

GEORGE WASHINGTON HOUGH (1836-1909) PAPERS, 1855-1909

Series 29/1

Boxes 1-7 (and 5 oversize folders)

Biography

George Washington Hough was born near Albany, New York, the son of William and Magdalene Selmsler Hough, on October 24, 1836. He was educated in the Waterloo and Seneca Falls, New York public schools and earned a Bachelor of Arts in the scientific course from Union College in Schenectady, New York in 1856. After serving two years as a school principal in Dubuque, Iowa, Hough did graduate work in mathematics and engineering at Harvard University. He received a Master of Arts degree from Union College in 1861.

In 1859 Hough became Assistant Astronomer of the Cincinnati Observatory under Ormsby McKnight Mitchel. In 1860 Mitchel took over the directorship of the Dudley Observatory in Albany, New York; bringing Hough with him as his assistant. Mitchel died of fever in 1862, while serving as a major general in the Union Army, and Hough succeeded him as Director of the Dudley Observatory.

Hough left Dudley in 1874 to enter the scientific machinery business in Riverside, Illinois, where he developed a number of instruments including self-recording barometers, anemometers, and chronographs. In 1879 he accepted the position of Director of the Dearborn Observatory in Chicago which had begun observations in October 1865. Located on the campus of the original University of Chicago at 3400 South Cottage Grove Avenue, the Observatory and its Director were supported and administered by the Chicago Astronomical Society. As Director, Hough held a professorship in astronomy at the University.

Beginning in 1881 the University experienced increasingly severe financial problems, until it was forced to cease operations in 1886. After securing title to the 18 inch refractor and other scientific instruments for the Astronomical Society in 1887, Hough planned and executed the removal of the Observatory to the Evanston campus of Northwestern University at the behest of Northwestern and Astronomical Society trustee Oliver Horton in early 1888. A building was constructed with a gift from University Trustee James Hobbs and on September 1, 1889 Hough was able to recommence observations. In addition to his directorship of Dearborn, Hough served as Professor of Astronomy at Northwestern from 1888 until his death in 1909.

Hough's research interests were broad. At the Dudley Observatory he studied comets, solar eclipses, and double stars. During his tenure at Dearborn he used the refractor, which had been used to discover the first double star, to discover over 250 double stars, and to measure a total of 550. He used the Observatory's meridian circle to chart star fields as part of several cooperative celestial mapping projects. Shortly after he came to Dearborn he began his systematic study of the planet Jupiter. He made the first accurate observations and measurements of the planet's red spot and various bands, and at the time of his death he was regarded as the foremost authority on Jupiter.

In addition to his astronomical observations, Hough was a major figure in the technological advances made in astronomical and meteorological instruments in the late nineteenth and early twentieth centuries. In the prephotographic era of astronomy he developed a mechanical star chart that produced colored dots on a chart according to the settings of the telescope. He invented or refined recording and printing barometers, thermometers, evaporators, anemometers, and meteorographs. He developed wet and dry thermometers and recording and printing chronographs (time clocks). He used the latter inventions to raise revenue for the

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Observatory by selling the correct time to the Chicago Board of Trade and the Elgin Watch Company. He was awarded a gold medal at the Columbian Exposition in 1893 for his printing barometer. He invented the revolving dome that is still being used for the Dearborn equatorial and an observation chair that moves in synchronization with the telescope. Hough also improved electrical instruments such as transmission dynamometers and electrical controls for the equatorial drive clock, and photographic equipment such as sensitometers and plate holders during the period that electricity and photography became widely used in astronomy.

Hough received an honorary LL.D. from Union College in 1891 and was elected a foreign associate of the Royal Astronomical Society of London in 1903. He was also a member of the Astronomische Gesellschaft in Leipzig and the American Philosophical Society.

Hough married Emma C. Shear in 1870, and they had two sons: George and William. Hough died in Evanston on January 1, 1909.

