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Acoustic signals from gold nanoparticles irradiated with pulsed lasers

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Photoacoustic imaging is a new imaging technique, which enables imaging of living tissue with high resolution. The technique analyses ultrasound pulses generated when absorbing structures in tissue are irradiated with pulsed light. Due to the phenomenon of plasmon resonance gold nanoparticles possess high optical absorption coefficients which makes them potential contrast agents in photoacoustics. Further, the heat generated around these particles when irradiated with pulsed light can lead to nonlinear effects including bubble formation. The acoustic signals produced by gold nanoparticles in the linear thermoelastic and non-linear regimes are expected to have specific acoustic signatures. In this study, we investigate the acoustic signals generated by two sets of gold spheres having 25 nm and 60 nm diameter irradiated by laser pulses with increasing incident fluence rates. We identify and discuss the differences in acoustic signals belonging to the thermoelastic expansion regime and the non-linear regime. Finally, the experimental results are compared with different theoretical models available in literature.