LEWIS MORRIS RUTHERFURD (1816-1892), LAWYER, SPECTROSCOPIST AND ASTROPHOTOGRAPHER

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Lewis Morris Rutherford (1816-1892) performed pioneering work in spectral analysis and experimented with astronomical photography. He invented several instruments for his studies, including a micrometre for measuring astronomical photographs, a machine for producing improved ruled diffraction gratings and the first telescope designed specifically for astrophotography. He produced many photographs of the Sun, Moon, and planets, as well as star clusters and stars down to the fifth magnitude.

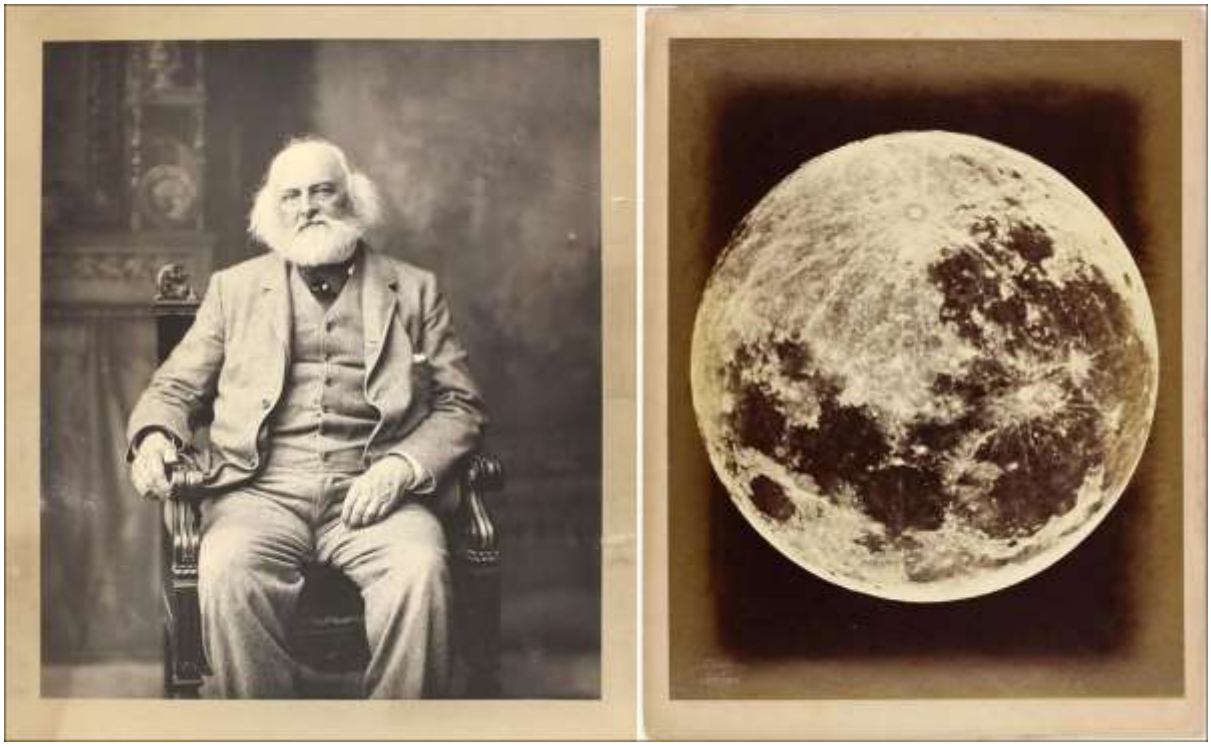

Figure 1- Lewis M. Rutherfurd, Full Moon image obtained in 1858.

Lewis M. Rutherfurd was born at Morrisania, Bronx N.Y. and entered Williams College at the age of fifteen. After graduation in 1834 he studied law and was admitted to the bar in 1837. Lewis Rutherfurd although coming from an unlikely legal background and having received no formal scientific education, made contributions to Astronomical Spectroscopy that were truly ground-breaking. He was also the first person to build a telescope suitable for photographic use. With this instrument he took photographs of the Moon, which were for over twenty years unequalled in their quality.

