

Abstract Submitted
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Three-dimensional solitons in Bose-Einstein condensates with Rydberg state mediated nonlocal interactions MARK SAFFMAN, Department of Physics, University of Wisconsin, STEFAN SKUPIN, Max-Planck Institut für Physik Komplexer Systeme, Dresden, Germany, PAVEL LUSHNIKOV, Department of Mathematics and Statistics, University of New Mexico, WIESLAW KROLIKOWSKI, Laser Physics Center, Australian National University, Canberra, Australia — We analyze theoretically and numerically creation of stable three dimensional bright solitons in Bose-Einstein condensates by optical coupling of the condensate atoms to Rydberg levels. This gives an effective ground state potential that is dressed by the long range Rydberg interaction. Coupling to Rydberg s -states provides an isotropic and attractive long range interaction, while coupling to p - or d - states provides an anisotropic but sign-definite attractive or repulsive interaction. We find stable three-dimensional solitons taking into account both the long range interaction and a short range contact interaction. Modulational instability of the condensate is observed for a repulsive long range interaction.

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