

# From Galileo to Newton

*The Emergence of Modern Physical Science*

Academic Year 2022-2023, Terms 2-3, Deep Springs College, Prof. **Brian Hill**

## Course Description

Our goal is to work through all of the central arguments in Newton's *Principia*. The 17th century saw the birth of modern physical science, wherein increasingly accurate laboratory measurements and increasingly well-formulated, sophisticated, and beautiful theoretical developments confront each other. The century begins with Galileo, Brahe, and Kepler, but its grand synthesis is by Newton, and to this day every aspiring engineer, physicist, chemist, and astronomer begins by learning Newton's Laws (his Three Laws of Motion and his Law of Universal Gravitation) and their consequences.

We will use a translated and annotated version of Newton's *Principia* (the original is in Latin): Newton's *Principia*, *The Central Argument*, by Dana Densmore, Third Edition. Newton's *Principia* presupposes an understanding of parts of Euclid's *Elements*, Apollonius's *On Conic Sections*, and Galileo's *Two New Sciences*. We would therefore supplement our study of the *Principia* with the necessary excerpts from these other works.

Newton's Laws have since been modified in very specific domains by quantum mechanics, special relativity, and general relativity, but where quantum or relativistic effects are not important, they remain pre-eminent, unmodified, and unchallenged, and if one wishes to rigorously understand the quantum or relativistic modifications, one still starts with Newton.

It might be exhausting to read proposition, corollaries, lemmas, and proofs, but the reward is to understand the laws of motion, including celestial mechanics, as Newton presented them. Much of the class time will consist of students presenting proofs. It will be tricky for me to develop problems to go along with the texts, since Newton intended his proofs to be completely self-contained and his presentation is aimed at his colleagues, not at students. However, proofs without problems and examples would be like learning about ranching without coming into contact with any rangeland or cows, so we will need to develop and work some illustrative problems as we read the text.