JOHN CHARLES DUNCAN'S PHOTOGRAPHIC STUDIES OF NEBULAE

PEDRO RÉ
http://pedroreastrophotography.com/

John Charles Duncan (1882-1967) is mainly known for his photographic demonstration of expansion in the Crab nebula (M1)[1]. He is also the author of *Astronomy*, a standard college textbook for more than 30 years, which is illustrated with many astronomical photographs obtained by Duncan at Mount Wilson Observatory.

Duncan received his BA in 1905 and his Master in 1906, both at the Indiana University. He was a fellow of Lowell Observatory obtaining a PhD in 1909 at the University of California. His dissertation was on Cepheid variables and his supervisor was William Wallace Campbell (1862-1938).

From 1909 until 1916 Duncan was an instructor in astronomy at Harvard University and later became Professor of astronomy and director of Whitin Observatory.

Duncan compared a photograph obtained in 1909 by George Willis Ritchey (1864-1945) with one he took in 1921 with the same instrument (60" reflector Mount Wilson Observatory). He was able to demonstrate that the filaments of the planetary nebula M1 were expanding[2]. Confirmation of these expansion came in 1938 when Duncan obtained another photograph of the Crab Nebula (Figure 1).

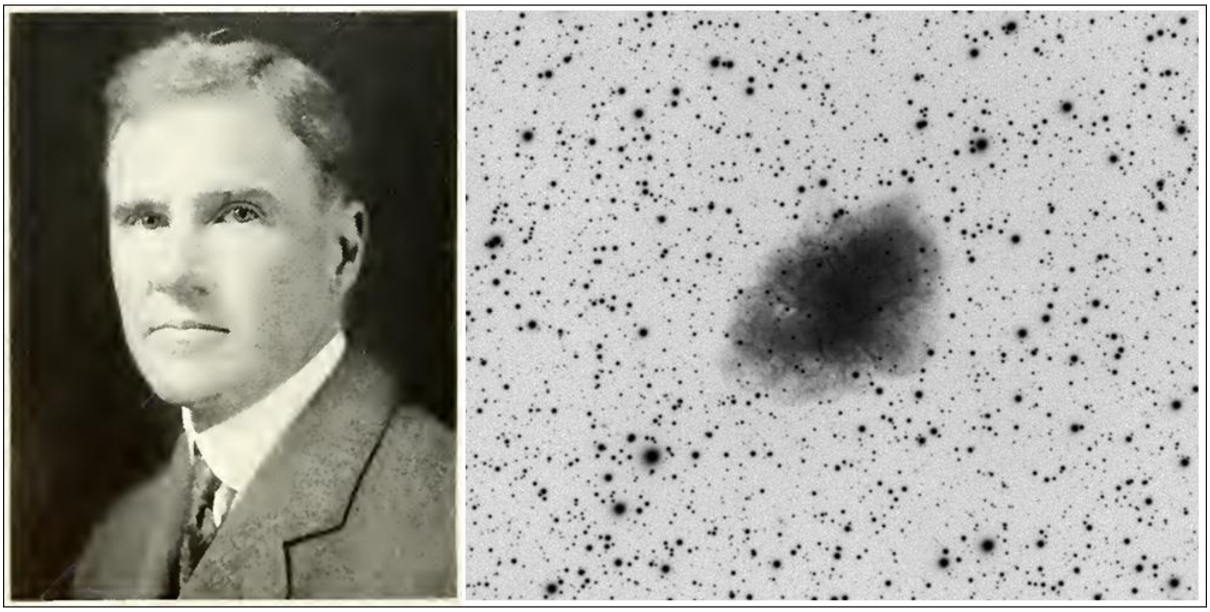


Figure 1 – John Charles Duncan, Crab Nebula (Pedro RÉ, TMB175 F/8, STL11000).

[1] The Crab nebula, located in the constellation of Taurus, is associated with the pulsar NP 0532. It is the remnant of a supernova observed in Japan and China in A.D. 1054.

