph

¹ *Harv. Ann.*, **88**, No. 2, 1932.

and another that I made earlier with the 100-inch I am inclined to describe the nebula as irregular (like M 82 or NGC 4449). On weaker plates, one might be tempted to regard the preceding and following parts as separate nebulae seen perhaps in perspective, but here they are clearly connected or enveloped by faint nebulosity. Obscuration is conspicuous, especially in the brighter, preceding part.

The star images are somewhat distorted by atmospheric dispersion, which at the focus of the 100-inch mirror used at so low an altitude is by no means negligible.

The beautiful nebula NGC 253 (α 0^h 45^m1, δ -25° 34', 1950.0; gal. long. 100° , gal. lat. -88°), Plate XV, was discovered by Caroline Herschel in 1783. It is described in the *NGC* as "very remarkable; very, very bright; very, very large; very much elongated; gradually brighter in the middle"; and by Shapley and Miss Ames as spiral, class c, $22' \times 6'$ in size, total magnitude 7.0. This would place it as the second-brightest spiral in the sky. Its photographic magnitude as measured by A. E. Whitford with the photoelectric photometer² is 8.1, placing it as the fourth-brightest spiral, exceeded by M 31 (the great Andromeda nebula), by M 33, and by M 81. Visually, it appears as a ghostly ray. It has been photographed with the 42-inch reflector at Flagstaff by C. O. Lampland, who has sent me a positive from one of his excellent plates.

The photograph reproduced in Plate XV shows clearly a right-handed spiral in which there is much beautiful detail. I find the size to be $24' \times 5'$ and infer that the principal plane is inclined 78° to the plane tangent to the celestial sphere. There are numerous stars so arranged as evidently to belong to the nebula, and there are also small bright objects that differ from stars by having the slightly hazy appearance that would be expected of globular star clusters if situated at an extragalactic distance. One of these, examined under magnification on the original negative, shows a bright nucleus bisected by a luminous bar. This object is about $10''$ in diameter. In Plate XV, *a*, it is 24 mm from the bottom and 44 mm from

² *Mt. W. Contr.*, No. 543; *Ap. J.*, **83**, 424, 1936.

the right edge; in Plate XV, *b*, 16 mm from the bottom and 31 mm from the right edge. There is strong obscuration in the nebula, especially on the north-preceding side; and there is a faint veil of amorphous nebulosity which is particularly evident at the north-following end and which suggests the effect of vast numbers of faint stars such as have been revealed by W. Baade in the nuclear region of the Andromeda nebula and in some other galaxies. In the surrounding field there are many small nebulae, evidently more distant galaxies, as would be expected to appear in this region, which is only 2° from the south galactic pole.

Dr. Harlow Shapley has kindly compared a print from this plate with a negative of the same region made near the zenith at the Harvard station at Bloemfontein with an exposure of three hours at the Bruce telescope. On the Bruce plate is a magnitude system previously set up in the course of the Harvard general surveys. Dr. Shapley states that the print shows stars to approximate magnitude 19.5 on the Harvard scale, and that the brightest stars in my photograph which can be attributed with considerable certainty to the nebula are of magnitude 17.5. E. P. Hubble's measures³ give 18.3 as the mean photographic magnitude of the nebula's brightest stars, resulting in a distance-modulus of 24.6 magnitudes, a distance of 2,800,000 light-years, a diameter of 19,000 light-years, and an absolute magnitude of -16.5 . The corresponding figures from Shapley's estimate are 23.8 magnitudes, 1,875,000 light-years, 13,000 light-years, and -15.7 magnitudes.⁴ It appears therefore that NGC 253, though much smaller than our own galaxy, is a spiral galaxy that is both larger and brighter than the average.

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³ *Mt. W. Contr.*, No. 548; *Ap. J.*, **84**, 158, 1936.

⁴ The total magnitude given by Shapley and Ames, 7.0, indicates an absolute magnitude 1.1 brighter.