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**Tomography of ultra-cold atoms via time-of-flight images**

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Abstract:

We propose to utilize density distributions from a series of time-of-flight images of an expanding gas cloud to probe single-particle correlation functions of trapped ultra-cold atoms. In particular, we show how this technique can be used to detect off-diagonal correlations of bosonic atoms in a quasi- one-dimensional trap, where both real- and momentum- space correlations are extracted explicitly in a quantitative level. The feasibility of this method is investigated by an error evaluation with various temporal and spatial resolutions.