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Thermal Dileptons as Fireball Probes at SIS Energies

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Electromagnetic probes are radiated during the whole time evolution of a heavy-ion collision. They decouple from the collision zone once they are produced and carry valuable information about the properties of matter created inside the hot and dense fireball to the detector.

In particular, the yield of low-mass dileptons was identified to be sensitive to the fireball lifetime, while the slope in the intermediate-mass region of the dilepton invariant-mass spectrum can serve as a thermometer which is unaffected by blue-shift effects caused by the collective expansion of the medium [1].

Realistic thermal dilepton emission rates and an accurate description of the fireball's space-time evolution are needed to properly describe the contribution of in-medium signals to the dilepton invariant-mass spectrum.

Utilizing a coarse-graining method we extract local temperature, baryon and pion densities from hadronic transport simulations of Au+Au collisions at SIS energies. These serve as an input for the calculation of the pertinent radiation of thermal dileptons based on an in-medium ρ spectral function that describes available spectra at ultrarelativistic collision energies.

The obtained yields and slopes of the invariant-mass spectra [2] will be compared to the excitation function of the lifetime and temperatures of the fireball established at higher energies [1]. The results can serve as a baseline for future explorations by the HADES and CBM experiments at FAIR as well as the RHIC beam energy scan phase II.

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[1] R. Rapp and H. van Hees, Phys. Lett. B 753 (2016) 586.

[2] T. Galatyuk, P. M. Hohler, R. Rapp, F. Seck and J. Stroth, arXiv:1512.08688 [nucl-th].

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