



DUENDE

Programs



The Starry Messenger Historical Background



Notes by Rick Foster

THE RENAISSANCE

The period called the Renaissance is commonly seen as the time when Europe emerged from the "darkness" of the Middle Ages to enter the light of the modern. Beginning in Italy, then moving north and west, it gave us great painters, sculptors, and architects from the early 1400s till sometime around 1600 when the Baroque style began to dominate.



One of the central events of the Renaissance was the fall of Constantinople to the Turkish invasion in 1453. This caused an exodus of scholars from the Greek Orthodox world to Italy and with them came many texts of the ancient Greeks which were introduced to Western Europe for the first time. "Renaissance" means "rebirth" and these scholars midwived the rebirth of Classical thought in Italy, Germany and beyond.

At the same time, the elegance of Arabic mathematics was transforming European ability to make complex computations. It became much easier to do accounting, calculate architectural coefficients and the positions of the planets, compute areas and the volumes of containers, etc.

But the rebirth of ancient learning and the studying of the ancient scientific theories did not lead directly to modern science. On the contrary, it led to the formation of a class of professional philosophers whose central belief was that Aristotle and the other ancient Greeks had written the final word on how the world works. So the Scientific Renaissance actually became an impediment to the kind of empirical thinking and experimental approach that



Ptolemaic/Aristotelian Model

was needed to bring about the Scientific Revolution.

Other factors that impinged on the acceptance of new scientific ideas included the intense political and religious turmoil of the era. The Church had been fractured by the Reformation and its conversion of many rulers to Protestantism. Within the Catholic Church there was continual struggle between the allies of the Holy Roman Emperor and the Pope as each tried to assert political dominance over the Catholic world. The Thirty Years War, which would devastate much of Germany, broke out when Galileo was in middle age and continued beyond the end of his

long life. Since this war was ostensibly over which region would triumph, there was a conservative movement to assert doctrinal purity and come down hard on ideas that might seem to attack the faith. Then as now, the powers were all for technical advances that would produce better weapons and fortifications, but wary of scientific ideas that would challenge traditional notions of faith and patriotism.

In addition to the intellectual, political, and religious factors there was a practical impediment to the evolution of the empirical-experimental method: it was very difficult to measure short intervals of time with any accuracy. The best available technology was the water clock which required great skill to operate—precise opening and closing of small valves—and even then was subject to individual variations. At the end of his life Galileo was working on the pendulum clock, but he died before he could make one that worked. It was fifteen years after his death when Christiaan Huygens (1629-1695) published the design for the first pendulum clock that was truly functional.

GALILEO



Galileo Galilei (1564-1642) was born the year that Michelangelo died, just ten weeks before the birth of Shakespeare. His father, Vincenzo Galilei (1520s-1591), was a musician and composer who experimented with strings, wires, and weights to determine the laws of pitch. So the young Galileo was provided a model of hands-on empiricism for investigating the natural world. It is hard now to imagine how unusual this was for a future intellectual of the Sixteenth Century. Vincenzo wanted his oldest son to study medicine. Having pursued a financially difficult career in the arts, he hoped Galileo would earn enough to provide large dowries for his sisters, so they could marry into prominent families. But at the University of Pisa, young Galileo fell in love with mathematics. The court mathematician to the Duke of Tuscany persuaded Vincenzo that his son had real talent. The father relented and let

Galileo follow his bliss.

Though he did not graduate from Pisa, he was hired on as a math teacher. Soon, he moved to the University of Padua, where he taught geometry, mechanics, and astronomy for twenty years. A large part of his work involved teaching medical students how to cast horoscopes, which were expected at the beginning of treatment—at least when the patients were rich enough to afford state-of-the-art care.

In Padua, Galileo formed a long-term relationship with Marina Gamba who bore him three children. They Never married, perhaps because Galileo had incurred so much debt providing his sisters' dowries that he thought he could never take on the financial obligations of a wife. But it was also true the he had to pay for his experiments from his own pocket and he always seemed to find the money for his pursuit of science.



