

We investigate the optomechanical coupling between 1D interacting bosons and the electromagnetic field in a high-finesse optical cavity. We show that by tuning the interatomic interactions, one can realize the effective optomechanics with the mechanical resonators ranging from the side-mode excitations of a Bose-Einstein condensate (BEC) to particle-hole excitations of Tonks-Girardeau (TG) gas. We propose that, this unique feature can be formulated to detect the BEC-TG gas crossover and measure the sine-Gordon transition continuously and nondestructively, which are achievable immediately in current experiments.