“Galileo’s Life and Research”
Hannah Marcus
Professor of the History of Science
Faculty Director of the Collection of Historical Scientific Instruments
Harvard University

Good afternoon. By way of introduction, I study the history of science, medicine, and religion in early modern Europe—the shorthand I use for my work when I’m talking to other parents at the side of the baseball field is “Galileo, friends and foe.” In all seriousness though, in my research on everything from Catholic censorship to plague to correspondence networks to my current book on old age, Galileo’s life and legacy has been a central historical touchpoint.

It’s an honor to join this event to offer a few reflections on Galileo’s life and research, which I think holds the relatively unique position of being both a source of historical fascination and a source of scientific inspiration four hundred years after the fact.

Galileo was born on February 15, 1564, a bit over 461 years ago. He was baptized a few days later in the baptistry in Pisa, across from the famous leaning tower. As a teenager and young adult, he began and abandoned studies in religion and medicine before moving on to a career in mathematics, which brought him eventually to essentially a junior faculty position at the University of Pisa and then at the more prestigious University of Padua.

It was in Padua, the university city connected to Venice, that Galileo really got to work. He invented a geometrical and military compass (a type of sector) and sold lessons on how to use it to students who boarded in his home. He read in the library of the polymath gentleman Gian Vincenzo Pinelli and tread carefully around his much more famous (even infamous and heretical) senior colleague Cesare Cremonini. Galileo witnessed the super nova of 1604 and wrote about it with a friend in the form of a rustic dialogue in the Paduan dialect, while Tycho Brahe made the star famous in Latin and noted that the unchanging realm of the fixed stars appeared to be flux.

In May 1609, Galileo heard news via Venice of the invention of an instrument that could make distant things close, and he got to work. Within the month Galileo had made his own 3-powered telescope and by August his Venetian friends had him demonstrating the function of his 8-powered telescope to the government of the Venetian Republic. He was rewarded with a doubled salary and tenure for life at the University of Padua.

It’s at this juncture that we see Galileo’s ambition in earnest. The science of the stars wasn’t just about a paycheck (though it was also about a paycheck). Galileo’s observations through the telescope of mountains on the moon, the phases of Venus, satellites of Jupiter, a “tripartite” lumpy Saturn, a seeming infinity of stars, and, later, spots on the sun gave him evidence that supported the radical rearrangement of the cosmos. Paired with Copernicus’s hypothesis and Kepler’s calculations, Galileo had discovered the empirical evidence to support a heliocentric cosmos.

But what was the state of this evidence? After all, it couldn't be seen without Galileo's instrument, and he was not forthcoming with exemplars unless you were his good friend or he wanted to be your good friend. Also, you had to be trained to properly use the telescope, which was a meter long, extremely fussy, and plagued by optical aberrations. Were these "observations" that Galileo claimed to be "evidence" actually just tricks of the lenses? How are we to trust the knowledge created by instruments that we don't fully understand? Further, this "evidence" contradicted Aristotelian theories that had reigned in scientific circles for two millennia. And, it didn't make sense that we were on a spinning earth. Two balls allegedly dropped from the Tower of Pisa fell straight down, after all. This "evidence" required rethinking the theoretical basis of natural philosophy and the empirical experiences that people lived within every day.

And then there was the Bible. And the Church Fathers. In the midst of Counter-Reformation Italy, interpreting the Bible in ways that contradicted Church teaching could be dangerous. Galileo passionately defended the separate realms of the of the book of Scripture, that is the word of god, and the book of nature, written in the language of mathematics. One taught you how to go to heaven and the other taught you how the heavens go. These writings would bring Galileo before the future saint Robert Bellarmine in 1616, who admonished Galileo to stop with this line of reasoning and refrain from teaching or writing about heliocentrism, a warning that Galileo would ultimately ignore. Galileo's *Dialogue on the Two Chief World Systems*, his defense of Copernicanism, was published in 1632 and immediately banned. Galileo was summoned to Rome to appear before the Roman Inquisition. By 1633, Galileo had repented and returned to his villa in Arcetri where he would live out the rest of his life under house arrest, all the while smuggling his writings to northern Europe through old friends in Venice where they would be printed, published, and circulate widely.

What a career! These are the broad outlines of Galileo's life and research, a life of science and controversy. In addition to being fascinating in its own right, Galileo's life raises important questions for us today. How do new scientific discoveries overturn long held theories? What counts as scientific evidence? How should scientific controversies be disputed, and where? (Galileo was a deep believer in the well-placed ad hominem attack, which does not meet the standards of our university initiatives on civil discourse.) How do religious beliefs and scientific theories intersect? Can they coexist? These are open questions that are the shared work of scientists, philosophers, and historians.

To bring us to a close and to turn us to the unveiling of this afternoon, I don't think any conversation about Galileo is complete without speaking of beauty. Galileo saw things through his telescope that no one else had seen before. He turned to art and to print to communicate these findings. He used literature to bring his experiments and his thought experiments to life—he is one of Italy's greatest prose writers in addition to a scientific mind. I'm grateful to be part of bringing Greg Wyatt's sculpture to Avi's office today. It is a reminder that great science has long had the power to bring both beauty and understanding to our complicated world.