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| Titel | **Quantum Effects in Curved Space-time** |
| Dozenten/innen | Shohreh Abdolrahimi |
| Sprache | English |
| Lehrform / SWS | VL / 2 SWS |
| Kreditpunkte | 3 |
| Voraussetzungen (Empfehl.) | Quantum Mechanics, Thermodynamics, Relativity |
| Angestrebte Lernergebnisse | The students combine their basic knowledge of quantum mechanics, thermodynamics and relativity theory to gain new fundamental insights into advanced concepts of theoretical physics. The students enhance their competence in making connections between different fields of physics and in exploiting these connections. The applications like Hawking radiation and Unruh effect will bring the students to the frontier of modern science, enabling them to start research projects in this field. |
| Inhalt | In the absence of a viable theory of quantum gravity, we can still understand some of the influences of the gravitational field on quantum phenomena. To do so, we consider a classical background and the matter fields quantized in the usual way in this background. Given that we possess a reasonable approximation to the gravitational effects on quantum fields there are some important phenomena we can discuss, including the Hawking radiation and quantum fluctuations and application to cosmology and origin of the structure. Hawking radiation has exposed a small corner of a new area of fundamental physics in which gravity, quantum field theory and thermodynamics are closely interwoven. In this course we begin by a study of quantum field theory in Minkowski space-time, then we consider the quantum field theory in the curved space-time. We discuss Unruh effect, Hawking and Casimir effect and if time allows we study quantum fields in an expanding universe, quantum fields in a de-Sitter universe, and application of quantum fluctuation of scalar fields and of the metric to inflationary cosmology and origin of the structure in the universe. |
| Medienformen | Blackboard, beamer |
| Literatur | o N. D. Birrell, P. C. W. Davis: "Quantum fields in curved space", Cambridge University Press, Cambridge, 1982<br>o S. A. Fulling: "Aspects of quantum field theory in curved space-time", Cambridge University Press, Cambridge, 1989<br>o V. Mukhanov, S. Winitzki: "Introduction to quantum effects in gravity", Cambridge University Press, Cambridge, 2007<br>o A. R. Liddle, D. H. Lyth: "Cosmological inflation and large scale structure", Cambridge University Press, Cambridge, 2000<br>o T. Jacobson: " Introduction to quantum fileds in curved |

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| | spacetime and the Hawking effect" , gr-qc/0308048, http://arxiv.org/abs/gr-qc/0308048<br>o L. H. Ford, "Quantum field theory in curved space-time" , gr-qc/9707062, http://arxiv.org/abs/gr-qc/9707062 |