[2] J.C. Duncan compared photographic plates taken 11.5 years apart and found that the Crab Nebula was expanding at an average of about 0.2" per year; backtracking of this motion showed that this expansion must have begun about 900 years ago. Duncan, J.C. (1921). Changes Observed in the Crab Nebula in Taurus. Mt. Wilson Communications, No. 76. *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 7 (6): 179-180.

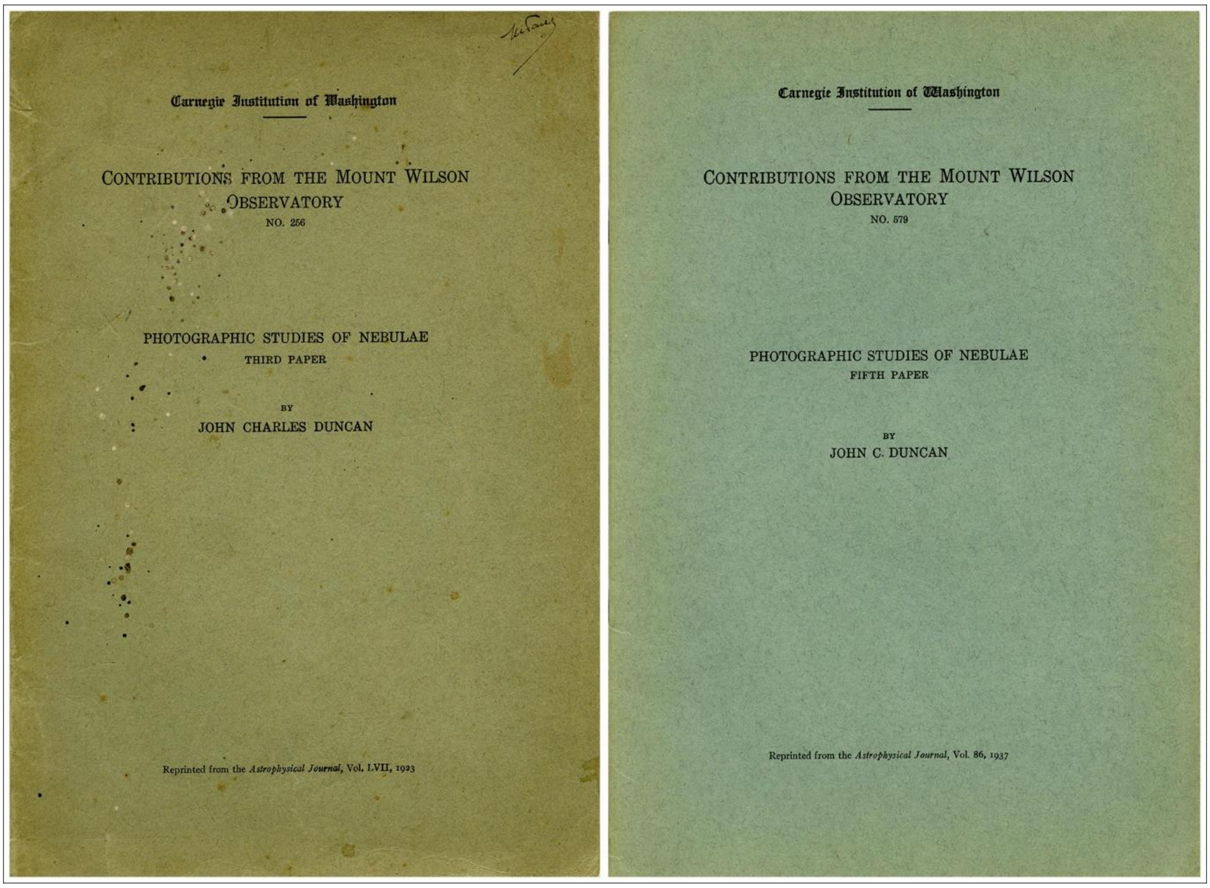


Figure 2- Photographic Studies of Nebulae (third and fifth papers), 1927 and 1937.

Duncan was also interested in comets, spectroscopic binary stars, and novae. His photographic studies of Nebulae were obtained during several visits he made to Mount Wilson Observatory as a guest astronomer in 1920 and during subsequent summers spent as a voluntary research assistant[3] (Figure 2).