Description of the Series

The George Washington Hough Papers, spanning the years 1855 to 1909, comprise seven boxes and five Gaylord oversize folders. They are arranged in seven subseries: diaries and notebooks; correspondence; teaching material; research material; lectures; manuscripts and drafts; and published works. Included are diaries Hough kept as a student, lecture notes, professional and personal correspondence, class books, graded student exams, observational records, drawings of and data pertaining to scientific instruments, handwritten lectures, handwritten drafts of reports and articles, and offprint of scientific articles. The papers reflect the full range of Hough's interests from his student days until his death.

One folder of biographical material, consisting of Hough's Union College Master's degree certificate, miscellaneous notices of events, clippings, obituaries, lists of memberships and subscriptions, and an undated four page biographical sketch is filed in Box 1. Also included in the biographical folder is a draft of the agreement between Hough, his brother William and William Barclay that established the manufacturing firm of Barclay and Hough in August 1874. The agreement and several miscellaneous invoices provide the only information in the papers on Hough's business venture between 1874 and 1879.

Arrangement within folders is chronological.

1. Diaries and Notebooks:

Two diaries cover the years 1855 to 1856. Although they include sporadic entries illuminating Hough's daily activities, they are filled mainly with lecture and reading notes; mathematical, physics, astronomical problems and their solutions; and an index to the solutions. The notebook includes lecture notes from Hough's undergraduate course work in 1855. Volume II of the diary was also used to record astronomical observations after Hough became Assistant Astronomer at the Cincinnati Observatory in 1855. This data should be consulted in conjunction with related observational records in Box 4, Folder 6.

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2. Correspondence:

Eleven folders of correspondence span the period 1855 to 1900. The first ten folders, comprising the bulk of the correspondence, span Hough's student days and his early astronomical career from 1855 to 1867. The eleventh folder includes a relatively small amount of correspondence spanning Hough's career as the Director of the Dudley and Dearborn observatories from 1868 to 1900.

Included in the correspondence are professional and personal letters received by Hough, as well as a few copies or drafts of letters sent by him. Of particular interest is a series of letters from Major General O. M. Mitchel, Astronomer of the Dudley Observatory, responding to weekly reports sent to him during 1861-1862 by Hough, who had assumed the day to day operation of the Observatory in Mitchel's absence. Copies of Hough's reports are filed in Box 6, Folder 3. Also of interest is a letter dated December 11, 1862 (Box 1, Folder 8) from William H. Wells, on behalf of the Chicago Astronomical Society, seeking Hough's opinion on telescope lenses that might suit the needs of the newly formed Society.

Hough married in 1870 and in 1874 left his wife and children in Albany while he initiated a machinery manufacturing venture in Riverside (now part of Belvidere), Illinois with his brother William and William Barclay. The correspondence includes a number of letters from Emma Hough to her husband (Box 2, Folder 3) relating her feelings about their separation and her reluctance to follow him to Illinois.

The bulk of the correspondence details Hough's association with astronomers such as James Craig Watson of the Ann Arbor Observatory and Captain S. W. Gilliss of the Naval Observatory in Washington, D.C. Hough participated in a number of cooperative star mapping projects, many of them under the direction of the staff of the Naval Observatory. There are also letters from Alvan Clark, America's foremost nineteenth century lens maker, and creator of the 18½ inch Dearborn refractor. The correspondence is arranged chronologically.

3. Teaching Material:

One and one-half boxes of teaching material document Hough's teaching of astronomy at Northwestern from 1888 to 1909. There is also one class book for an astronomy course taught by Hough at the Dudley Observatory. Included are class books for astronomy and meteorology classes taught between 1891 and 1904 at Northwestern. Hough taught a sequence of two courses: general astronomy and astronomy and meteorology, which were offered as electives in the scientific course of study. The majority of the teaching material consists of graded student examinations from various astronomy and meteorology classes offered between 1892 and 1908.

