Summary

The scientific Revolution as a Linguistic Event: Galileo, Descartes, and Newton as Creators of the Language of Physics

The Scientific Revolution is one of the most thoroughly studied episodes in the history of Western learning. It spanned several decades and roughly can be demarcated by the publication of Galileo's *Siderius Nuntius* (1610) and Newton's *Philosophiae Naturalis Principia Mathematica* (1687). The present book aims to interpret the Scientific Revolution as a linguistic event, as the creation of a new language, that made it possible to describe the dynamical processes occurring in nature.

In the first chapter, dedicated to the analysis of Galilean physics, the book offers an analysis of the Galilean experimental method. It characterizes this method by *use of instruments in the observation of phenomena* (like the telescope or the microscope); *creation of artificial experimental situations* (such as the inclined plane or the pendulum) and *the introduction of measurement equipments* (like the chronometer or the barometer). Among the main achievements of Galilean physics we can count the discovery of one of the first scientific laws (the law of free fall or the law of the isochrony of the pendulum), the first attempt to formulate the principle of inertia and the introduction of the distinction between the primary and the secondary qualities. Besides these unquestionable successes Galilean science had also several conceptual shortcomings. In its linguistic framework it was not possible to express laws of sufficient generality (each law of Galilean science concerns a particular

kind of phenomena), to express interactions among bodies (each law of Galilean science describes the behavior of a single body) and to study complex mechanical systems (all systems studied by Galilean science are rather simple).

The shortcomings of Galilean science were criticized by Descartes, who created the first linguistic framework, by means of which it was possible to overcome them. In the book we try to interpret the well known Cartesian reduction of all phenomena to extension and motion as the first attempt to introduce the notion of a physical state. This made it possible for Descartes to formulate the first truly universal scientific law (the law of the conservation of the quantity of motion), to describe interactions among bodies (by means of his theory of collisions), and to find a way how to unite several bodies into a complex mechanical system (by means of his theory of vortices). Nevertheless, just like in the case of Galileo, also Cartesian science had deep conceptual shortcomings. Maybe the gravest among them was the impossibility to connect in an unequivocal manner the explanatory models (like the vortex of fine matter) with the observed phenomena (like gravity).

One of the staunchest critiques of Cartesian science was Isaac Newton. In the book we try to interpret Newtonian physics as a correction of the shortcomings of the Cartesian system. We show how it is possible to derive several components of Newtonian physics as transformations and emendations of some ingredients of Cartesian physics. By the comparison of the Cartesian and the Newtonian description of collisions we try to show the main merit of the Newtonian system. We see it in Newton's creation of a *linguistic framework* that makes it possible to connect the phenomena to the description of the state of a physical system and to calculate by mathematical means the temporal evolution of the state of a mechanical system. In this sense we consider the Scientific Revolution a *linguistic event.*

In the last two chapters of the book our interpretation of the Scientific Revolution, which can be characterized as idealization, is compared with the theories of idealization (or mathematization) discussed in the philosophical literature, both analytic and phenomenological.

The whole book concentrates on the analysis of language, on the linguistic tools by means of which Galileo, Descartes, and Newton formulated their physical systems. We focus first of all on the changes of these linguistic tools, on the nature of the *linguistic innovations* that were necessary in order to create a language that enables us to describe nature in the way contemporary physics does. The book presents thus a further development of the linguistic approach presented in the book *Patterns of Change, Linguistic Innovations in the Development of Classical Mathematics*. It tries to transfer the methods of linguistic reconstruction from history of mathematics to the history of physics.