Galileo as a fairly young man
Di Tito



Sister Maria Celeste

His eldest child, Virginia, was born in 1600 and was entered into a convent outside Florence in 1613. The next year she became a nun with the name of Maria Celeste. It seems likely she truly had a religious vocation. She was also an unfailing support to her father. He kept many of her letters to him and they form the basis of the popular book *Galileo's Daughter* by Dava Sobel. (Incidentally, Galileo was a great keeper of letters; his life is therefore extraordinarily well documented for a man of his time.

Unfortunately, his correspondents were not so careful and the letters he wrote them were mostly lost.)

Maria Celeste's younger sister, Livia, entered the convent with her. She had much less contact with her father and seems to have led a disturbed life, as detailed in Maria Celeste's letters. A son, Vincenzo, was born in 1606 and would be working with his father on the pendulum clock in the last year of Galileo's life.

Galileo's Padua years were filled with patient experimental work in addition to his burdensome teaching duties. He was intuitively groping his way toward the experimental method as he defined the laws of motions for falling bodies and pendulums, and answered other fundamental questions by experimental means, such as: "Why does ice float?"

These activities got him into intense arguments with the philosophy faculty, but not yet with the Church. Indeed, his proof that ice is less dense than water embarrassed the philosophers but won him the admiration and friendship of Cardinal Mafeo Barberini, who would in time become Pope Urban VIII.

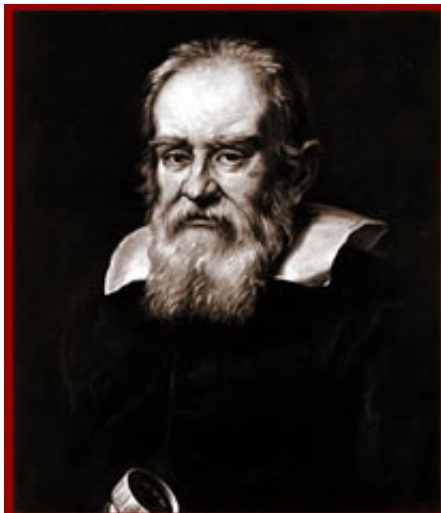


Nicolaus Copernicus
(Galileo adopted his theory of the solar system)
Jan Matejko

In 1609 Galileo heard about the telescope, which had been invented the year before by Hans Lippershey in Holland. Ablaze with curiosity, and aided by very skilled craftsmen, Galileo made his own telescopes and quickly found many ways to improve the design. Within a few months he had a model ten times more powerful than the original.

Galileo's story from this point through his trial is covered by the play itself so I'll interrupt the narrative here.

In December, 1633, some months after his conviction in the heresy trial, he was allowed to return to his home outside Florence. He would spend the rest of his life under house arrest, forbidden contact with other scientists.



Galileo in early old age
Sustermans

Maria Celeste, whose fear for her father had kept her from taking proper care of herself, died in April, 1634.

Devastated, Galileo would write: "The most profound melancholy comes over me. I have no appetite and loathe myself. I feel perpetually called by my beloved daughter."

Yet, despite everything, Galileo continued to work. He was able to get the manuscript for his *Two New Sciences* out of Italy to a publisher in Holland where it was printed in 1638. This book, which does not deal with astronomy, systematizes his experimental work begun more than forty years before. It establishes Galileo as the father of modern

physics.

Galileo died in January, 1642, blind and still under house arrest. The Grand Duke Ferdinando II asked permission to honor him with a funeral oration and a marble monument. Galileo's old friend, Pope Urban VIII, refused to allow either. At the end of that year, Isaac Newton would be born in England.



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e-mail inquiries: info@DuendeDrama.org • vox: [209.532.9177](tel:209.532.9177) • po box 5469, sonora, ca 95370
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