Highlights from Recent Acquisitions


The Dibner Library completes its set of the Heralds of Science with the purchase of a set of the Acta Eruditorum containing Leibniz's article on the new method of differential calculus.

The Dibner Library is at long last happy to announce that it has now collected all of the works listed as being in Bern Dibner's Heralds of Science. The last piece of the puzzle was Herald 109, Leibniz's 1684 article in the journal Acta eruditorum on the invention of the differential calculus. The Spring 2001 issue of Dibner Library News noted how we managed to obtain three of the four Heralds that we were missing, but the Leibniz article still eluded us. Fortunately, the opportunity arose for us to not only purchase the Leibniz article, but also a complete run of the Acta eruditorum from the first volume of 1682 through 1731.

Gottfried Wilhelm Leibniz (1646-1716), a German philosopher and mathematician, although largely self-trained, became adept at working on some of the most sophisticated mathematical problems of the time, including work on infinite series and infinitesimals. In 1675 to 1676, Leibniz made his breakthrough on the development of calculus, a mathematical method used to determine the rates of change of quantities. Such problems were not solvable through algebra or geometry alone, and their solution occupied mathematicians throughout the seventeenth century.

Isaac Newton (1642-1727) had developed calculus independently back in 1665 and 1666 but shared his discovery with only a few colleagues and his early treatises on the matter went unpublished. It was not until 1687 that Newton published his discovery in his monumental work, Philosophiae naturalis principia mathematica [Mathematical principles of natural philosophy]. Like Newton, Leibniz did not publish anything on his discovery, and only hinted in his correspondence that he had developed the calculus. It was not until 1684 that Leibniz published his method of finding tangents to curves, the "calculus differentialis," in an article titled "Nova methodus pro maximis et minimis, itemque tangentibus, qua nec irrationals quantitates moratur [A new method for maxima and minima, and also for tangents, which is not obstructed by irrational qualities]." This article is the famous Herald of Science 109 and was published in the Acta eruditorum. In 1686, he followed up this work with a second article on his method of finding the areas under curves, the "calculus integralis," and demonstrated that it was an inverse method of the differential calculus.

Leibniz had published his discovery first, and this set up a battle with Newton and his allies who countered that Newton deserved to be credited with the
and his times who countered that Newton deserved to be credited with the invention of calculus since he had developed it prior to Leibniz, even though the Englishman did not publish his work until later. The priority dispute between Leibniz and Newton raged on for some time and was often quite bitter. The English were quite upset over the fact that Leibniz and Newton had corresponded briefly in 1676 and felt that Leibniz stole his ideas from their hero. John Wallis (1616-1703) implied that Leibniz lifted Newton's work, while Nicholas Fatio de Duillier came right out and accused him of plagiarism. The Royal Society of London established a rather biased commission to rule on the matter and, not surprisingly, came out in favor of Newton in 1712. Leibniz prepared a response, but this remained unpublished until the nineteenth century. Today, historical scholarship indicates that the two men did indeed come up with calculus quite independently. And it was Leibniz's more useful methods and notation that ended up becoming the standard for use in differential and integral calculus.

Publication of a new discovery is usually a good way for you to establish priority in science and mathematics, but if you wait too long to publish you leave yourself open to criticism and disputes such as the one between Newton and Leibniz. Newton's earlier disputes with Robert Hooke had left him in an uncommunicative mood and an unwillingness to share new ideas with the scientific community at large. His state of mind only made things worse for the calculus affair. Leibniz waited much too long as well and that delay only helped make matters worse. Part of the problem was due to the fact that Leibniz did not have an effective journal in which to publish short notices. The only satisfactory places available to him to publish such brief papers at the time of his discovery of the calculus were the Philosophical transactions of the Royal Society of London (Leibniz was a member), and the French Journal des sçavans. His problem was solved with the appearance in 1682 of a new scholarly journal, the Acta eruditorum [Records of the learned], in Leipzig thanks to the efforts of its editor, Otto Mencke (1644-1707). Mencke sought to elevate German learning in the eyes of the international community of scholars by providing a forum for German savants to publish reviews of books and occasional topical articles. In its first twenty-five years of existence, the Acta was primarily book reviews, being eighty-nine per cent of its contents. Mencke did include mathematical and scientific articles (seven per cent of the contents) in order to increase the prestige of the journal. Leibniz wasted no time in taking advantage of the forum provided by the Acta, and published articles in the journal almost every year until his death. Other notable figures published important articles in the Acta including the Bernoullis, Johann (1667-1748) and Jakob (1654-1703), and Christiaan Huygens (1629-1695). After Otto Mencke's death, the editorship of the journal stayed in the family through his son and grandson, but the quality of the Acta started to decline in the mid-1700s. Its final publication was the 1776 issue, but this did not appear until 1782 due to the scheduling problems.

