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Genetic Algorithm approach to Excited Gaussons in Bose-Einstein Condensates with attractive interactions MATT KALINSKI, Utah State University — Using our recently developed Genetic Algorithm (GC) implementation of the non-fixed node Quantum Difussion Monte Carlo (QDMC) method we find the stationary solutions of the Gross-Pitaevskii equation with the attractive nonlinearity with the Galilean invariance originated from our theory of bright solitons without the inverse scattering transformation. The nodal constraints are randomly tossed for the population of solitons and genetic operations are performed for the lowest energy members of the population for the next generation. Within our theory the ground state bright soliton is approximated by Gausson of the Nonlinear Quantum Mechanics with the Logarithmic nonlinearity and therefore excited solutions, topologically originated from the excited states of the harmonic oscillator are also expected. However those are only possible within the fist nonlinear interation and the second interation alters the potential. Therefore no straightforward analytical theory is possible. The ground state of the nonlinear Schrodinger equation is found with the nonlinear Diffussion Monte Carlo Method. Those are excited solitons in the laboratory frame. Restricted basis Fourier-Mathieu nonlinear theory is also provided as semi-analytical comparison.

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