John Charles Duncan used the 60", 100" Hooker and later the 200" Hale telescopes to obtain some of the finest astrophotographs ever taken. His image of B33 taken in 1920 is now known as the Horsehead Nebula[4]. Duncan used the 60" and 100" telescopes, in 1939, to obtain colour photographs of star clusters and Nebulae using Kodachrome sheets. In the same year during the Sixty-Second meeting of the American Astronomical Society Duncan reported on his experiments with colour Photography of Nebulae:

With the 60-inch and 100-inch Mount Wilson Telescopes, the author has photographed a few nebulae and star-groups on sheets of Kodachrome Aim, "daylight" type, size 4x5 inches, Vivid pictures of certain star clusters were obtained, notably of Chi Persei with an exposure of two minutes and of M11 Scutti with as exposure of thirty minutes. These show star images of a wide range in magnitude and colour ranging from a pronounced blue to a deep orange red. The colours of bright as well as faint stars are well shown while the centre of the image of a bright coloured star might be overexposed, there is near its edge a zone correctly exposed (…). Certain coloured planetary nebulae also are well pictured. The

[3] Duncan published six papers on "Photographic Studies of Nebulae" in the years 1920-1949.

[4] Duncan obtained on November 13, 1920, a three-hour photograph of the Horsehead nebula with the 100-inch Hooker telescope. It is this image which gave the name of, the up until then, anonymous dark nebulae.

colours of certain diffuse gaseous nebulae, on the other hand, appear strange, for example the grrat nebulae M42 and M8 which over most of their areas are green to the eye and photographed without a filter are bright purple and with a W2A filter, which stops the ultra-violet light but very little visible light, are red. On the Orion nebulae, exposures were made with the 100-inch up to 45 min and with the 60-inch up to two hours. They show especially well the multitude of faint red and the portions of the nebulae which appear reddish to the eye (…).

PLATE VI

North

Negative Δ 127

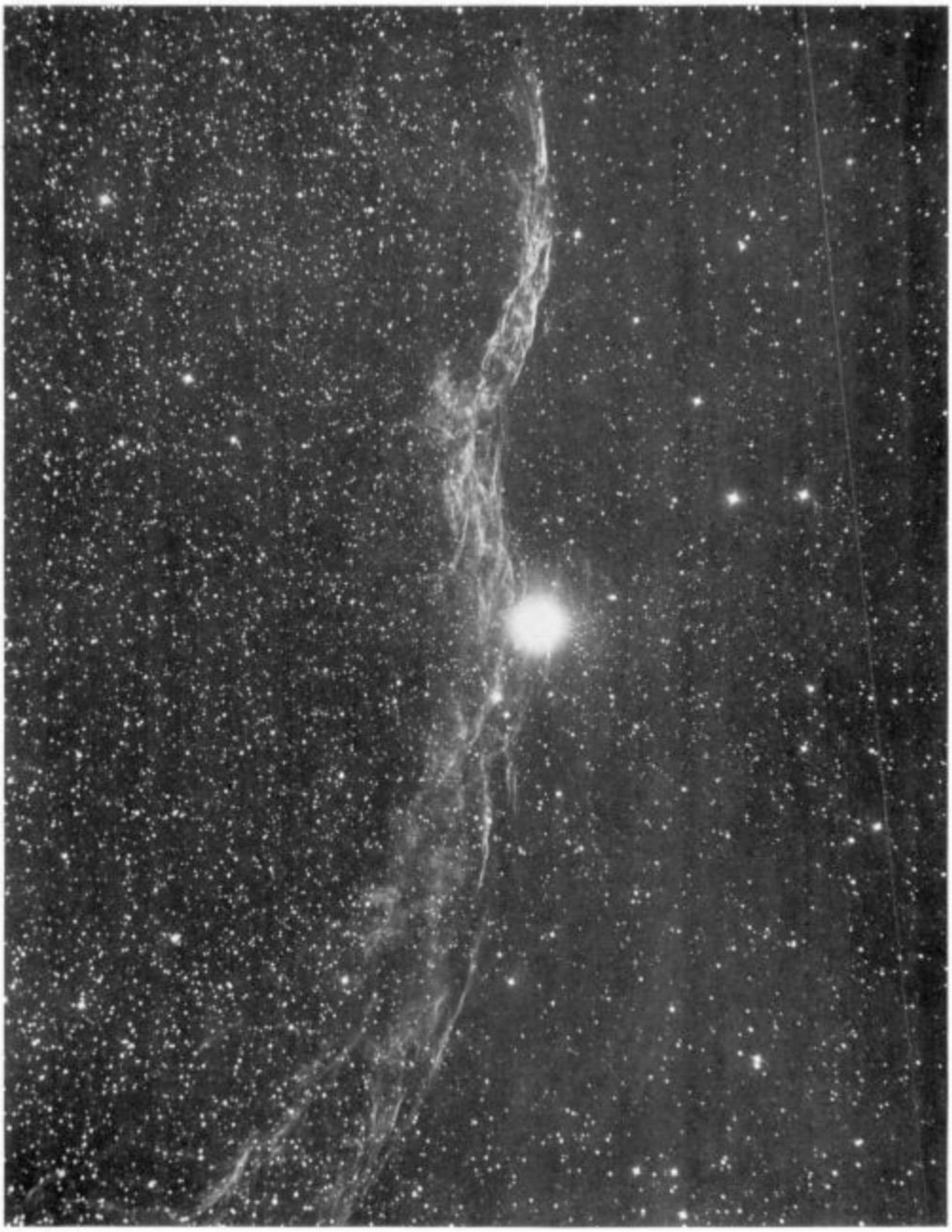
THE NEBULA N.G.C. 1977, SURROUNDING *c* ORIONIS

