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Quantum phase transitions in a polarized gas of dipolar molecules forming flexible chain¹ BARBARA CAPOGROSSO-SANSONE, ITAMP, Harvard-Smithsonian center for Astrophysics, Cambridge, MA, 02138, ANATOLY KUKLOV, Department of Engineering Science and Physics, CSI, CUNY, Staten Island, NY 10314, USA — We numerically demonstrate the formation of quantum flexible chains in a gas of polar molecules confined into a stack of N 1d or 2d optical lattice layers, and with dipole moment aligned perpendicularly to the layers. Molecules interact via dipole-dipole interaction. Ab initio simulations of a single chain pinned at one end reveal quantum roughening transition. Multi-chain ensemble is studied in the J-current model approximation and chain superfluidity (CSF) is found. Increasing density of the chains leads to quantum phase transition from CSF to N -layered molecular superfluid (N-SF). We discuss the nature of this transition and its dependence on density, and the conditions for experimental realization and detection of the chain soup.

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