



# PHYSIKALISCHES KOLLOQUIUM

des Fachbereichs Physik  
der Johann Wolfgang Goethe-Universität Frankfurt

Mittwoch, den 30.05.2018, 16 Uhr c.t.  
Großer Hörsaal, Raum \_0.111,  
Max-von-Laue-Str. 1



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## A n t r i t t s v o r l e s u n g

*"Dileptons and photons  
Messengers from strongly interacting matter  
under extreme conditions from the hot  
and dense state"*

The understanding of the properties of matter from the fundamental laws describing its elementary building blocks and their interactions is among the most interesting goals of physics. In this talk I will first give an overview over the efforts to explore the phase diagram of strongly interacting matter under extreme conditions of high temperature and densities as present in Nature for the first few microseconds after the Big Bang and today in neutron stars and supernovae explosions.

In the laboratory such a medium can be created in the laboratory in ultra-relativistic heavy-ion collisions for a duration of about  $10^{-23}$ s ( $\sim 10$ fm/c). Among the many observables measured in heavy-ion collisions the so-called "electromagnetic probes", i.e., electron-positron and muon-anti-muon pairs (dileptons) as well as photons, are unique, because they do not participate in the strong interaction. They are created during the entire evolution of the fireball and are leaving the medium nearly unaffected by final-state interactions. In this way they are the only probes that can reveal the spectral properties of their strongly interacting sources deep inside the fireball. I will describe recent theoretical research that has led to a good understanding of the underlying processes.

A careful experimental and theoretical investigation of electromagnetic probes in heavy-ion collisions at a broad range of heavy-ion-beam energies may lead to a more precise understanding of the phase structure of strongly matter like the observation of a first-order phase transition or even a critical point.