After pursuing the study of law for two years in the office of William H. Seward, at Auburn, and afterwards in that of George Wood, in New York city, he began the practice of his profession as partner of Mr. Peter A. Jay, and subsequently continued it as partner of the late Hamilton Fish.

Astronomy had for him a higher charm than legal studies and Rutherford devoted himself more and more to scientific studies. An observatory, with an 11 ¼ -inch telescope constructed by Henry Fitz and

a good transit-instrument afforded opportunity for different researches of a higher character than those of a mere amateur, and later a workshop was gradually equipped with apparatus which he employed for the construction of instruments the precision of which was hardly, if at all, surpassed in his time.

Figure 2- Two stereographs of the moon by Lewis M. Rutherfurd and Henry Draper.
Pedro Ré's private collection.

In 1849 he travelled in Europe and studied with the Italian optician Giovanni Battista Amici (1786-1863). On his return to New York City he erected in his garden, at the back of his house at the corner of Second Avenue and Eleventh Street, a small observatory.

His astronomical observatory was built in the last half of 1856 and in 1858 he began his experiments in astronomical photography. During the summer of that year he obtained negatives of the full moon which would well bear an enlargement of fifty diameters, and stereographs which gave excellent effects (Figure 2).

His first scientific paper dated July 28, 1862 (American Journal of Science, September 1862), confirmed Clark's discovery of the companion of Sirius and provided a series of measures. The laboratory experimentation of Kirchhoff and Bunsen in spectroscopy was attracting great attention. Turning his attention to this field, Rutherfurd followed up the observational work of Fraunhofer and succeeded in observing the general characteristics of the spectra of the Sun, Moon, and a few stars.

