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Higher Structures in Physics

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Abstract

This is an overview of higher structures in physics. In this talk, we intend to outline the basics of derived algebraic geometry and its essential role in encoding the formal geometric aspects of moduli spaces of solutions to certain differential equations. Throughout the talk, we always study objects with higher structures in a functorial perspective, and we shall focus on algebraic local models for those structures. To be more precise, we shall be interested in derived geometric constructions and higher spaces for certain moduli problems associated with classical field theories and their defining equations, the so-called Euler-Lagrange equations. To this end, the talk is organized into two main parts: In the first part of the talk, we shall revisit the naïve and algebro-geometric definition of a classical field theory together with some examples, and then we will establish the connection between classical field theories and moduli problems. In the second part of the talk, we first recall the basic aspects of moduli theory in a categorical perspective and explain how higher-categorical notions like stacks come into play to overcome certain technical problems naturally arising in many moduli problems. In the spirit of these discussions, we shall also give some examples from gauge theory and Einstein gravity.

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