

# Experimental Evidence-Based Sub-Rayleigh Source Discrimination

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We propose a Bayesian evidence-based inference framework based on relative belief ratios and apply it to the problem of resolving one versus two incoherent optical sources using experimental data from spatial-mode demultiplexing (SPADE). Unlike the Helstrom measurement, SPADE does not require collective detection, and its optimality is well-established for asymptotically large samples. Our technique avoids *ad hoc* statistical constructs and reasserts the superior resolving performance of SPADE compared to conventional direct imaging, referring strictly to the data at hand. All assumptions enter the analysis only through the likelihood model and prior beliefs. By using evidence from experimental data, we establish the superior resolving performance of SPADE compared to direct imaging from a new perspective, which extends naturally to multiple sources, providing a practical and robust alternative route for analyzing quantum-enhanced superresolution in imaging.