Summary: We consider the non-relativistic limit of gravity in four dimensions in the first order formalism. First, we revisit the case of the Einstein-Hilbert action and formally discuss some geometrical configurations in vacuum and in the presence of matter at leading order. Second, we consider the more general Mardones-Zanelli action and its non-relativistic limit. The field equations and some interesting geometries, in vacuum and in the presence of matter, are formally obtained. Remarkably, in contrast to the Einstein-Hilbert limit, the set of field equations is fully determined because the boost connection appears in the field action and field equations. It is found that the cosmological constant must disappear in the non-relativistic Mardones-Zanelli action at leading order. The conditions for Newtonian absolute time be acceptable are also discussed. It turns out that Newtonian absolute time can be safely implemented with reasonable conditions.

MSC:

83C05 Einstein’s equations (general structure, canonical formalism, Cauchy problems)
83C25 Approximation procedures, weak fields in general relativity and gravitational theory
83D05 Relativistic gravitational theories other than Einstein’s, including asymmetric field theories

Keywords:
classical theories of gravity; gauge symmetry; space-time symmetries; Einstein-Cartan gravity

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References:
