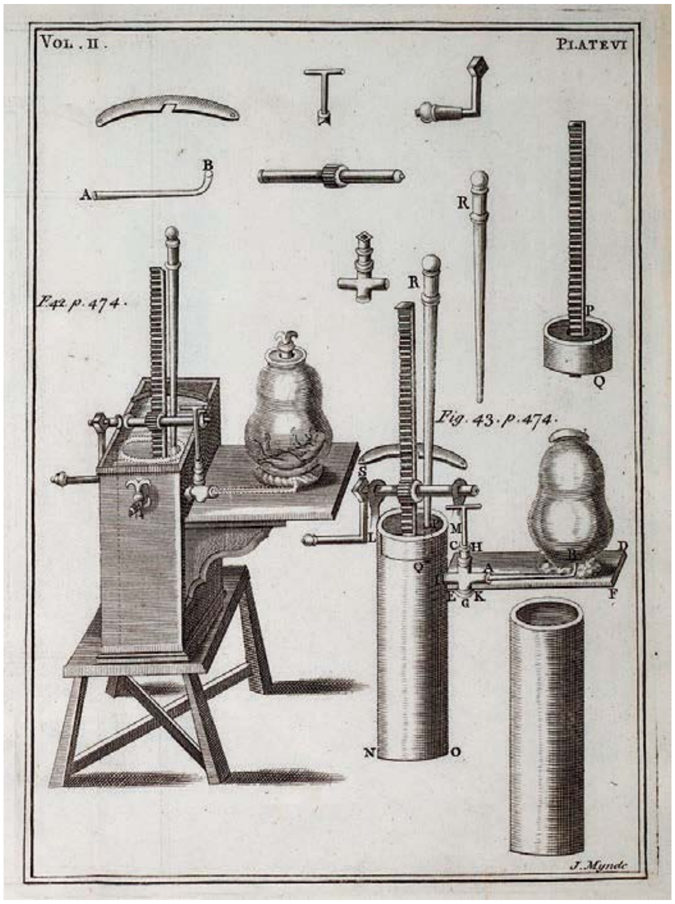
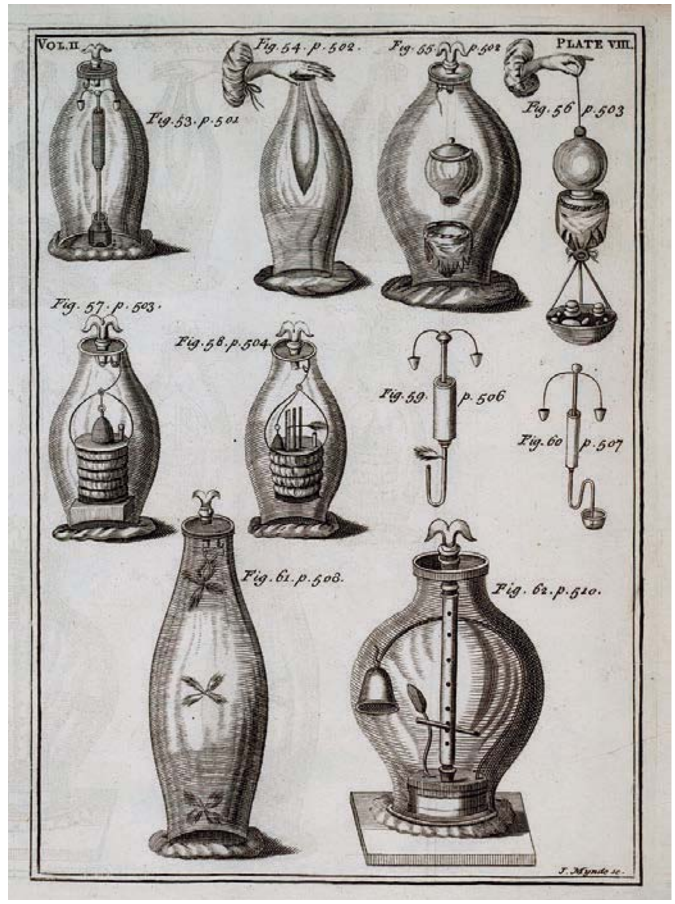




