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Dynamics of Large Boson Systems with Attractive Interaction and a Derivation of the Cubic Focusing NLS in \mathbb{R}^3 .

We consider a N -particle boson system with two-body interaction $N^{3\beta-1}v(N^\beta x)$ where $v \in C_0^\infty$ for some range of β . We extend the results of Grillakis et al. in *Comm. Math. Phys.*, (2013) and Kuz in *Differential Integral Equations*, (2017) regarding second-order correction to mean-field evolution of systems with repulsive interaction to the case of attractive interaction for $0 < \beta < \frac{1}{2}$. The two key ingredients used to extend to this case of attractive interaction are the proofs of the uniform global wellposedness of solutions to a family of Hartree-type equations and the corresponding L^∞ -decay estimates on the solutions. Inspired by the recent works Pickl *J. Stat. Phys.* (2010), Chen et al. in *Theo. and Math. Phys.*, (2013) and Chen et al. in *Arch. Ration. Mech. Anal.* (2016), we also provide both a derivation of the focusing cubic nonlinear Schrodinger equation (NLS) in 3D from the many-body Boson system and its rate of convergence toward mean field.