**Galileo, Epistemology and Science**

**SCL 2016 Summer Conference**

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Recommended reading: *Galileo's Mistake*, Wade Rowland (2001)

1. Conventional accounts of the Galileo story are way off the mark: The Church was not opposed to science; Galileo was not tortured; the Church was not against the Copernican heliocentric system (at least initially); the saga does not demonstrate any incompatibility between science and religion; the saga does not establish science as the only way to know truth; and the actual issue in the trial was not Galileo's purported belief in the Copernican system.
2. The context of the story includes:
   1. the widely accepted Ptolemaic geocentric model of the heavens, which "saves the appearances,"
   2. a widely held Aristotelian view of the heavens as perfect and unchanging, built from perfect circles and spheres, and incorporating symbols of divine perfection such as the seven heavenly bodies
   3. a prevailing notion that biblical passages aligned with the Ptolemaic system (e.g., Ps 19:6; Ps 104:5, 19; Eccl 1:5)
   4. publication of Copernicus' model in 1543, which was dedicated to Pope Paul III. Pope Clement VII had urged Copernicus to publish in 1536. By the end of the 16th century, the general attitude among theologians toward Copernicus' model was "benign indifference."
   5. conservative stance among many theologians due to the Counter-Reformation and Thirty Years War (1618-1648). Even theologians who were friends of Galileo were led by this conservatism to reject Galileo's calls for different interpretations of Scripture, as long as there was doubt about the science.
3. Galileo made improvements to the telescope and made a series of discoveries in 1610-1611: craters on the moon, sunspots (which had been observed by others as well), the phases of Venus in a pattern the Ptolemaic model could not readily explain, and the increase in apparent size of Mars when it is closer to the earth (a phenomenon explained by the heliocentric system). These discoveries were published in *The Starry Messenger* in 1610. The discoveries were widely acclaimed, but Galileo's haughty manner (he was "insufferable") generated some negative reaction. As a result of his discoveries, Galileo was strongly opposed to the Aristotelian idea of a perfect, unchanging heavens with seven heavenly bodies.
4. Although the Copernican model was accepted as correct by Copernicus, Kepler and Galileo, *actual* evidence supporting the theory that the earth moved in an orbit and rotated on its axis was not available until the 19th century: 1838—first observation of stellar parallax; 1851—invention of Foucault pendulum.
5. In his famous letter to the Grand Duchess Christina (1613; revised over the next year or so), Galileo defended the Copernican model and maintained (correctly) that Scripture was subject to interpretation. (In 1992, Pope John Paul II commended Galileo's comments on the necessity of interpreting scripture.) Galileo also claimed (incorrectly) that "nature was its own interpreter," that his discoveries were conclusive, and that scientific/mathematical explanations could be regarded as true to the exclusion of other explanations. This was "Galileo's mistake."
6. The other big mistake in this saga is on the part of the theologians who did not understand that Scripture must also be interpreted. Thus, both nature and Scripture must be interpreted, Galileo denying the first and some theologians denying the second.
7. Three important events transpired in 1615:
   1. Galileo traveled to Rome to defend his name and persuade Church authorities. He was armed with his new (incorrect) theory that the tides are caused by the earth's motion.
   2. Galileo was charged with suspicion of heresy by the Holy Office. The Holy Office investigated, but charges were dropped.
   3. Cardinal Roberto Bellarmine, a friend of Galileo, wrote an authoritative statement to the effect that absent an actual demonstration of the truth of the heliocentric model, questioning traditional interpretations by the Church Fathers was inappropriate.
8. After the investigation by the Holy Office, rumors got around that Galileo had been examined and forced to abjure his views. To help Galileo fight these rumors, in 1616 Cardinal Bellarmine wrote Galileo a letter disclaiming the rumor, but stating that Galileo had been directed not to hold or defend the Copernican system as true.
9. In 1632, Galileo published another major astronomical work, *Dialog Concerning the Two Chief World Systems*. Pope Urban VIII, also a friend and admirer of Galileo, had sanctioned the publication, assuming that it had fully passed muster with the chief censor. It had, but under confused circumstances, leading Urban to state that Galileo had deceived him. In its preface and in its text, the book includes language describing heliocentrism as a model that is not to be understood as a true description of the motion of the heavenly bodies. However, the arguments in the book are so forcefully presented that the reader is given the opposite impression. Further, the "argument from God's omnipotence," supported by the Pope, was not included. This upset the Pope terribly and he had no choice but to submit Galileo to the Holy Office.
10. Galileo was tried in 1633. The two issues were: First, Galileo pushed his scientific claims too far, claiming truth for a scientific theory which could not be regarded as more than a model of nature. Second, he published a book in defiance of an injunction against doing so. Galileo was a pious and godly man. There is good evidence that he never did actually intend to fall afoul of the injunction. But when the Holy Office persuaded him that he had, he was immediately ready to confess his actions and abjure them. This he did. Galileo was never tortured, but it was necessary that he be punished in some way. His friend Pope Urban VIII made it as easy on Galileo as he could by confining him to “house arrest” and prohibited him from further publishing. He lived for a few months in Rome in the palace of one of the cardinals, and then was allowed to return to his home in Florence were he lived in house arrest for the last eight years of his life.