(2) If a tea cup could be made impervious to nucleons, how many neutrons could it hold at absolute zero, without running over? How many protons?

Solution: At the level of the brim the density of the neutron fluid is zero, the neutron wavelength infinite, the kinetic energy zero. At the bottom of the tea cup, y cm deeper, a neutron's kinetic energy is mgy, the neutron wavelength λ is $h\sqrt{2gy}$, or 4×10^{-5} cm for $y = 5$ cm. (You can get the same answer by requiring that the Fermi pressure support the weight of the fluid above.) In a cold Fermi fluid the density η is very nearly $(\lambda/2)^{-3} = 10^{14}$ cm^{-3}. The mean density will be roughly half that. A 200-cm^3 cup will hold 10^{16} neutrons. It will hold only one proton. The repulsion of two protons 5 cm apart exceeds a proton's weight though not by much. (An impervious brandy glass could hold many.)