4. Research Material:

The research materials comprise more than one and one-half boxes. Two types of material are represented: the bulk consisting of observational data gathered by Hough between 1859 and 1906. Included are one notebook containing data compiled during Hough's brief tenure as Assistant Astronomer at the Cincinnati Observatory and four folders of material from his directorship of the Dearborn Observatory. Data collected during the majority of his career at Dearborn has been retained with the records of the Dearborn Observatory (Series 29/2). The bulk of the data in the Hough Papers was compiled at the Dudley Observatory in Albany, New York between 1860 and 1874. Included are data on comets, asteroids, planetary motion, eclipses, and

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celestial mapping, and seven folders of unidentified data. The papers also include one Gaylord oversize folder (#1) containing miscellaneous observational data.

The other type of research material in the Hough Papers consists of nine folders of material relating to engineering problems, and the design and testing of scientific instruments. The material that reflects Hough's wide-ranging interest in the development and improvement of astronomical and meteorological instruments provides information documenting Hough's work on barometers, batteries, declinometers, thermometers, and star charts. One Gaylord oversize folder (#2) containing scientific instrument sketches is also included.

5. Lectures:

Twenty-one of Hough's lectures comprising three folders reflect his multiple roles as observatory administrator, educator, scientist, and observer of human nature. Most observatories in the nineteenth century were supported by private societies, whose members considered the observatory to be a cultural and educational resource, as well as a scientific endeavor. Consequently, many professional astronomers were also accomplished platform speakers, able to expound upon their researches to non-professional audiences. Hough's lectures reveal his versatility as a popularizer of his vocation.

6. Manuscripts/Drafts:

In addition to his extensive research, Hough was a prodigious author. The contents of eleven folders and three oversize folders reflect the breadth of his writings. Included are three folders of manuscript scientific articles, two folders of manuscript non-scientific articles, one folder of article fragments, and five folders of monographic manuscripts, including a complete draft of his book *History of Planetary Astronomy*. The Gaylord folders include manuscripts and typescripts of articles on Jupiter and other scientific topics.

7. Published Works:

Two folders contain offprints of thirty-seven scientific publications authored by Hough. No definitive bibliography of Hough's work exists but he authored more than sixty-two articles. A short bibliographic essay on Hough is in Box 1, Folder 1.

The bulk of the records documenting his astronomical observations at the Dearborn Observatory has been retained with the records of the Observatory (Series 29/2).

8. Oversize folders:

The material in the Gaylord oversize folders had been stored in rolls and bundles for many years. After pressing, these materials were still not sufficiently flattened to allow interfiling. The oversized folders include research materials and manuscript drafts which should be consulted in conjunction with related materials in the main body of the papers.

Provenance: The George Washington Hough Papers were separated from the Records of the Dearborn Observatory (Series 29/2) in February, 1982 as Accession #82-36. The Dearborn Observatory records were transferred to the University Archives prior to June 1974 as Accession # 74-65.

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Restrictions: None.

Separations: Twelve linear inches of unrelated publications and War Department weather maps were separated from the Hough Papers. The publications were discarded and the maps were transferred to the Government Publications Department.

Processor: Thomas Dorst; March 1982.

Scanned and Reformatted by: Rachel C. Teuer; August 24, 2004.

