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

G. Fibich, Tel Aviv University

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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