Malcolm Graham Donation of Works on Physics

Lauren Williams
Thomas Fisher Rare Book Library

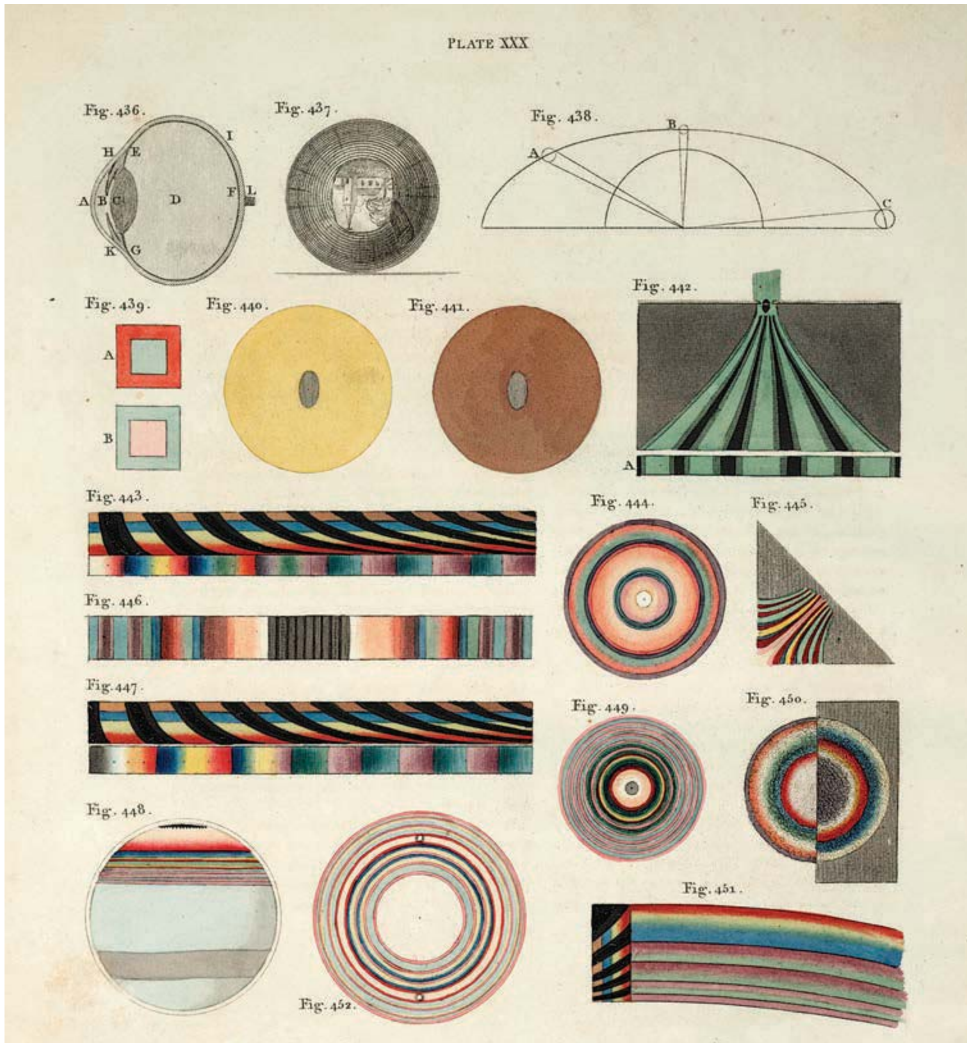
When we turn on a lightbulb, open the refrigerator, or drive to work; when we notice the static electricity in our clothes, slip on some ice, or shake a bottle of shaving foam; when we feel the sun's heat on our faces, or look up in wonder at the night sky, we are experiencing the physics of everyday life. As with all of the natural sciences, we benefit from the understanding and harnessing of physics principles throughout nearly every moment of our lives. Human knowledge of the physical forces that govern our world has developed over the course of centuries to such a remarkable extent that it is easy to take this knowledge for granted, especially for those of us who have not dedicated our lives to its study.