We have been on the lookout for the 1684 Leibniz article on the calculus for the last few years in our push to complete the Heralds of Science. We were dismayed to see the Haskell Norman 7-page extract of the article from the Acta sell at Christies' for $15,000 in 1998. Fortunately, in 2002, a large run was available from the famous Bibliotheca Mechanica collection of Veme Roberts and we decided that this was the opportune time to obtain the set. The completion of the Heralds collection will enable the Dibner Library to properly celebrate in 2005 the 50th anniversary of the publication of Bern Dibner's Heralds of Science.

An Undignified Planet? The Discovery of the First Asteroid, or "Minor Planet."

This is the first edition of the second of Piazzi's two publications (and the most important for research purposes) relating to the discovery of the minor planet Ceres and the work in which he names the planet. This was the first of a new class of celestial bodies, the minor planets, and confirmation of Bode's Law, which predicted a planet occupying the space between the orbits of Mars and Jupiter. It also involved a prodigious feat of calculation by Gauss to discover it again after it had passed behind the sun. The Dibner Library has the works relating to the discovery of Uranus in 1781 by William Herschel, and the discovery of Neptune in 1846 by Galle, Leverrier, and Adams, so the acquisition of this work fills in a nice missing piece of astronomical history in our collection. The engraved allegorical vignette on the title-page is very fine and it shows the figure of Ceres, as the goddess in her chariot, between the planets Mars and Jupiter, being observed by a cherub with a telescope inscribed "Ceres Addita Coelo" over the bay of Palermo. Of particular interest is the fact that this significant work is bound with a number of lesser-known rare works that also fit in well with the Dibner Library's holdings (printed in Palermo by the Stamperia Reale, unless otherwise stated):

PIAZZI, Giuseppe. *Sull' orologia Italiano, ed Europeo*, 1798. pp 79, with one folding engraved plate; a little browned. The first twelve pages and the plate are devoted to a trilingual inscription on a marble slab on the Palatine Chapel ... The remainder of the book is an able comparison of the Italian and foreign time reckoning.

[PIAZZI, Giuseppe]. *Della cometa del 1811. Osservata nella specola di Palermo*, [1812]. pp 45 [7, with tables], engraving of the Palermo observatory on title, one engraved headpiece on page 5, a little browned in places. Summary of Piazzi's observations of the comet of 1811.

PIAZZI, Giuseppe. *Dell' obliquità dell' eclittica*. Modena, Società Tipografica, 1804. Small 4to, uncut at sides, pp 22, [1 blank], title with woodcut vignette, woodcut headpiece on page 3; folded to fit to the format of the volume, title with hole in wide margin and remaining of label, a little spotted. Piazzi's work on the determination of the obliquity of the ecliptic.

PIAZZI, Giuseppe. *Ricerche su la parallese annua di alcune delle principali fisse*. Modena, Società Tipografica, 1805. Small 4to, uncut at sides, pp 34, folded to fit to the format of the volume, minor damage and old repairs due to the awkwardness of the format, some browning. Piazzi's research on determination of the Sun's annual parallax and related physical principles.

CACCIAFORE, Niccolò. *Della cometa apparsa in luglio del 1819. Osservazioni e risultati*, 1819. pp [iv] 72, engraved vignette depicting Palermo observatory on title, engraved headpiece on page 1, with one folding engraved plate; contemporary ownership inscription to head of title, occasionally a little spotted. Cacciatore's observations on the comet of 1819.

