

Methods, instruments, and realism in astrophysics

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The purpose of this work is to examine the ongoing discussion surrounding anti-realism about astronomy and astrophysics, initiated by Ian Hacking [2], and to highlight and analyze especially those aspects of the discussion, which relate to the philosophy of technology. According to Hacking ([2], 577) "the technology of astronomy and astrophysics has changed radically since ancient times, but its method remains exactly the same. Observe the heavenly bodies. Construct models of the (macro)cosmos. Try to bring observations and models into line." Because Hacking's criterion for realism is the ability to manipulate the object studied, and mere modeling and observation fall short of this, this makes astronomy and astrophysics different from experimental sciences. Hacking [2] even makes the outrageous claim that astronomy is not a natural science at all. Critics, such as Shapere [4], have attacked Hacking's criterion for realism or defended realism about astrophysics by Hacking's own standards (e.g. Sandell [3]).

Most recently, Anderl ([1], 667) has made the claim, (although, without explicitly endorsing realism), that "with respect to the complexity of data generation and processing there seems to be no obvious difference between astronomy and experimental sciences." Indeed, the situation in astrophysics has changed since Hacking's work. Following Anderl, one can raise the following question: how does the development of technology and observational methods affect the methodological status of non-cosmological astrophysics? In answering this, one must consider the variety of observational methods in astronomy. The most common modes discussed by Anderl, (classical observing, remote observing, queue observing, and service observing) will be analyzed here as well.

Additionally, it should be noted that the discussion has so far focused on wholesale realism and anti-realism about astrophysics, although one might alternatively subscribe to realism about some theoretical entities featured in astrophysics and to anti-realism or skepticism about others. It is the latter option, which will be defended here as the more promising one. As an example, very few of the thousands of known exoplanets have been observed with an optical telescope. Instead, their detection relies on multiple independent, but highly theory-laden, techniques which allows astrophysical modeling to confirm their existence and properties by convergence. On the other hand, black holes remain purely hypothetical entities for the most part. While their dynamical mass can be observed independently of the theoretical motivation to postulate their existence, it is not unreasonable to remain skeptical about their existence as singularities, since this has not been (and neither have event horizons or Hawking radiation) independently observed, but remains only a prediction of general relativity.

Источники и литература

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- 4) Shapere, D. Astronomy and Antirealism // *Philosophy of Science* 60: 134–150. 1993