But imagine, if you will, a world where electricity, magnetism, gravity, and the origin of the universe had yet to be understood, or even theoretically conceived. It is staggering to consider the amount of time and the capacity for unique thought that would have been required, through trial and error, to discover and understand these aspects of our physical world. The vast majority of science today builds and depends upon the centuries of knowledge that have come before it, but throughout the history of physics we find instances of what can only be described as truly creative genius. Time and again, early natural scientists managed, through sheer determination and a profound sense of curiosity, to break from convention and to make the astounding leaps of logic necessary to grasp and define the makeup of the physical world.

The Graham Collection of works on physics, which was generously donated to the Fisher Library in 2015 by University of Toronto Professor Emeritus Malcolm Graham, contains an incredible number of the works in which these kinds of foundational discoveries were announced, and provides bibliographic documentation of the extraordinary lives and achievements of these pivotal figures.

Consider, for example, Michael Faraday (1791–1867). Born into a poor family in England, Faraday received no formal education, and at fourteen began a bookbinding apprenticeship. Faraday would often read the books and encyclopedias he was instructed to bind, and in this way managed to teach himself the principles of chemistry. He was later able to continue this informal education by serving as valet to a prominent English chemist. Despite these humble beginnings, Faraday would go on to lay the foundation of what would become nanoscience. He also invented an early form of the Bunsen burner, and discovered several chemical elements. His most important contributions were to the fields of electricity and magnetism, in which he discovered electromagnetic induction.

OPENING PAGE: Boyle, Robert. *The Philosophical Works of the Honourable Robert Boyle*. London: Printed for W. Innys and R. Manby, [1738]. Vol. II, plates VI and VIII. **BELOW:** Young, Thomas. *A Course of Lectures on Natural Philosophy and the Mechanical Arts*. London: Printed for Joseph Johnson, 1807. Vol. I, plate XXX.



His work, published in a series of papers by the Royal Society (1839–1855), was assembled into a three-volume set titled *Experimental Researches in Electricity*; a first edition of this groundbreaking work is one of the many highlights of the Graham Collection.

The Graham Collection also includes a first edition of the mathematical papers of George Green (1793–1841), who received only one year of formal schooling, at the age of eight. Green began working in his father's bakery when he was five years old, and would continue to earn his living by working at the family mill throughout the remainder of his life. In 1823, however, Green used his meagre earnings to join the Nottingham subscription library, and it was through this membership that Green was able to teach himself mathematics. Green went on to create a mathematical theory of electricity and magnetism, and his theory formed the basis on which the work of James Clerk Maxwell, William Thomson, and Michael Faraday was built.

It is remarkable to consider that so many of the fundamental laws of physics, along with the math that describes them, were established by non-academics, who would likely have a difficult time being published in scientific journals today.

