Other Developments in Astronomy from 1609 to 1642

I. Introduction: Galileo's Place in 17th Century Science

A. Five Leading Figures in 17th Century Science

1. Transition tonight to the second of the five leading figures around whom this course is outwardly organized, following the standard stick-figure picture of Newton using Huygens' work to combine Kepler's and Galileo's results, in direct opposition to Descartes
   a. Kepler (1571-1630) -- German, living in Austria
   b. Galileo (1564-1642) -- Tuscany (and Venitian Republic)
   c. Descartes (1596-1650) -- French, living in Holland
   d. Huygens (1629-1695) -- Dutch, living in Paris
   e. Newton (1642-1727) -- English (Cambridge)
   f. Note: 1642 not just the year Galileo died (January 8) and Newton was born (Christmas day, old calendar), but also the halfway mark between the year Kepler began work on planetary orbits (1600) and the year Newton made the key discoveries leading to his *Principia* (1684)
2. Presenting science as a sequence of leading figures, however, is misleading, for (on my view) the repository of science lies not with such figures, but in the scientific community as a whole
   a. A community that critically examines and debates the work of the leading figures, extending, refining, and completing it, and deciding on what to accept and pass on and what to reject
   b. Rejection here no small thing, for every one of these five had some seriously wrong ideas that, in a field like philosophy, would have persisted far longer just by virtue of authority
   c. Scientific community has made science what it is, not just for the last 200 years, but also in the 17th century, as I hope you will begin to come to see later tonight
3. In this regard, worth noting that Kepler published three very different lines of evidential reasoning in support of his reforms, but few in the community saw all three and hence few had the same perspective he had on the evidence for these reforms
   a. A gap between Kepler and the community that was not closed any time during at least the first two thirds of the 17th century
   b. A good example of why concentrating on the figures at the forefront can be misleading, for the community has to assimilate their work; and in doing so it often takes on a different character than it had in the hands of its originator!
4. Nevertheless, easiest for a course to concentrate on the leading figures, i.e. on the individuals who were pushing frontiers back
   a. Leaders, not just in the sense that others followed them, but also in the sense that they were out in front, forcing advances that otherwise would have taken far longer
   b. Thus, for example, as remarked last time Kepler was more than a decade ahead of the rest of mathematical astronomy at the time he died, and the community had to catch up
   c. More than a decade ahead in large part because he alone had spent well over two decades

working with his numbers and Tycho's observations in his new framework

5. These five were strikingly different people, coming from five separate countries, and from three different generations
    a. Kepler and Newton worked largely in isolation; Descartes less so by virtue of his tie to Mersenne; Galileo constantly surrounded by students and protegés; and Huygens in constant personal contact with other leading scientific figures of the time
    b. More important from our point of view, they had substantially contrasting views of "scientific method" -- of how empirical inquiry was most likely to succeed
6. But the five also had a number of things in common over and above their commitment to forging an intellectual revolution in which empirical inquiry would achieve a dominant position
    a. They had ties to one another: Kepler and Galileo corresponded for 30 years; Galileo and Descartes had contact through Father Mersenne; Descartes was a close acquaintance of Huygens's father and a visitor to Huygens's home while he was growing up; and Huygens and Newton corresponded off and on for 15 years, finally meeting face to face in 1689
    b. Each of them made contributions to mathematics as well as to empirical science, and, while each made major advances before the age of 30, they all did much of their most important work after the age of 35
    c. And each of them worked with an intensity that never ceases to amaze me -- five of the hardest working individuals you will ever find

B. Galileo Galilei: A Biographical Sketch
1. Galileo born in Pisa to a long established Florentine family; his father was a cloth merchant, but also an accomplished musician (and author of books on music)
    a. Educated at University of Pisa, undoubtedly at some hardship to his father, who wanted him to study medicine
    b. Interest turned to mathematics, in which taught by Ricci, someone who emphasized the practical side of mathematics
2. His intellectual career stretched over 53 years, the first 21 of which as a university professor
    a. 1589-1592: Chair in mathematics at Pisa (poorly paid)
    b. 1592-1610: Professor of mathematics in Padua (near Venice), where he has three children by his mistress
    c. 1610: returns to Florence as Chief Mathematician and Philosopher (latter at Galileo's insistence) to Grand Duke de Medici
    d. 1611: elected to Lincean Academy of Rome
    e. 1616: Copernican theory condemned, and Galileo told by Bellarmine to abandon it
    f. 1633: trial and abjuration, with remaining years under house arrest in Arcetri, near Florence (and near the convent of his daughter Virginia)
3. First 20 years (1589-1609) devoted largely to questions about the nature of motion and other aspects of simple mechanics, along with various designs for military applications