

## General Relativity and Quantum Cosmology

# Observables in classical canonical gravity: folklore demystified

J. M. Pons, D. C. Salisbury, K. A. Sundermeyer

*(Submitted on 15 Jan 2010)*

We give an overview of some conceptual difficulties, sometimes called paradoxes, that have puzzled for years the physical interpretation of classical canonical gravity and, by extension, the canonical formulation of generally covariant theories. We identify these difficulties as stemming from some terminological misunderstandings as to what is meant by "gauge invariance", or what is understood classically by a "physical state". We make a thorough analysis of the issue and show that all purported paradoxes disappear when the right terminology is in place. Since this issue is connected with the search of observables - gauge invariant quantities - for these theories, we formally show that time evolving observables can be constructed for every observer. This construction relies on the fixation of the gauge freedom of diffeomorphism invariance by means of a scalar coordinatization. We stress the condition that the coordinatization must be made with scalars. As an example of our method for obtaining observables we discuss the case of the massive particle in AdS spacetime.

Comments: 15 pages, To appear in Proceedings of 1st Mediterranean Conference on Classical and Quantum Gravity

Subjects: **General Relativity and Quantum Cosmology (gr-qc)**

Cite as: [arXiv:1001.2726v1](https://arxiv.org/abs/1001.2726v1) [gr-qc]

## Submission history

From: Josep M. Pons [[view email](#)]

[v1] Fri, 15 Jan 2010 16:21:25 GMT (31kb)

*[Which authors of this paper are endorsers?](#)*

## Download:

- [PostScript](#)
- [PDF](#)
- [Other formats](#)

Current browse context:

**gr-qc**

[< prev](#) | [next >](#)

[new](#) | [recent](#) | [1001](#)

## References & Citations

- [SLAC-SPIRES HEP](#)  
([refers to](#) | [cited by](#))
- [CiteBase](#)

## Bookmark (what is this?)

[CiteULike logo](#)

[Connotea logo](#)

[BibSonomy logo](#)

[Mendeley logo](#)

[Facebook logo](#)

[del.icio.us logo](#)

[Digg logo](#)

[Reddit logo](#)