# Proposed talk by Tim Evans

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For “Identification, location and temporal evolution of topics” meeting, Budapest August 29-30, 2016. Part of COST Action TD1210 Knowescape, and the FP7 Project Impact-EV.

**Title**: The Location of Papers in Topic Space-Time.

**Abstract**: Many standard tools for the analysis of large data sets place data points in a natural space measuring distance in the intuitive way we use every day. However publications are characterised both by a position in some topic space and by a publication date. This suggests that we should use analysis tools which are aware of time and the difference in the geometry and space and time. Mathematics shows that the change from the simple spaces underlying traditional data analysis tools to space-times involves a fundamental change to the geometry which in turn brings new types of distance measure. I will show how we have adapted standard MDS (Multi-Dimensional Analysis) methods to take account of the direction of time allowing us to estimate the time and space location of vertices in a citation network (or any directed acyclic graph) from the network connections alone. I will use simple toy models to demonstrate the effectiveness of the method. I will then use our method to assign space and time coordinates to papers in an arXiv.org citation network which will reveal both topics and their evolution in a natural way.

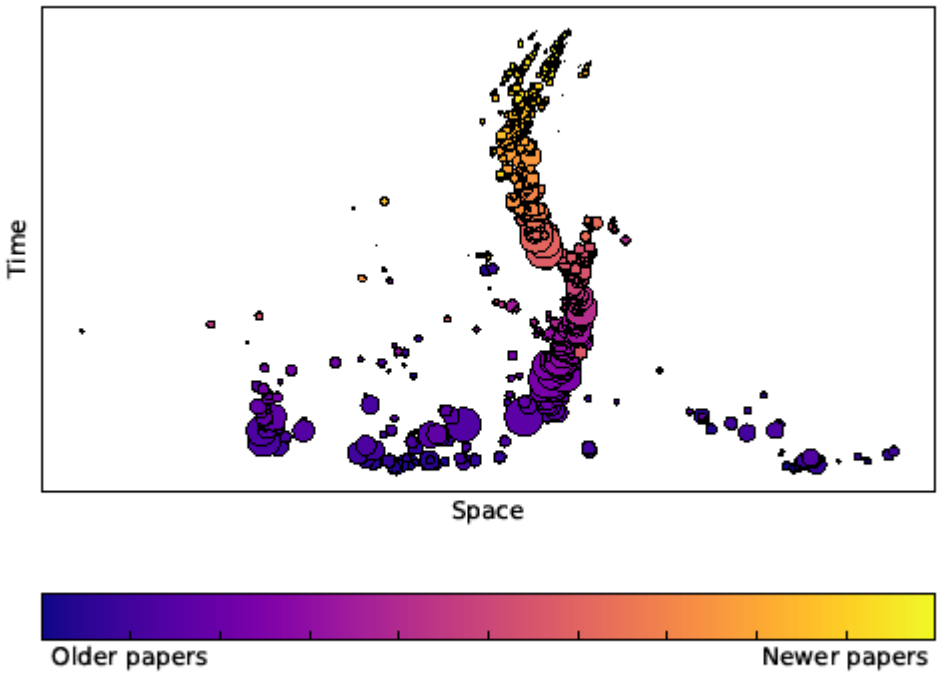


*Figure 1: Locations of top 1000 papers (by citation) in the hep-th section of arXiv from 1992- 2003. Coordinates assigned from citation network using Lorentzian MDS. Colours represent the actual publication date of each paper.*