

THE ROLE OF THE INFINITE IN THE DEVELOPMENT OF MATHEMATICS

ABSTRACT

The following hypothesis is proposed, 'In mathematics, contradictions involved in the development of human knowledge are represented with the infinite'. Then the author describes a history of mathematical physics on the base of the hypothesis, and he concludes, 'The contradiction in mathematical description of motion was represented with the infinite within recursive (computable) set level, by early Newtonian mechanics. The contradiction to describe discontinuous phenomena with continuous functions was represented with the infinite higher than the recursive set level, namely with the infinite of arithmetical set level in second order arithmetic (ordinary mathematics), by mechanics of continuous bodies. The contradiction about "ether" was represented also with the infinite of arithmetical set level. Contradictions appeared in macroscopic physics applied to microscopic phenomena were represented with the further higher infinite in third or higher order arithmetic (set-theoretic mathematics), by quantum mechanics'. The hypothesis is supported by studies in the higher infinite.

Keywords: infinity, contradiction, history, mathematical physics, dialectic, reverse mathematics

1. Introduction

'Philosophy of science without history of science is empty; history of science without philosophy of science is blind' (Lakatos 1970).

E. Wigner said, 'The first point is that the enormous usefulness of mathematics in the natural sciences is something bordering on the mysterious and that there is no rational explanation for it' (Wigner 1967). This quotation from the pioneer of quantum physics shows that elucidating the essential nature of mathematics is important for the natural science.