English version

During his long career as a thinker and publicist A.N. Whitehead passed through several developmental stages. These were invariably marked by a specific intellectual theme, or rather an expanding gamut of subjects that came into the focus of his analysis. Furthermore, these phases can be dated, with a relatively high degree of accuracy, according to the major landmarks in his career since they coincided almost precisely with his places of work. Thanks to these links, his works may be divided into the following stages of development:

a) works on mathematics and mathematical logic ("Cambridge period") (1898 – 1910)
b) "pan-physical" works, i.e. works on theoretical physics, "philosophy of nature" and the "philosophy of natural sciences" ("London period") (1910 – 1924)
c) "metaphysical" works ("Harvard period") (1925 – 1938)

The individual stages of his career display significant continuity (given by the author's personal idiosyncrasies), as well as substantial discontinuities (since Whitehead modifies terms and themes along the way), all of which are essential to understanding the development of his work.

The major goal of the present study is to provide a comprehensive overview of the works on "the philosophy of nature" developed in his "London period". This is accomplished by means of a threefold approach. The majority of this study is devoted to detailed description of the scheme of thought typical for "London period." In addition, this study works to describe many of the implicit references made by Whitehead during this period, both within the context of philosophy of science and the broader context of his own lifelong philosophical project. Thus, background for Whitehead´s positions is provided by recourse to modern science and philosophy (Descartes, Galileo, Kant, Locke, Newton) as well as Whitehead´s contemporaries (Bergson, Bridgman, Einstein, Poincaré, Reichenbach, Riemann, Russell, Wittgenstein). Finally a critical resume is added, where possible critiques from relevant more recent positions in philosophy are also taken into account (Goodman, Popper, Rorty, Sellars). At the very end of the study some of the previously unnoticed links between Whitehead´s "pan-physics" and "metaphysics" are suggested.

The explanatory strategy of this study is guided by an implicit assumption that there are three basic lines in Whitehead´s "pan-physical" thought that can be distinguished:

1) His attempt to solve the epistemological problems, which modern (e.g. nowadays out-fashioned) scientific theories have created for modern philosophy. These epistemological problems are in most cases connected to the problem of "the bifurcation of nature" into apparent and postulated layers.
2) The reconstruction of the elementary lexicon of natural science according to revolutionary developments in science, including relativity and quantum physics and the theory of evolution in biology.
3) Whitehead´s deep conviction that Einstein´s treatment of his revolutionary discoveries is ill-founded and has to be redesigned in order to lead to a sensible theory of nature which can serve as the basis for a systematic treatment of measurement. This objection applies especially to Einstein´s general theory of relativity. This part of Whitehead´s work includes his own alternative suggestion to Einstein´s theory shaped in mathematical language, an approach that for a long time was regarded as a viable alternative to Einstein.

Let our brief summary begin with the first section, the epistemological problems. According to Whitehead, a bifurcation in the theoretical handling of nature means a division of the nature sensed from the nature thought, without a systematical philosophical treatment

of their relationships. This absence of connection leaves scientific reasoning in an impenetrable maze, in which many possible theories of relation can be developed to fit various circumstances, but in such a manner as to obstruct the possibility of a more unified theory. Whitehead tries to solve this problem via his distinction between the "heterogenous" thinking of modern epistemology, which employs "mind" in order to describe the status of physical world, and a "homogenous" approach, which can be best described by the maxim that "nature is closed to mind" - everything we think of has to be found within nature itself. The whole of his "pan-physics" can be seen as the attempt to the most consistent fulfilment of this principle.

This brings us to the second point listed above - the reconstruction of basic terminology of scientific thought in connection to both the new situation in science and related epistemological demands. An ultimate reality, to which "sense awareness" is related, is nature in its character of "passage", the general fact that "something is going on". Philosophical analysis has to distinguish fundamental types of entities and relationships, which inhere in these entities within facts. The basic distinction that Whitehead makes is that between "events" and "objects". Events refer to the fluid aspect of reality, objects to the static one. The other important presupposition hidden in this distinction is that relationships between events are homogenous, and therefore can represent the uniformity in the basis of reality, while objects represent physical contingency. Objects are subjected to additional laws of nature, which govern their appearances. The general "ether of events" form a uniform four-dimensional space-time manifold, such that objects can only be said to be recognized in portions of "space-time" via their relations to events. Whitehead expresses this very fact by saying that they form "the adjectival characters" of events.

Whitehead´s appeal to the necessary uniformity at the most basic level of reality forms the foundation of his divergence from Einstein´s general theory of relativity. While accepting most of the outcomes of the special theory of relativity (the four dimensional space-time manifold, the rejection of one time-system, the general mathematical method of seeking frame-independent invariant forms of laws), he nevertheless uses the achievements of special relativity as a foothold whereby to build his treatment of nature. His main objection to Einstein is that by accepting a heterogenous space-time whose metrical properties are fully determined by the "contingent" distribution of "matter", he leaves the whole antecedent theory of measurement in a muddle. In order to establish a workable theory of measurement, Whitehead retains the old distinction between geometry and physics. He therefore adopts "a prior geometry", which he mostly identifies with a Minkowskian quasi-Euclidean geometry and treats gravity on a par with other physical fields (electromagnetism). In their mathematical expression, these presuppositions come in the guise of distinguishing Einstein´s "fundamental metrical tensor" into a "Galilean tensor", which includes Minkowski metric $\eta_{\mu\nu}$, and a tensor that represent the quality of an "impetus", which can be associated with its electromagnetic and gravitational field. In its original version, the latter tensor cannot be interpreted as representing a "metric" of space-time, but only the expression of properties of these fields. From purely mathematical point of view, Whitehead´s theory is much simpler compared to Einstein and the calculations can be obtained in much easier way. This ease of can be seen as one of the most important advantages of the theory. Whitehead also paid a special attention to establishing the link between the elements of Minkowskian geometry and congruence theory with data provided by the immediate sense-awareness.

As Whitehead himself showed, his theory is able to give the same predictions for standard tests of the theory of gravity as does Einstein´s, and therefore was for a long time considered a viable alternative to Einstein´s view. Eddington, who proved that both theories share Schwartzchild's solution, only reinforced this conclusion. Irish physicist Synge later reformulated Whitehead´s physical theory in order to make it comprehensible to

contemporary physicists. It must be noted, however, that he treats it solely from the point of view of mathematical physics, completely omitting the philosophical part. As a result, the theory lost its most important philosophical feature - the separation of geometry and physics, which lead to its subsequent placement among "metrical theories" of gravity. In this form, the theory underwent further tests within the "PPN-framework", and was proclaimed to have been disproved. The apparent beauty and simplicity of Whitehead´s theory was the key motivation behind the various reformulations that would rid it of the unfortunate effects by means of which it had been supposedly disproved. Although this goal does not seem to have been fulfilled, the discussions on viability of Whiteheadian "prior-geometry approach" still continue.

Despite the importance of Whitehead´s theory for both theoretical physics and the philosophy of science, the Czech-Slovakian learned community has been only marginally influenced by these debates. Only slight attention was given to his metaphysical writings, and his "pan-physical" period remained completely unnoticed. This is most likely due to the fact that Whitehead´s philosophy is highly complex, and its full appreciation requires formal training in various disciplinary traditions, as well as the patience to work through his inimitable and largely neologistic terminology. The present author was especially aware of these facts and therefore paid detailed attention to references to original texts and to careful translation of very complex terminology. Additional attention was given to the extensive body of secondary literature in order to make the present text comprehensive.