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Rigidity of long-term dynamics of the self-dual Chern-Simons-Schrödinger equation within equivariance

We consider the long time dynamics for the self-dual Chern-Simons-Schrödinger equation (CSS) within equivariant symmetry. Being a gauged 2D cubic nonlinear Schrödinger equation (NLS), (CSS) is L2-critical and has pseudoconformal invariance and solitons. However, there are two distinguished features of (CSS), the self-duality and non-locality, which make the long time dynamics of (CSS) surprisingly rigid. For instance, (i) any finite energy spatially decaying solutions to (CSS) decompose into at most one(!) modulated soliton and a radiation. Moreover, (ii) in the high equivariance case (i.e., the equivariance index ≥ 1), any smooth finite-time blow-up solutions even have a universal blow-up speed, namely, the pseudoconformal one. We explore this rigid dynamics using modulation analysis, combined with the self-duality and non-locality of the problem.