Electronic Journal: Southwest Journal of Pure and Applied Mathematics
Internet: http://rattler.cameron.edu/swjpam.html
ISSN 1083-0464
Vol. No. 02, 1997, pp. 1–11.
Submitted: January 13, 1997. Published: December 30, 1997.

CAUSAL STRUCTURES IN LINEAR SPACES

Victor R. Krym

Abstract. Linear kinematic spaces (i.e linear topological spaces with partial ordering) are studied. They are defined by a set of 8 axioms implying that topology, linear structure and ordering are compatible with each other. The weakest topology of a linear kinematics is shown to be determined by the open cone of future of any its points. This topology allows decomposition of a linear kinematics in a Cartesian product of Euclidean, antidiscrete and discrete spaces. The structure of linear kinematics is proven to be preserved by factorization along the antidiscrete component of this decomposition. Linear topological spaces with pseudometrics which satisfy a time inequality instead of the triangle inequality are studied (3 axioms). A pseudometric (which is determined by a pseudonorm) is shown to define a topology on a linear space, it being a continuous mapping in this topology. For a space with a pseudometric to be a linear kinematics it is necessary and sufficient that the mapping of multiplication by -1 be continuous. A pseudometric topology of a linear kinematics is identical with the weakest topology of a linear kinematics with a given cone of future. The Minkovskii space of special relativity theory is proved to be a pseudometric linear kinematics.

A.M.S. (MOS) Subject classification Codes. Primary 54F05, 06F20; Seconday 55R10.

Keywords and Phrases. Kinematics, partial ordering, linear spaces, pseudometric, fiber space

The author is grateful to V.A. Zalgaller for useful discussions.
Department of Geometry, V.A. Steklov Mathematical Institute,
St. Petersburg Division, Fontanka 27, St. Petersburg 191011, Russia
E-Mail address: snz@snz.usr.pu.ru

Typeset by $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX