

**Luca Lusanna**

INFN

**Canonical gravity, non-inertial frames, relativistic metrology  
and dark matter**

Authors: Luca Lusanna

Clock synchronization leads to the definition of instantaneous 3-spaces (to be used as Cauchy surfaces) in non-inertial frames, the only ones allowed by the equivalence principle. ADM canonical tetrad gravity in asymptotically Minkowskian space-times can be described in this framework. This allows to find the York canonical basis in which the inertial (gauge) and tidal (physical) degrees of freedom of the gravitational field can be identified. A Post-Minkowskian linearization with respect to the asymptotic Minkowski metric (asymptotic background) allows to solve the Dirac constraints in non-harmonic 3-orthogonal gauges and to find non-harmonic TT gravitational waves. The inertial gauge variable York time (the trace of the extrinsic curvature of the 3-space) describes the general relativistic freedom in clock synchronization. After a digression on the gauge problem in general relativity and its connection with relativistic metrology, it is shown that dark matter, whose experimental signatures are the rotation curves and the mass of galaxies, may be described (at least partially) as an inertial relativistic effect (absent in Newton gravity) connected with the York time, namely with the non-Euclidean nature of 3-spaces as 3-sub-manifolds of space-time.