

1125-35-2816

**Xuwen Chen** and **Justin Holmer\*** ([justin\\_holmer@brown.edu](mailto:justin_holmer@brown.edu)), Brown University, Box 1917, 151 Thayer St, Providence, RI 02912. *The rigorous derivation of the 2D cubic focusing NLS from quantum many-body evolution.*

We consider a 2D time-dependent quantum system of  $N$ -bosons with harmonic external confining and *attractive* interparticle interaction in the Gross-Pitaevskii scaling. We derive stability of matter type estimates proving that the  $k$ -th power of the energy controls the  $H^1$  Sobolev norm of the solution over  $k$  particles. This estimate is new and more difficult for attractive interactions than repulsive interactions. For the proof, we use a version of the finite-dimensional quantum de Finetti theorem. This *a priori* bound allows us to prove that the corresponding BBGKY hierarchy converges to the GP limit as was done in many previous works treating the case of repulsive interactions. As a result, we obtain that the *focusing* nonlinear Schrödinger equation is the mean-field limit of the 2D time-dependent quantum many-body system with attractive interatomic interaction and asymptotically factorized initial data. An assumption on the size of the  $L^1$ -norm of the interatomic interaction potential is needed that corresponds to the sharp constant in the 2D Gagliardo-Nirenberg inequality. (Received September 20, 2016)