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Microlocal analysis in cosmological X-ray tomography

Cosmic Microwave Background (CMB) is the radiation remnant from the Big Bang and is considered to be a primary source of information regarding the early universe. From the work of Sachs and Wolfe (1967), it is known that the linearization of the CMB redshift leads to an X-ray transform of the gravitational perturbations, called the light ray transform. We discuss recent results about the transform and the recovery of metric perturbations of scalar type. In particular, we focus on the microlocal properties of the light ray transform and its connection to hyperbolic type PDEs. Furthermore, we consider the transport theory of the light ray transform and study inverse source problems for the Boltzmann equation in the CMB kinetic theory.