CACCIAFORE, Niccolò. *Relazione dei tentativi fatti per determinare la differenza delle longitudini di Palermo e di Napoli*. Tipografia del Giornale Letterario, 1834. pp [iv] 30 [1 blank], with wood-engraved vignette on title, dedication to the Prince of Capua printed in bastard; a little browned in places. An account of the experiments, calculations, and measurements undertaken by Cacciatore, Piazzi's successor as director of the Palermo Observatory, consequent upon the most important result of Piazzi's English visit, the acquisition of Ramsden's great five-foot vertical circle, a masterpiece of eighteenth-century technology.

CACCIAFORE, Niccolò. *Sull' origine del sistema solare*. Seconda edizione. Lorenzo Dato, 1826. 8vo, pp 30 [1 blank], a good copy, printed on light green paper. Cacciatore's theoretical research on the origins of the solar system.

EXTEDED NOTE ON THE DISCOVERY OF CERES:

On January 1, 1801 Piazzi was searching a region in Taurus in which he hoped to see a star of the seventh magnitude, listed in Lacaille's catalog. Before that star appeared, however, he noticed the passage of a somewhat fainter body that Lacaille had not listed. Piazzi continued to observe the new body on the following evenings and ascertained from its movement that it must be a planet or comet. Having observed the body for a total of twenty-four nights, the object passed behind the sun, and at the same time Piazzi fell ill and was unable to renew his search for it. By the time he recovered, the object was lost and it was therefore necessary to calculate its orbit in order to find it again. Piazzi announced his discovery to Oriani, director of the Brera observatory, and to Bode, director of the Berlin observatory, and published his observations later in 1801 as *Risultati delle osservazioni della nuova stella scoperta il 1 gennaio 1801 nell'Osservatorio di Palermo*. In this work Piazzi was careful not to call the object a planet, instead referring to it as a comet or "new star." Other astronomers were eager to rediscover the new body; if it were a planet, it should be possible, on the example of Uranus, to compute from Piazzi's observations a circular orbit, even if the arc of the presumably elliptical orbit were to prove short. In December 1801 Karl Friedrich Gauss, [using Piazzi's data], calculated both such an orbit and an ephemeris for the new body. He communicated his calculations to F.X. von Zach, director of the Gotha observatory, who employed them to rediscover the body in almost exactly the position that Gauss had predicted. It was thus apparent that it was a planet, and in his publication of 1802, *Della scoperta del nuovo pianeta...* Piazzi named it "Ceres Ferdinanda," for Ceres, the patron goddess of Sicily and Ferdinand IV, King of Sicily. Later this was shortened to Ceres. In this work Piazzi identifies Ceres as the planet predicted by Kepler and Bode, gives a detailed account of the planet's discovery, the roles played by Bode, Oriani, Gauss, von Zach, Olbers, et al., and further tables of observations.

Herschel, the discoverer of the planet Uranus, was upset by Piazzi's addition to the planets, especially since his measurements showed that Ceres was relatively small, with a diameter less than 162 miles. In the meantime, in 1802, Olbers discovered another small planet at the same distance as Ceres, which he named "Pallas." Herschel argued that the new planets should be called asteroids, and further suggested that these bodies were not worthy of the name of planets, since they did not occupy the space between Mars and Jupiter "with sufficient dignity." Piazzi reacted with republican fervor and accused Herschel of being a planetary snob, fixated on hierarchy. Gradually the term asteroid fell into astronomical disuse and the term "minor planet" has become standard.

Piazzi (1746–1826) was the first director of the Palermo Observatory, and traveled to England in order to equip the observatory with the finest astronomical instruments he could obtain, including the great five-foot vertical circle by Ramsden. Palermo was Europe's southernmost observatory, and its position and climatic conditions allowed Piazzi to catalog numerous new stars.
How Do We Solve a Problem Like Uranus?


