

GHE030-P02

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## Philosophy of Experiment: Analyzing neutrino oscillation experiment (OPERA)

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In the history of the modern philosophy of science, little attention had been paid for decades to how observations and experiments were conducted in actual scientific practices. The tendency started to change, and in the '80s some philosophers of science, such as I. Hacking and A. Franklin, began to illuminate rational aspects of science by examining actual experiments in detail (New experimentalism). Our study pushes this trend one step further.

In these days, experiments are getting more and more advanced and diversified, and observations and experiments in geosciences seem to have various characteristics. So we treat one of experiments in physics, which are rather simple and analyzed most frequently by philosophers of science. In this presentation, we take up OPERA experiment (\*) that F-lab in Nagoya University conducts. We intend to reveal what principles of epistemic justification are at work there.

This presentation belongs to "epistemology of experiment", where the central issue is the problem of rationality, such as how much reason we have to believe in conclusions scientists derive from empirical evidence.

In the case of OPERA, questions are its relation to KAMIOKANDE (advantage of using accelerator), how the experiment is designed to detect tau-neutrinos after oscillation (the process to reach that design), and whether its design is sufficient to meet its purpose.

Related topics such as the relation between theories and experiments (including independence of experiments from theories), how to think of data and phenomena, what roles instruments play, training of experimentalists, will also be discussed.

In this presentation, we aim not only to test existing philosophical views, but also to discover new aspects of experiments with the aid of working scientists. We also expect to hear from the audience about distinguishing features of observations and experiments in geosciences.

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OPERA(Oscillation Project with Emulsion-tRacking Apparatus) is aimed for testing the hypothesis of neutrino oscillation directly, which explains disappearances of mu-neutrinos found in KAMIOKANDE or some accelerator experiments, by detecting tau-neutrinos after oscillation. Mu-neutrino beam is shot from CERN in Switzerland to Gran Sasso underground laboratory close to Roma in Italy through the distance of 730km. The OPERA collaboration tries to detect directly tau-neutrinos in the beam at Gran Sasso by using nuclear emulsion, which is a kind of photographic film.

Keywords: philosophy, experiment, neutrino, opera