Correlation Based Passive Imaging with a White Noise Source

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Passive imaging refers to problems where waves generated by unknown sources are recorded and used to image the medium through which they travel. In this talk I discuss a passive imaging problem related to wave equation in Riemannian geometry, where the metric tensor is unknown within some compact set. An unknown white noise random source gives rise to echoes that are observed elsewhere. We show that the empirical correlations in the observed echoes become statistically stable as the observational time increases. Our main result is that, with probability one, the limiting empirical correlations determine the unknown metric tensor up to an isometry. To our knowledge, this is the first result showing that a medium can be determined in a passive imaging setting without assuming a separation of scales.

This is joint work with Matti Lassas, Lauri Oksanen and Teemu Saksala.