This is the first edition of the work in which Bode gave the name "Uranus" to the newly discovered planet that Herschel had first observed on March 13, 1781. This book is the earliest detailed account of the planet. Herschel at first thought that he had discovered a new comet and his discovery papers were printed in the *Philosophical transactions of the Royal Society of London* (held in the Dibner Library). During the late spring and early summer, the new object was blocked by the Sun, but on July 20 it was relocated and on August 1 Johann Bode observed it. Bode, royal astronomer and director of the astronomical observatory at Berlin for nearly forty years, immediately declared that it was a planet and suggested that it be called Uranus. Herschel took his time deciding upon a name for the planet, but in July 1782 he finally proposed the name "Georgium Sidus," or "George's Star," in honor of the British monarch. Most astronomers, however, did not like this precedent, preferring a mythological name for the planet. Eventually, the name Uranus prevailed, despite the efforts of a group of Englishmen who advocated the name "Herschel" for the newly discovered planet. The discovery of Uranus was a victory for Bode who for some years had been promoting the validity of a curious mathematical progression that conformed to the relative distances of the planets from the Sun. Named "Bode's Law," the progression predicted that, if there were a planet beyond Saturn it would be 19.2 times more distant from the Sun than the Earth. Uranus turned out to be 19.6 times more distant and greatly strengthened the belief in Bode's Law. The book mentioned above outlines Bode's theory, how Uranus fit into the equation of the solar system, and that there might be additional planets beyond Uranus and where they might be. The study of planetary distances is well represented in the Dibner Library, from 1596 with Kepler's *Mysterium cosmographicum* to the 1802 work by Piazzi on the discovery of the minor planet Ceres (see above).

What Would Apollonius Do?


The *De maximis et minimis* copy is a first edition and a splendid copy of the author's first book in which Viviani attempted a reconstruction of the important fifth book of Apollonius' *Conics* (there are ten early editions of the Conics in the Dibner Library). The *Conics* was originally in eight books, but only the first four had survived from ancient times.
There was some knowledge of the fifth book due to hints supplied by other Greek mathematicians and it was this information that Viviani used. While Viviani was working on his reconstruction of the fifth book, Giovanni Borelli discovered in an Arabic manuscript in the Medicean Library the text of books five through seven (book eight is still lost). Borelli brought the manuscript to Rome where it was translated into Latin by Abraham Ecchellensis. This discovery, however, was kept a secret in order to give Viviani a chance to complete his reconstruction, which was published in 1659. Viviani, a disciple and biographer of Galileo, established his reputation with this work.

The Latin translation of books five through seven was then edited by Borelli and published in 1661 (this work is in the Dibner Library). The similarity between Viviani's reconstruction and the actual text was very great, and it is nice to have these two works together in the Dibner Library. As a final note, Edmond Halley attempted a reconstruction of the lost eighth book of the Conics, and this work, published in 1706, is also in the Dibner Library.

**Raising Water in a Screw'y Manner.**


This is the first and only edition of this rare and important Renaissance work on mechanics and hydraulics. It appears to be one of the earliest books on the subject. Ceredi was an engineer from Piacenza who was very interested in the principle of the Archimedean screw, a long spiral structure wound around a central axis, that is used to draw water up by simply turning the screw. Ceredi saw the value of using such a screw to irrigate fields and drain swamps, and found ways of improving the efficiency of the ancient design. He also includes discussions on the economic analysis of the crop gain through the use of his device and obtained a patent from Ottavio Farnese in 1566 for the use of his machines (which allowed him the luxury of printing this book). The book is also valuable because of how Ceredi links his work with that of other engineers such as Archimedes, Pappus of Alexandria, Georgio Valla, Girolamo Cardano, and Georg Agricola, all of whom have works held in the Dibner Library. The Dibner Library's collection is rich in Renaissance mechanics, and this important work has been conspicuous by its absence from our holdings.

**The History of Television-up to 1926!**

The history of television is a tangled one, with numerous inventors coming up with ideas that eventually coalesced into modern electronic television. As a result, many laid claim to the "invention of television," a title that will never be agreed upon to everyone's satisfaction. While nineteenth-century scientists and inventors struggled with the concept of sending images via telegraph, it was not until the twentieth century that success was achieved. Charles F. Jenkins in the United States managed to transmit backlit silhouettes in 1923, but John Logie Baird was eventually able to transmit fully lit images in 1926 before a group of scientists from the Royal Institution. Baird's success prompted Alfred Dinsdale to publish a book detailing the historical development of television. The work, *Television*, was the first book on the subject (Dinsdale went on to become editor of the British *Television* magazine which he founded in 1928). It is quite rare on the market and is considered the first of the *incunabula* of printed works on television, making it a prime target for collectors. The book was revised and expanded in 1928, the number of pages triple that of the 1926 edition. In 1932 Dinsdale rewrote it as *First principles of television*. 