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Local quasiequivalence and adiabatic vacuum states. (English) Zbl 0749.46045
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Summary: The problem of determining the physically relevant states acquires a new dimension in curved spacetime where there is, in general, no natural definition of a vacuum state. It is argued that there is a unique local quasiequivalence class of physically relevant states and it is shown how this class can be specified for the free Klein-Gordon field on a Robertson-Walker spacetime by using the concept of an adiabatic vacuum state. Any two adiabatic vacuum states of order two are locally quasiequivalent.

MSC:

46N50 Applications of functional analysis in quantum physics
81T20 Quantum field theory on curved space or space-time backgrounds

Cited in **1** Review
Cited in **23** Documents

Keywords:

determining the physically relevant states; curved spacetime; local quasiequivalence class; Klein-Gordon field; Robertson-Walker spacetime; adiabatic vacuum state

Full Text: [DOI](#)

References:

- [1] Haag, R., Narnhofer, H., Stein, U.: On quantum field theory in gravitational background. *Commun. Math. Phys.* 94, 219–238 (1984) · [doi:10.1007/BF01209302](#)
- [2] Haag, R., Kastler, D.: An algebraic approach to quantum field theory. *J. Math. Phys.* 5, 848–861 (1964) · [Zbl 0139.46003](#) · [doi:10.1063/1.1704187](#)
- [3] Dimock, J.: Algebras of local observables on a manifold. *Commun. Math. Phys.* 77, 219–228 (1980) · [Zbl 0455.58030](#) · [doi:10.1007/BF01269921](#)
- [4] Araki, H., Yamagami, S.: On quasiequivalence of quasifree states of the canonical commutation relations. *Publ. RIMS, Kyoto* 18, 283–338 (1982) · [Zbl 0505.46052](#)
- [5] Najmi, A. H., Ottewill, A. C.: Quantum states and the Hadamard form. III. Constraints in cosmological space-times. *Phys. Rev. D* 32, 1942–1948 (1985). · [doi:10.1103/PhysRevD.32.1942](#)
- [6] Bernard, D.: Hadamard singularity and quantum states in Bianchi type-I space-time. *Phys. Rev. D* 33, 3581–3589 (1986) · [doi:10.1103/PhysRevD.33.3581](#)
- [7] Mazzitelli, F. D., Paz, J. P., Castagnino, M. A.: Cauchy data and Hadamard singularities in time-dependent backgrounds. *Phys. Rev. D* 36, 2994–3001
- [8] Fulling, S. A., Narcowich, F. J., Wald, R. M.: Singularity structure of the two-point function in quantum field theory in curved spacetime II. *Ann. Phys.* 136, 243–272 (1981) · [Zbl 0495.35054](#) · [doi:10.1016/0003-4916\(81\)90098-1](#)
- [9] Kay, B. S.: Linear spin-zero quantum fields in external gravitational and scalar fields I. *Commun. Math. Phys.* 62, 55–70 (1978) · [doi:10.1007/BF01940330](#)
- [10] Gelfand, I. M., Graev, M. I., Vilenkin, N. J.: Generalized functions, vol. 5. New York, London: Academic Press 1966 · [Zbl 0144.17202](#)
- [11] Vilenkin, N. J.: Special functions and the theory of group representations. Providence, Rhode Island: American Mathematical Society 1968 · [Zbl 0172.18404](#)
- [12] Dixmier, J.: C^* -Algebras. Amsterdam, New York, Oxford: North-Holland 1977 · [Zbl 0372.46058](#)
- [13] Parker, L.: Quantized fields and particle creation in expanding universes I. *Phys. Rev.* 183, 1057–1068 (1969) · [Zbl 0186.58603](#) · [doi:10.1103/PhysRev.183.1057](#)
- [14] Parker, L., Fulling, S. A.: Adiabatic regularization of the energy-momentum tensor of a quantized field in homogeneous spaces. *Phys. Rev. D* 9, 341–354 (1974) · [doi:10.1103/PhysRevD.9.341](#)
- [15] Buchholz, D.: Product states for local algebras. *Commun. Math. Phys.* 36, 287–304 (1974) · [Zbl 0289.46050](#) · [doi:10.1007/BF01646201](#)
- [16] Hörmander, L.: The analysis of linear partial differential operators I. Berlin, Heidelberg, New York: Springer 1983 · [Zbl 0521.35001](#)
- [17] Araki, H.: Von Neumann algebras of local observables for the free scalar field. *J. Math. Phys.* 5, 1–13 (1964). · [Zbl 0151.44401](#)

· doi:10.1063/1.1704063

- [18] Hörmander, L.: Linear partial differential operators. Berlin, Heidelberg, New York: Springer 1976 · Zbl 0321.35001
- [19] Trèves, F.: Basic linear partial differential equations. New York, San Francisco, London: Academic Press 1975 · Zbl 0305.35001
- [20] Palais, R. S.: Seminar on the Atiyah-Singer index theorem. Princeton, New Jersey: Princeton University Press 1965 · Zbl 0137.17002
- [21] Fell, J. M. G.: The dual spaces of C^* -algebras. Trans. Am. Math. Soc.94, 365–403 (1960) · Zbl 0090.32803
- [22] Fell, J. M. G.: The structure of algebras of operator fields. Acta Math.106, 233–280 (1961) · Zbl 0101.09301 · doi:10.1007/BF02545788
- [23] Stein, E. M.: Singular integrals and differentiability properties of functions. Princeton, New Jersey: Princeton University Press 1970 · Zbl 0207.13501

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