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Linearized seismic inversion in the presence of caustics

Linearized high frequency seismic inversion attempts to determine the singularities of the sound speed in the subsurface of the Earth from singularities of pressure field data recorded at the surface. If the ray geometry for the smooth background sound speed has no caustics, then Beylkin showed that the forward map is a "classical" Fourier integral operator, associated with a canonical graph, and the resulting normal operator is a pseudodifferential operator. Nolan and Symes began the examination of the consequences of caustics for the operator theory. I will discuss what happens both for folds and the next most commonly encountered type of caustics, namely cusps. The work described is due to various subsets of Raluca Felea, Malabika Pramanik and myself.