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Focusing dynamics of 2D Bose gases in the instability regime

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We consider the dynamics of a 2D Bose gas with an interaction potential of the form $N^{2\beta-1}w(N^\beta\cdot)$ for $\beta \in (0, 3/2)$. The interaction may be chosen to be negative and large, leading to the instability regime where the corresponding focusing cubic nonlinear Schrödinger equation (NLS) may blow up in finite time. We show that to leading order, the N-body quantum dynamics can be effectively described by the NLS prior to the blow-up time. Moreover, we prove the validity of the Bogoliubov approximation, where the excitations from the condensate are captured in a norm approximation of the many-body dynamics. This is joint work with Lea Boßmann and Phan Thành Nam.

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