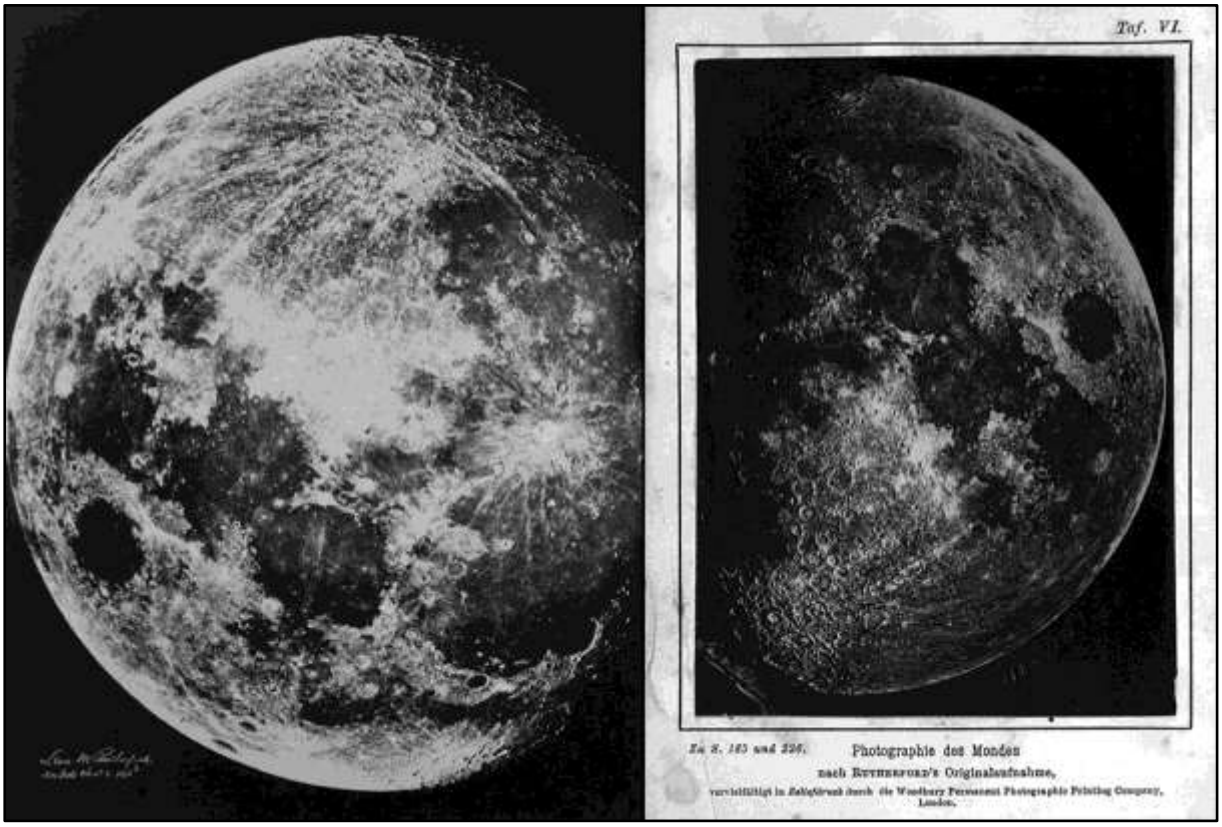

Figure 3- Wet collodion Moon images obtained by Lewis M. Rutherfurd in 1865.

In his paper, dated December 4, 1862 (American Journal of Science, January 1863) he attempted, for the first time, a classification of stellar spectra, which agrees essentially with that published later by Angelo Secchi. During this research he realized that the spectroscope could be used to determine the colour curve of a telescope objective and, using this discovery to test his work as it progressed, he succeeded, in 1864, in finishing an objective, 11 ¼ inches in diameter, designed solely for astrophotography. A 13-inch telescope which could be converted from a visual to a photographic instrument by the addition of a third lens was finished in 1868[1]. With these instruments he made many photographs of the Sun and Moon (Figure 3 to 5).

Realizing the value and convenience of obtaining a photographic record of the relative positions of stars, Rutherfurd initiated an extensive program of photographing numerous star fields. The measurement of the plates was carried out on an engine which he devised and built. In the first design the micrometre wire was carried entirely across the plate by a very long screw. Later a glass scale was added making it necessary to use the screw for measuring short distances only and thus greatly reducing the errors inherent in the screw. Troubled by the possibility that the photographic film might not stay fixed in position and thus impair the measures, Rutherfurd experimented and found that

[1] The 13-inch is now at in Magdalena, New Mexico and his owned by John W. Briggs. Briggs started collecting telescopes in New England in the early 1980s, having been inspired by historical telescopes and their history up at the Stellafane convention.

treatment with dilute albumen secured this necessary condition. He is to be credited with overcoming the mechanical difficulties of making an efficient spectroscope of hollow prisms filled with liquid maintained at uniform density. It was with a spectroscope of this type that he secured a photograph of the solar spectrum showing many new lines. He also devised the now well-known method of connecting the prisms so that they all automatically come to the angle of least deviation.

Figure 4- Solar images obtained in March and April 1890.

During 1870 he built an engine with which he succeeded in ruling interference gratings, which was superior to all others down to the time of Henry A. Rowland. Rutherfurd was a trustee of Columbia College for more than twenty-five years and took a leading part in establishing the department of geodesy and practical astronomy in 1881.

In 1883 he made an unconditional gift to the college of his entire observatory equipment, following this gift in 1890 with that of all his negatives and twenty folio volumes of plate measures. The work of measurement and reduction was later carried on by John K. Rees and Harold Jacoby.

175 plates of the Sun taken between 1860-74
174 plates of the Solar Spectrum taken between 1860-74
435 plates of the Moon taken between 1858-77
664 plates of the Star groups taken between 1858-77
33 plates of 44 Bootis taken between 1868-75
12 plates of B A. C. 8083 taken between 1873-74
27 plates of η Cassiopeæ taken between 1870-73
58 plates of μ Cassiopeæ taken between 1868-73

15 plates of β Cygni taken between 1875-76
24 plates of 21 Cygni taken between 1875-76
22 plates of 61 Cygni taken between 1871-76
19 plates of 7 Cygni taken between 1875-76
27 plates of Perseus Clusters taken between 1865-74
54 plates of Pleiades taken between 1865-74
23 plates of Præsepe taken between 1865-77
23 plates of 1830 Groombridge taken between 1872-77