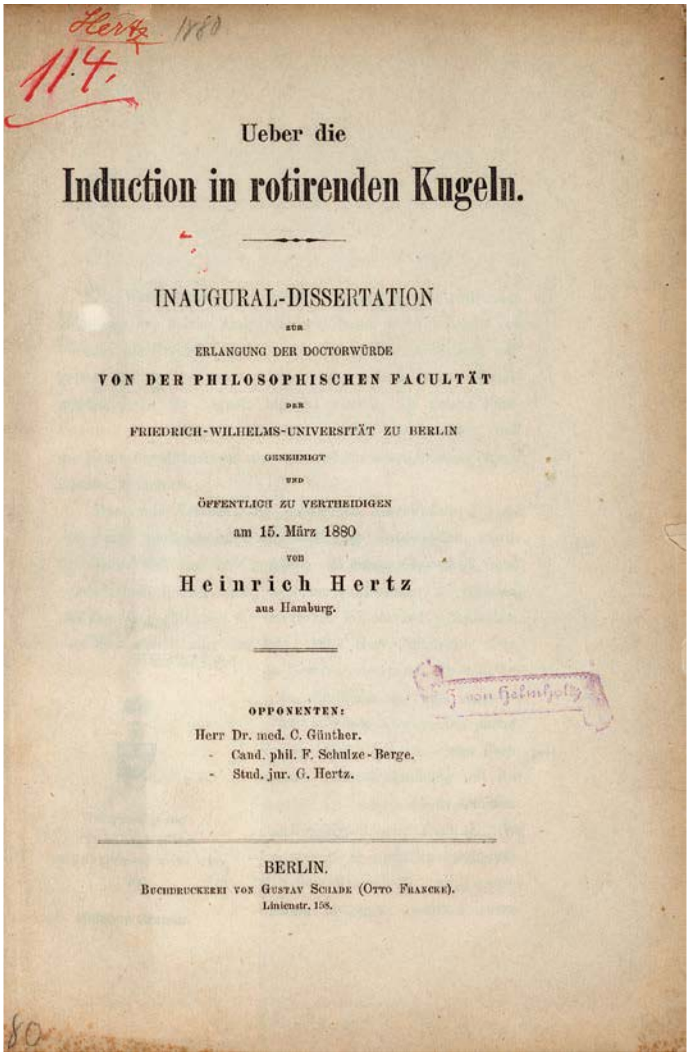
Not all scientists, however, emerged from humble beginnings. Robert Boyle — whose 1666 work *The Usefulness of Experimental Natural Philosophy* is the earliest in the Graham Collection — was born into a wealthy family, and received the best education available. Boyle was an early proponent of what would become known as the scientific method, and in addition to his many important contributions to the fields of chemistry and physics, he was also one of the founding members of the *Royal Society in London for Improving Natural Knowledge*. In the mid-seventeenth century, scientific ideas were predominantly shared through printed monographs and correspondence; as a result, their dissemination was slow and costly, and there were few opportunities for collaboration.

Boyle saw the Royal Society's secretary struggling to maintain the correspondence required to keep members informed of new developments, and in response, personally funded the publishing of what would become the first journal in the world devoted entirely to science — the *Philosophical Transactions of the Royal Society*. Many of the seminal works in the Graham Collection are in fact compilations of journal articles originally published in the *Philosophical Transactions*, a fact that speaks to the profound impact of this development in scientific scholarly publishing.

At 245 items, including monographs, periodicals, lectures, and offprints, the Graham Collection includes an incredible number of landmark publications and foundational discoveries in the history of physics. By extension, it also provides powerful physical evidence of the ways in which scientific information has been shared, received, and interpreted over the course of four centuries. The beautifully colourful plates from Thomas Young's *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (1807), featured above, for example, would not have been sold that way: an early owner would have meticulously coloured these diagrams by hand, perhaps to better understand the principles described by Young.

Items in the Graham Collection also highlight evidence of books shared between student and teacher, and between colleagues. The copy of Heinrich Hertz's PhD dissertation, *Ueber die Induction in rotirenden Kugeln* [*On Induction*

BELOW, LEFT TO RIGHT: Hertz, Heinrich. *Ueber die Induction in rotirenden Kugeln*. Berlin: Buchdruckerei von Gustav Schade (Otto Francke), [1880]. Faraday, Michael. *Experimental Researches in Electricity*. London: Richard and John Edward Taylor, 1839–1855. Vol. III, plate IV.



Hertz 1880
114.