Photographed with the 100-inch Hooker telescope, 1921, January 7. Exposure, 5^h40^m

Scale: 1 mm = 18″.2 (0.87 that of original negative)

PLATE XIII

North



Negative Δ 203

THE NEBULA N.G.C. 6960 CYGNI, WITH METEOR TRAIL

Photographed with the 100-inch Hooker telescope, 1921, August 3. Exposure, 7 hours
Scale: 1 mm = 21.″9 (0.72 that of original negative). The line on the right is the meteor trail

PLATE IX

North

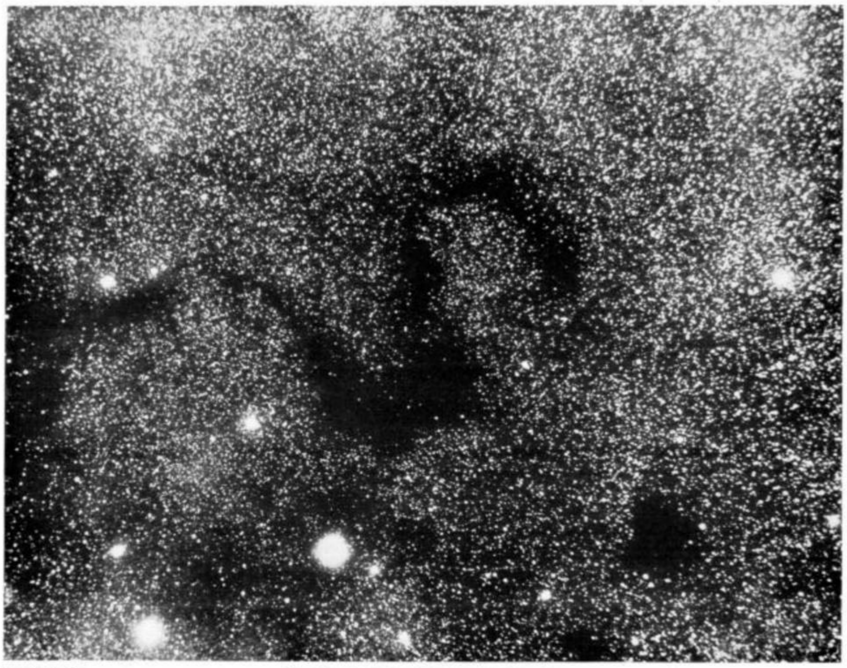
Negative Δ 184

THE TRIFID NEBULA, N.G.C. 6514 = M20 SAGITTARII

Photographed with the 100-inch Hooker telescope, 1921, June 30. Exposure, 2^h30^m
Scale: 1 mm = $11''.5$ (1.37 times that of original negative)

