General Relativity and Quantum Cosmology

On the initial conditions and solutions of the semiclassical Einstein equations in a cosmological scenario

Nicola Pinamonti

(Submitted on 6 Jan 2010)

In this paper we shall discuss the backreaction of a massive quantum scalar field on the curvature, the latter treated as a classical field. Furthermore, we shall deal with this problem in the realm of cosmological spacetime by analyzing the Einstein equations in a semiclassical fashion. More precisely, we shall show that, at least on small intervals of time, solutions for this interacting system exist. This result will be achieved furnishing an iteration scheme and showing that it converges in the appropriate Banach space. Moreover, we shall show that the quantum states with good ultraviolet behavior (Hadamard property) used in order to obtain the backreaction will be completely individuated by their form on the initial surface if chosen to be lightlike. On large intervals of time the situation is more complicated but, if the spacetime is expanding, we shall show that the end limiting point of the evolution does not depend strongly on the quantum state, because, in this limit, the expectation values of the matter fields responsible for the backreaction do not depend on the particular homogeneous Hadamard state at all. Finally, we shall comment on the interpretation of the semiclassical Einstein equations for this kind of problems. Although the fluctuations of the expectation values of pointlike fields diverge, if the spacetime and the quantum state have a large spatial symmetry and if we consider the smeared fields on regions of large spatial volume, they tend to vanish. Assuming this point of view the semiclassical Einstein equations become more reliable.

Comments:	46 pages
Subjects:	**General Relativity and Quantum Cosmology (gr-qc)**; Mathematical Physics (math-ph)
Report number:	DESY-10-002 and ZMP-HH/10-01
Cite as:	**arXiv:1001.0864v1 [gr-qc]**

Submission history

From: Nicola Pinamonti [view email]
[v1] Wed, 6 Jan 2010 11:16:05 GMT (44kb)

Which authors of this paper are endorsers?

Download:

- PostScript
- PDF
- Other formats

Current browse context:
gr-qc
< prev | next >
new | recent | 1001

Change to browse by:
math
math-ph

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