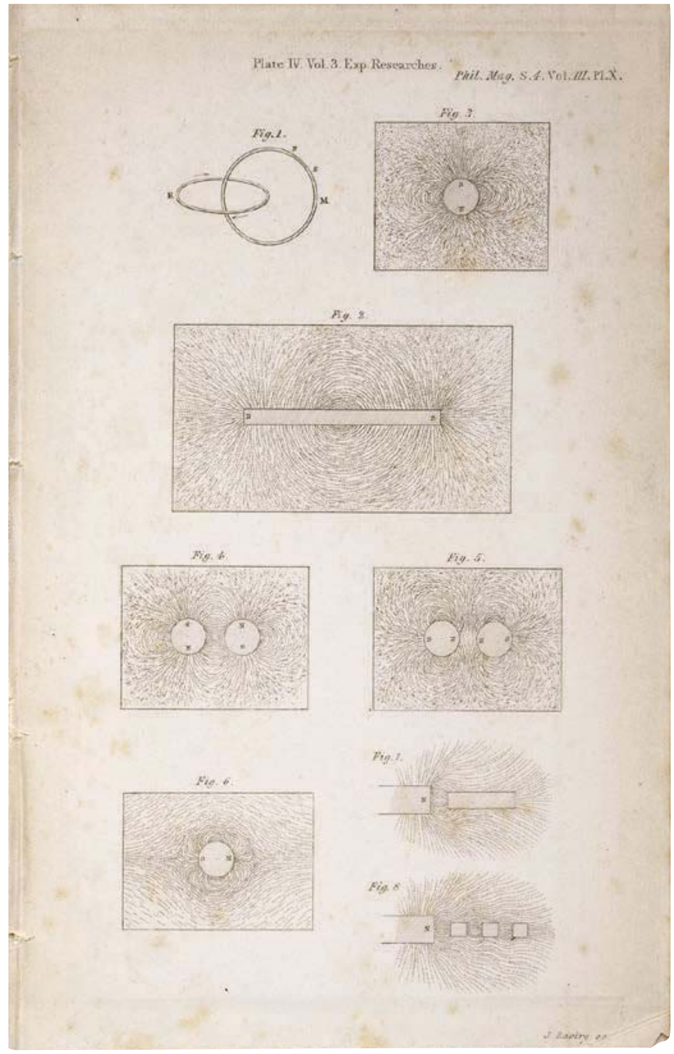
Ueber die

Induction in rotirenden Kugeln.

INAUGURAL-DISSERTATION
zur
ERLANGUNG DER DOCTORWÜRDE
VON DER PHILOSOPHISCHEN FACULTÄT
der
FRIEDRICH-WILHELMS-UNIVERSITÄT ZU BERLIN
genehmigt
und
ÖFFENTLICH ZU VERTHEIDIGEN
am 15. März 1880
von
Heinrich Hertz
aus Hamburg.

OPPONENTEN:
Herr Dr. med. C. Günther.
- Cand. phil. F. Schulze-Berge.
- Stud. jur. G. Hertz.

BERLIN.
Buchdruckerei von Gustav Schade (Otto Francke).
Linienstr. 158.



in Rotating Spheres, 1880], for example, bears the bookstamp of his doctoral supervisor, Hermann von Helmholtz. Similarly, the copy of Sir William Thomson, 1st Baron Kelvin's *Notes of Lectures on Molecular Dynamics and The Wave Theory of Light*, delivered at Johns Hopkins University in 1884, is also exceptional, not only for its content, but for the way in which it was created. A. S. Hathaway, a trained stenographer and mathematician, happened to be among the lecture attendees. He transcribed Thomson's lectures, and reproduced the text using the papyography process. As Hathaway made no editorial modifications to the text, many have suggested that the transcript preserves the true style of Thomson as a speaker. Hathaway only produced a few hundred copies, and for this reason this item is considered extremely rare.

The study of the history of science differs somewhat from conventional history, in that it encourages students and scholars to place themselves at a certain point in history, and to imagine what it would have been like to observe the natural world through someone else's eyes; to understand how they interpreted that world, and how this led to their discoveries. While so much of modern science is concerned with only the most up-to-date research and data, the incredible materials in the Graham Collection make a compelling case for the importance of teaching science history to modern science students. For current physics students in search of potential research projects, developing a familiarity with the history of the discipline could serve as a veritable goldmine of ideas. Paths of inquiry that were abandoned in the past due to technological limitations often merit further consideration now, and can also inspire innovative approaches to modern questions. For students of science history, this collection will provide excellent physical evidence of important developments within the discipline, along with the unique ways in which science has been conducted, shared, and understood throughout the ages.