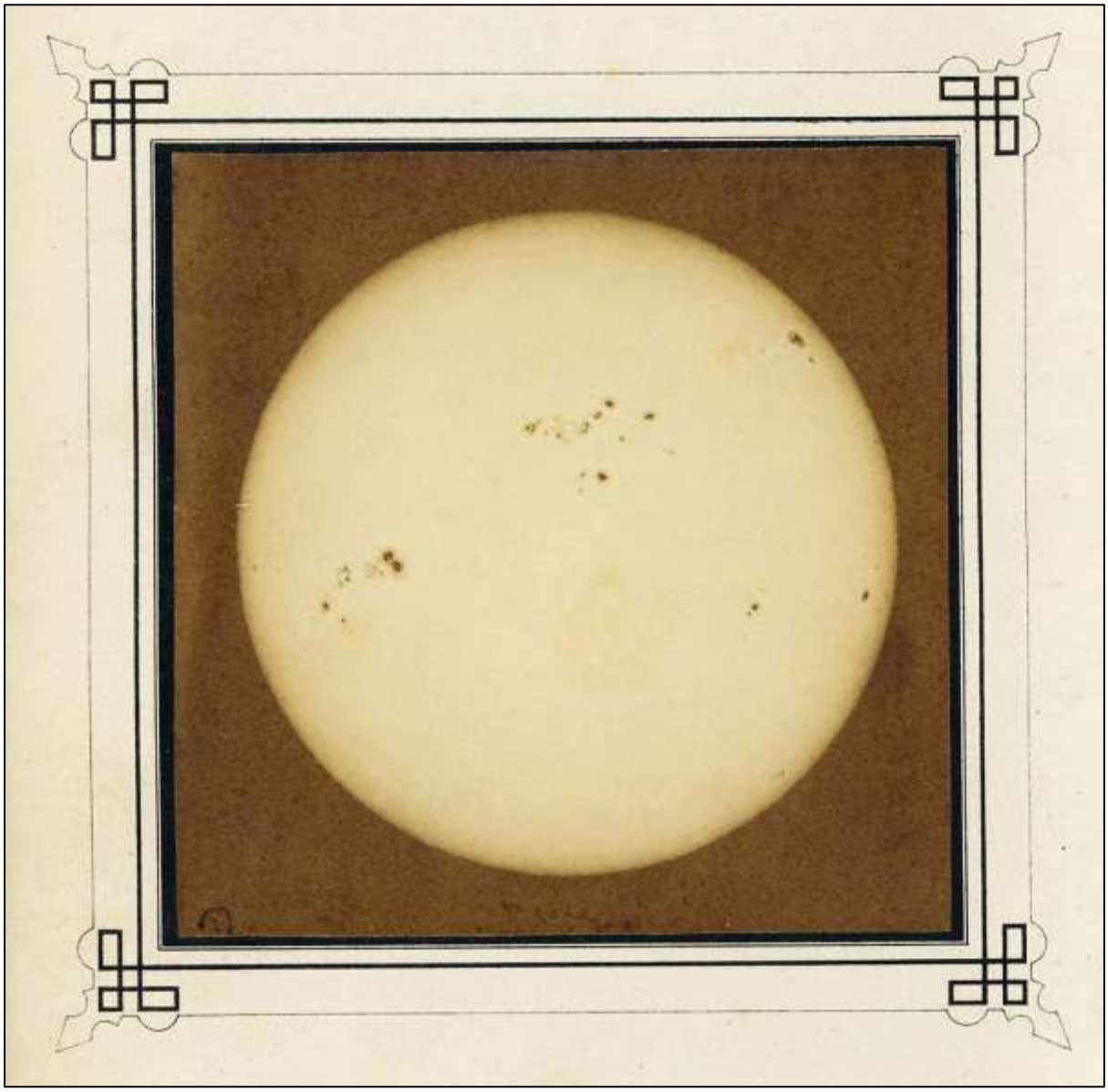

Figure 5- Photograph of the Sun by Rutherfurd in September 22, 1870.

Sources:
Hughes. S. (2013). *Catchers of the Light*. ArtDeCiel Publishing: 1612 pages.
http://www.nasonline.org/publications/biographical-memoirs/memoir-pdfs/rutherfurd-lewis.pdf