PLATE VIII

North



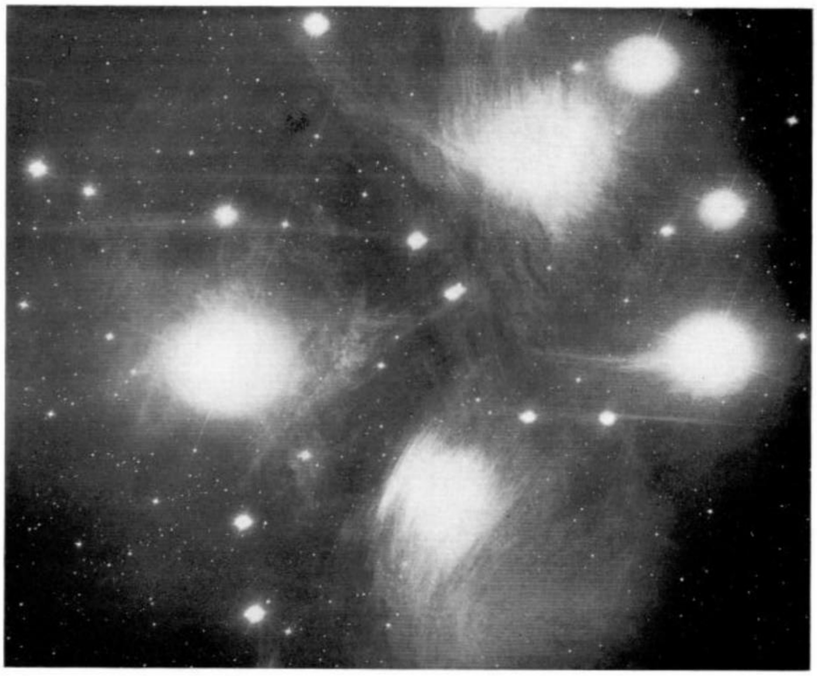
Negative Δ 189

THE DARK NEBULA BARNARD 72 OPHIUCHI

Photographed with the 100-inch Hooker telescope, 1921, July 4. Exposure, 2^h45^m
Scale: 1 mm = 18″.2 (0.87 that of original negative)

PLATE XIV

North



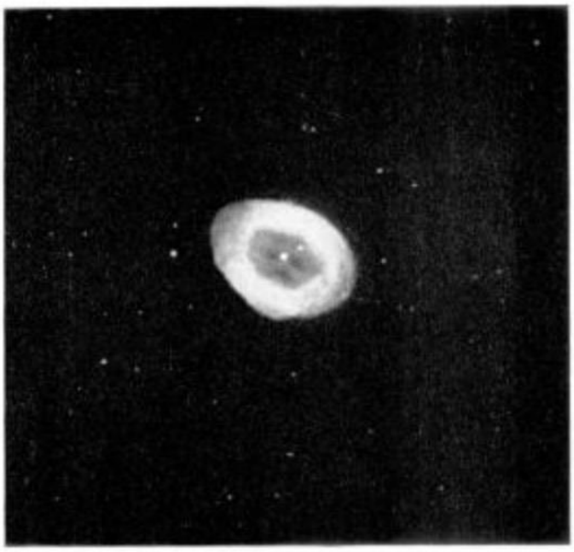
THE PLEIADES

Negative Δ548. Photographed with the 100-inch telescope (aperture reduced to 84 in.) and Ross zero-power correcting lens, August 20, 1933. Imperial Eclipse plate. Exposure, 2 hours and 10 minutes. Scale: 1 mm = 23″.7.

PLATE XV

North

a



b

THE RING NEBULA IN LYRA

Photographed with the 100-inch Hooker telescope (aluminum-coated mirrors) and Imperial Eclipse plates. (*a*) Negative Δ554, aperture 84 inches, August 6, 1935; exposure, 15 minutes. (*b*) Negative Δ591, full aperture, August 13, 1936; exposure, 2 hours. Scale of both cuts: 1 mm = 5″.3.