



The Time Machine Factory Conference  
25-28 October 2015  
Turin, Italy



**October 28, 2015, Wednesday**

## Session [ V-A ] Faster Than Light

Chair Lorenzo Fatibene

09:15 **The Light as Probe of Space-Time** *Orfeu Bertolami*

### Introductory talk

09:30 **On causality, time machines, wormholes and non-locality** *Orfeu Bertolami* *[key-speaker]*

### Abstract

In this talk I shall discuss the issues of causality and the complications brought by the putative existence of time machine-like wormholes, as well as the non-locality of quantum mechanics. After a general discussion, we shall focus on examples of some of these issues in the context on phase-space noncommutative quantum mechanics.

10:15 **From the Flamm-Einstein-Rosen bridge and geons to the modern renaissance of traversable wormholes** *Francisco Lobo* *[invited]*

### Abstract

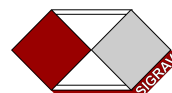
The General Theory of Relativity has been an extremely successful theory, with a well established experimental footing, at least for weak gravitational fields. Its predictions range from the existence of black holes, gravitational radiation to the cosmological models, predicting a primordial beginning, namely the big-bang. All these solutions have been obtained by first considering a plausible distribution of matter, and through the Einstein field equation, the spacetime metric of the geometry is determined. However, one may solve the Einstein field equation in the reverse direction, namely, one first considers an interesting and exotic spacetime metric, then finds the matter source responsible for the respective geometry. In this manner, it was found that some of these solutions possess a peculiar property, namely 'exotic matter,' involving a stress-energy tensor that violates the null energy condition. These geometries also allow closed timelike curves, with the respective causality violations. These solutions are primarily useful as 'gedanken-experiments' and as a theoretician's probe of the foundations of general relativity, and include traversable wormholes and superluminal 'warp drive' spacetimes. In this talk, in addition to extensively exploring interesting features, in particular, the physical properties and characteristics of these 'exotic spacetimes,' we also explore other non-trivial general relativistic geometries that generate closed timelike curves.



DIPARTIMENTO  
DI MATEMATICA  
GIUSEPPE PEANO  
UNIVERSITÀ DI TORINO



POLITECNICO  
DI TORINO



10:45 COFFE BREAK

## Session [ V-B ] Faster Than Light

Chair Lorenzo Fatibene

11:15 **Dark Matter and Wormholes** *[invited]*

*Paolo Salucci*

### Abstract

Earlier studies have demonstrated the possible existence of wormholes in galaxies back to Einstein Rosen seminal paper. This work uses the well known Universal Rotation Curve (URC) dark and luminous mass model of Spirals in order to show that the fine tuned combination of their density distribution make possible the existence of traversable stable wormholes in these galaxies.

11:45 **Traversable Wormholes in Gravity's Rainbow** *Remo Garattini*

### Abstract

We consider the effects of Gravity's Rainbow on the self-sustained equation which is responsible to find new traversable wormholes configurations which are sustained by their own gravitational quantum fluctuations. The same self-sustained equation can be used to discover if topology change is possible. In this contribution, we will show that for every framework, the self-sustained equation will produce a Wheeler wormhole, namely a wormhole of Planckian size. This means that, from the point of view of traversability, the wormhole will be traversable in principle, but not in practice.

12:05 **Effects of rotation on particle dynamics in wormhole metrics** *Zaza Osmanov (TBC)*

### Abstract

We consider a toy model of a particle, moving along one dimensional channels rotating in the wormhole metrics. It is strongly believed that special relativistic effects of rotation lead to nontrivial behavior of particle dynamics. In particular, it is known that under the condition of rigid rotation centrifugal force may change its sign leading to radial deceleration. Examining traversable wormholes we analyze the role of rotation in such nontrivial geometries and study several aspects of space-time traveling in this case.

12:25 **Poster Session**

**On the Morris - Thorne wormhole geodesics** *Culetu Hristu*

**Abstract**

The properties of a particular Misner - Thorne wormhole are investigated. The "exotic stress-energy" needed to maintain the wormhole open corresponds to a massless scalar field whose Lagrangean density contains a negative kinetic term. While the Komar energy of the spacetime is vanishing due to the negative energy density and radial pressure, the ADM energy is vanishing. The timelike geodesics are hyperbolae and any static observer is inertial. The null radial trajectories are also hyperbolae and Lorentz invariant as Coleman- de Luccia expanding bubble or Ipsier-Sikivie domain wall.

**De Sitter spacetimes and their characteristics** *Koohbor Javad*

**Abstract**

There could be found many different forms of the de-Sitter metric in different coordinate system. Two of them are the common: the static form and the non-stationary cosmological (exponentially expanding) form. The staticity and non-stationary of these two different forms are traced back to the non-commoving and commoving nature of the corresponding coordinate systems. Also, there are exist another exact solutions of the Einstein equations with a positive cosmological constant and in the absence of matter, which goes over to the flat metric as  $\Lambda \rightarrow 0$ , these static solutions are called de Sitter-type spacetimes. We have shown that the identification of the geometric term of the cosmological constant with a perfect fluid with equation of state  $P = -\rho = \text{const}$ , and find a rational answer to the question "Why there are different de Sitter-type spacetimes?" Indeed, by using the quasi-Maxwell form of the Einstein equations, we look at these two different forms of the same solution from a new perspective.

12:35 **LUNCH**