Continuations beyond the singularity, loss of phase, stochastic interactions, and universality

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The continuation of NLS solutions beyond the singularity has been an open problem for many years. In the first part of this talk, I will discuss several potential continuations. A common feature of all these continuations is that the solution phase is lost after the singularity. Then I will show that ``loss of phase'' can occur even if the NLS solution does not collapse (e.g., in the subcritical case). Therefore, if two NLS solutions travel a sufficiently long distance (time) before interacting, it is not possible to predict whether they would intersect in- or out-of-phase. Hence, if the underlying propagation model is non-integrable, a deterministic prediction of the interaction outcome becomes impossible. "Fortunately", because the relative phase between the two solutions becomes uniformly distributed in $[0, 2\pi]$, the statistics of the interaction outcome is universal, and can be efficiently computed using a novel uncertainty-quantification approach, even when the distribution of the noise source is unknown.

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