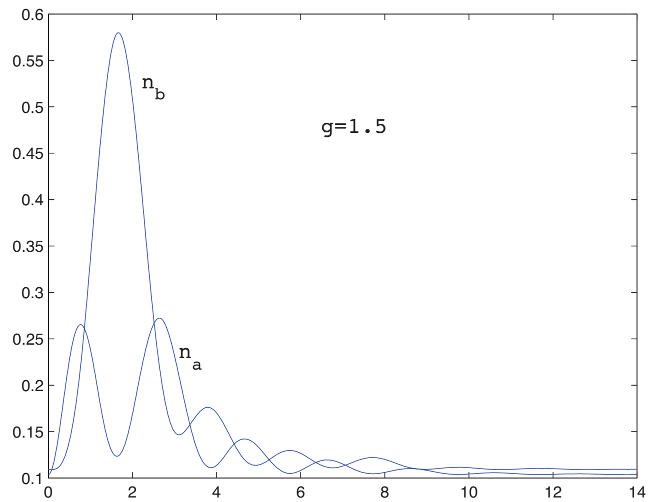

FIG. 3: (a) The mean photon number in the opto-mechanical cavity and the mean phonon number in the mechanical resonator versus time for $g = 1.5,\ \bar{n} = 0, \gamma = 0.9, \kappa = 1.0, \mu = 0.001,\ \omega_m = 4.4, \Delta = 1.02\omega_m,\ \omega_m = 4.4$.

can, for example, be done by mixing the output field from the cavity with a local oscillator coherent field (split off from the driving laser) on a beam splitter with very high reflectivity, see for example [23]. Another possibility is to spectrally separate the two components by an additional filtering cavity at resonance with the driving field. With the coherent amplitude displaced away, the photon detection rate is proportional to κ times the mean photon number as presented in figures 2-6.

We have modeled the single photon source as a single cavity initialized with one photon. In order to sample the mean photon number in the cavity, the single photon source cavity needs to be re-prepared. In reality, a single photon source is either a pulsed or a heralded source with one and only one photon per trigger event[24]. The model we have used can apply to these case provided that the period between pulses is sufficiently long that the opto-mechanical system can return to steady state after detection of the single photon emitted from the cavity between each pulse. In addition, our cavity model assumes an exponential temporal pulse shape. These assumptions are however consistent with new narrow-linewidth single-photon sources that have been developed in the context of atom-light interfaces[25]. Yet, the actual pulse shape is not very important provided it is matched reasonably well to the opto-mechanical cavity line-width. Finally, the timing information in heralding the