

THE HISTORY AND PHILOSOPHY OF SCIENCE DEPARTMENT

Announces

THE ANNUAL HPS ALUMNI LECTURE

“Topology and the Structure of Space-Time”

given by Alumnus

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New York University

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5:00 pm

University Club – Conference Room A

Abstract: Mathematical representations of physical entities are shaped by the mathematical tools used to create them. Space, time, and space-time have traditionally been represented by topological spaces: sets of points that are knit together, at the most fundamental level, by a structure of open sets that satisfies the axioms of standard topology. Notions such as the connectedness of a space, the boundary of a set, and the continuity of a function are defined by reference to these open sets. Additional geometrical structure (such as metrical or affine structure) can be added to a topological space, but the mathematical representation typically begins with a topological manifold. I will argue that standard topology is wrong mathematical tool to use for representing the structure of space and time (or space-time). I will present an alternative mathematical tool, the Theory of Linear Structures, whose primitive notion is the line rather than the open set. The Theory of Linear Structures has a wider field of useful application than topology in that it can be used to capture the geometry of discrete spaces as well as continua. It provides alternative, non-equivalent definitions of, e.g., connectedness, boundaries, and the continuity of a function. And it offers a more detailed account of the sub-metrical geometry of a space: every Linear Structure induces a topology on a space, but many different Linear Structures give rise to the same topology. Using the Theory of Linear Structures rather than standard topology to describe space-time has a powerful ontological payoff: one can show that the basic organizing principle of a Relativistic space-time (but not a classical space-time) is time. Contrary to common belief, Relativity does not “spatialize time”, it rather “temporalizes space”.