“Fate of bright solitary waves in attractive low-dimensional BECs”

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Experiments on ultra-cold attractive Bose-Einstein Condensates (BECs) have demonstrated that at low dimensions atomic clouds can form localized objects, propagating for long times without significant changes in their shapes and attributed to bright matter-wave solitons, which are coherent objects.

However, the ultra-cold attractive BECs are quantum many-particle systems, governed by the many-boson Schrödinger equation. I will consider the dynamics of bright soliton trains from the perspective of many-boson physics and show that the fate of matter-wave soliton trains is actually to quickly lose their coherence and become macroscopically fragmented BECs.

Thus, the death of the coherent matter-wave soliton trains gives birth to fragmented objects, whose quantum properties and experimental signatures differ substantially from what is currently assumed.