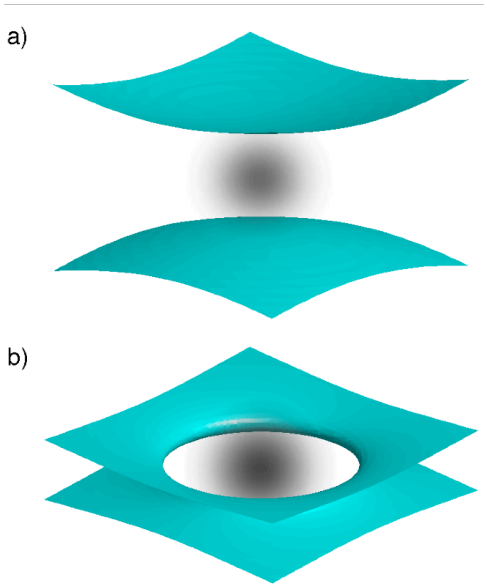
Lowering of bound-state energies of Schrödinger-Newton systems in repulsive potentials.

Markku Jääskeläinen
Dalarna University, SE791-88, Falun, Sweden

Quantum mechanics of many-body systems with Newtonian self-interaction are nowadays investigated as a possible extension of standard quantum mechanics. Here the Schrödinger-Newton system describing the center-of-mass wave-function of a solid spherical object is investigated in the presence of external potentials. Numerical solutions are computed for different potential geometries that do not support bound states in standard quantum mechanics. It is found that repulsive potentials can lower bound state energies by compressing the center-of-mass wave-function. This leads to gain in the gravitational self-energy and thus causes the system to attach itself to potential locations that do not constitute minima.



Densities of the Schrödinger-Newton center-of-mass wave-function in two unstable potentials that give localized states due to the gravitational self-interaction.