

# Understanding and improving the telescope in the early seventeenth century

In my talk, I will present findings from recent artefact and archival research on the early history of the telescope. In the past decades, the debate about the invention of the telescope has shifted from a discussion about lens combinations to a discussion about lens quality. In particular, in 2007, historian of optics Rolf Willach posited that the telescope was invented when an artisan masked the grinding aberrations at the edge of a lens with cardboard diaphragm. In the first part of my talk, I will elaborate on Willach's thesis. I present new measurements, carried out in collaboration with Michael Korey and Marvin Bolt, using phase-shifting interferometry, of early spectacles and some of the world's oldest telescopes. What do these measurements tell us about lens quality improvement? Rather than linking it to the telescope's invention, I will discuss the implications of these measurements for our knowledge of telescope development in the first decades. Because they do raise some new questions. What happened in the longer run with the practice of aberration masking? What were the typical aberrations that needed to be dealt with? And how was all this approached conceptually?

In the second part of my talk, I bring further contextualisation to these issues by drawing from the notebook entries by Dutch scholar Isaac Beeckman (1588-1637). Beeckman was one of the first mechanical thinkers and had a lasting influence on René Descartes. But he also witnessed the emergence of the telescope first-hand, and engaged in lens grinding. Beeckman's notes are important because they show how the telescope could be understood within the amalgamation of c. 1600 optical thought, without requiring awareness of focal lengths. To Beeckman, the telescope was just as much a cosmological instrument as it was an optical one. It was understood to strengthen the causal effect of celestial radiation, and that was also the context in which the diaphragm was understood. Only later did awareness of material aberrations set in. This happened in the context of lens quality evaluation by using camera obscura projection. Beeckman's ideas of the telescope are revealing, because they suggest how the early understanding of the telescope could be more firmly rooted in sixteenth-century cosmology. Finally, they explain to us why the telescope was named as an instrument for seeing far, and not an instrument for seeing large.

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