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Container List

| <u>Box</u> | <u>Folder</u> | <u>Title</u> | <u>Dates</u> |
|------------------------------|----------------------|---|-----------------------------------|
| 1 | 1 | Biographical Material | 1860, 1876-1879 |
| DIARIES AND NOTEBOOKS | | | |
| | 2 | Diary-Volume I | January 12, 1855-October 30, 1856 |
| | 3 | Diary-Volume II | Sept 11, 1855-October 28, 1855 |
| | 4 | Notebook | May 17, 1855-November 21, 1855 |
| CORRESPONDENCE | | | |
| | 5 | Correspondence | Feb 7, 1860-December 20, 1860 |
| | 6 | Correspondence | Feb 2, 1861-December 31, 1861 |
| | 7 | Correspondence | Jan 18, 1862-December 11, 1862 |
| | 8 | Correspondence | Feb 2, 1863-December 29, 1863 |
| | 9 | Correspondence | Jan 8, 1864-December 31, 1864 |
| | 10 | Correspondence | Jan 5, 1865-December 27, 1865 |
| | 11 | Correspondence | Jan 7, 1866-August 27, 1866 |
| 2 | 1 | Correspondence | Aug 28, 1866-December 31, 1866 |
| | 2 | Correspondence | Jan 1, 1867-December 20, 1867 |
| | 3 | Correspondence | Jan 1, 1868-July 19, 1900 |
| | 4 | Correspondence | n.d. |
| TEACHING MATERIALS | | | |
| | 5 | Class Books-Dudley Observatory | 1871-1873 |
| | 6 | Class Books-Northwestern University | 1891-1904 |
| | 7 | Class Cards for Astronomy A- Northwestern University | 1904 |
| 2 | 8 | Student Exams-Astronomy | December 15, 1892 |
| 3 | 1 | Student Exams-Astronomy | December 15, 1892 |
| | 2 | Student Exams-Astronomy | December 16, 1895 |
| | 3 | Student Exams-Astronomy | December 16, 1895 |
| | 4 | Student Exams-Astronomy | February 8, 1900 |
| | 5 | Student Exams-Astronomy | February 10, 1903 |
| | 6 | Student Exams-Astronomy | February 10, 1903 |
| | 7 | Student Exams-Astronomy | February 8, 1905 |
| 4 | 1 | Student Exams-Astronomy | February 8, 1905 |
| | 2 | Student Exams-Astronomy | February 11, 1907 |
| | 3 | Student Exams-Astronomy | June 8, 1901 |

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| <u>Box</u> | <u>Folder</u> | <u>Title</u> | <u>Dates</u> |
|--------------------------|----------------------|--|---|
| 4 | 4 | Student Exams-Astronomy | June 10, 1908 |
| | 5 | Student Exams-Miscellaneous | n.d. |
| RESEARCH MATERIAL | | | |
| | 6 | Observational Records-Cincinnati Observatory | October 29, 1859-July 18, 1860 |
| | 7 | Observational Records-Dudley Observatory-Solar Eclipse | July 18, 1860 |
| | 8 | Observational Records-Dudley Observatory-Comet | 1861 |
| | 9 | Observational Records-Dudley Observatory-Comet Orbits | 1861 |
| | 10 | Observational Records-Dudley Observatory-Comets | 1862 |
| 5 | 1 | Observational Records-Dudley Observatory-Planetary Observations | August 20, 1862-October 8, 1862; 1869-1870 |
| | 2 | Observational Records-Dudley Observatory-Asteroids | 1861-1864 |
| | 3 | Observational Records-Dudley Observatory-B. J. Stars | 1861-1865 |
| | 4 | Observational Records-Dudley Observatory-Washington Stars | 1865-1868 |
| | 5 | Observational Records-Dudley Observatory-Transit Circle | 1868 |
| | 6 | Observational Records-Dudley Observatory-Eclipse | 1869 |
| | 7 | Observational Records-Dudley Observatory-Recorded Charts | Dec 26, 1870-December 28, 1870 |
| | 8 | Observational Records-Dudley Observatory-Revision of the Lake Survey Catalogue | March 27, 1871 |
| | 9 | Observational Records-Dudley Observatory-Gaertner | October 23, 1872-May 26, 1874 |
| | 10 | Observational Records-Dudley Observatory-Miscellaneous | August 10, 1862-August 18, 1862 |
| | 11 | Observational Records-Dudley Observatory-Miscellaneous | n.d. |

