

# Exporting Methods from the Foundation of Mathematics to the Foundation of Relativity Theory

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We use experience gained during the success story of the foundation of mathematics to serve as guideline for elaborating foundation for natural sciences. Since spacetime is the arena in which the processes of physics and indeed most of natural sciences unfold, it seems to be reasonable to start with elaborating a logic based foundation for spacetime. For this, Tarski's work, in particular his first-order logic axiomatization and analysis of geometry, is a good starting point. Goldblatt's book on spacetime geometry already made progress in this direction. We report on progress made in this direction in our school in the last 10 years.

In particular, we will show how one can build up relativity theories (including general relativity and cosmology and Einstein's  $E = mc^2$ ) purely within logic, as theories in the sense of logic, and with no other prerequisites than some familiarity with the basics of logic. This will provide, as a byproduct, a logic based foundation for relativity (in analogy with the foundation of mathematics) as well as a conceptual analysis for relativity theories. Further, it will provide a gentle (and streamlined) introduction to relativity for the questioning mind or for the logically minded.

We touch upon connections with the logical theory of definability (Reichenbach, Tarski, Beth, Makkai). Instead of putting the emphasis on a particular formulation of relativity theory, we put the emphasis on the connections (interpretations) between different theories leading up to logical dynamics, the technical counterpart of which is known as algebraic logic.