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| <u>Box</u> | <u>Folder</u> | <u>Title</u> | <u>Dates</u> |
|-------------------|----------------------|---|--|
| 5 | 12 | Observational Records-Dudley Observatory-Miscellaneous | n.d. |
| | 13 | Observational Records-Dudley Observatory-Miscellaneous | n.d. |
| | 14 | Observational Records-Dudley Observatory-Miscellaneous | n.d. |
| | 15 | Observational Records-Dudley Observatory-Miscellaneous | n.d. |
| | 16 | Observational Records-Dudley Observatory-Miscellaneous-Fragments | n.d. |
| | 17 | Observational Records-Dearborn Observatory-Notebook | 1880 |
| | 18 | Observational Records-Dearborn Observatory-Jupiter-Miscellaneous | June 11, 1899-June 9, 1900; January 1, 1906 |
| | 19 | Observational Records-Dearborn Observatory-Latitude Observations | n.d. |
| | 20 | Observational Records-Dearborn Observatory-Miscellaneous-Fragments | n.d. |
| | 21 | Scientific Instruments-Patent Applications | n.d. |
| | 22 | Scientific Instruments-Barometer- Drawings | |
| | 23 | Scientific Instruments-Barometer- Description | |
| | 24 | Scientific Instruments-Barometer-Data | |
| | 25 | Scientific Instruments-Batteries | |
| | 26 | Scientific Instruments-Declinometer | |
| | 27 | Scientific Instruments-Printing Thermometer | |
| | 28 | Scientific Instruments-Star Charter | |
| 6 | 1 | Scientific Instruments-Sketches | |

LECTURES

| | | | |
|---|---|---|------|
| 6 | 2 | "Numerical computations by machinery, with remarks on the economy of labor in science." (1) | n.d. |
| | | "Numerical computations by machinery, with remarks on the economy of labor in science." (2) | n.d. |

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|------------|---------------|---|--------------------------------|
| | | "Numerical computations by machinery, with remarks on the economy of labor in science." (3) | n.d. n.d. |
| | | "The uses of an observatory." | |
| | | "Thanks for the privilege of presenting the observatory." | |
| 6 | 3 | "Lectures before the Dudley Observatory Board of Directors." | 1857, 1858, 1878, 1908 n.d. |
| | | "Astronomy-first part-the planets." | |
| | | "Total solar eclipse, July 29, 1878 at Denver, Colorado." | n.d. n.d. |
| | | "The physical constitution of the sun." | |
| | 4 | "Lectures on astronomy." | n.d. |
| | | "Intellectual progress and attainments of our country." | n.d. |
| | | "The comet." | n.d. |
| | | "Stellar astronomy." "Lecture series." | 1862 |
| | | "Astronomy A." | n.d. |

MANUSCRIPTS/DRAFTS

| | | | |
|---|----|---|-----------------------------|
| | 5 | <i>Dudley Observatory Annual Reports</i> | 1861-1864; 1871; 1873; n.d. |
| | 6 | <i>Weekly Reports to O.M. Mitchel from the Dudley Observatory</i> | 1861 |
| | 7 | <i>Report Describing the Building and Instruments of the Dudley Observatory</i> | |
| | 8 | <i>Report on the Dudley Observatory</i> | |
| | 9 | <i>A Visit to the Dudley Observatory</i> | |
| | 10 | <i>Report to the Dearborn Observatory Board of Directors</i> | 1885 |
| | 11 | Scientific Papers-Drafts Folder | |
| | 12 | Scientific Papers-Drafts | |
| | 13 | Scientific Papers-Drafts | |
| | 14 | Non-Scientific Papers-Drafts | |
| 7 | 1 | Non-Scientific Papers-Drafts | |
| | 2 | Non-Scientific Papers-Drafts-Fragments | |
| | 3 | "Astronomical Declination of North Polar Distance"-Draft | |
| | 4 | "History of Planetary Astronomy"-no. 1-2 | |

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| <u>Box</u> | <u>Folder</u> | <u>Title</u> | <u>Dates</u> |
|-------------------|----------------------|--|---------------------|
| 7 | 5 | "History of Planetary Astronomy"-no. 3-4 | |
| | 6 | "History of Planetary Astronomy"-no. 5-6 | |
| | 7 | "History of Planetary Astronomy"-no. 7 | |

PUBLISHED WORKS

| | | |
|---|--------------|-----------|
| 7 | Publications | 1863-1896 |
| 8 | Publications | 1896-1908 |

OVERSIZE FOLDERS

| | |
|---|----------------------------------|
| 1 | Observational Data-Miscellaneous |
| 2 | Scientific Instruments-Sketches |
| 3 | Manuscripts-Jupiter Article |
| 4 | Manuscripts-Scientific Articles |
| 5 | Manuscripts-Fragments |