

# Enhancement of Mechanical Response in MoS<sub>2</sub> Drum Resonator using Parametric Amplification

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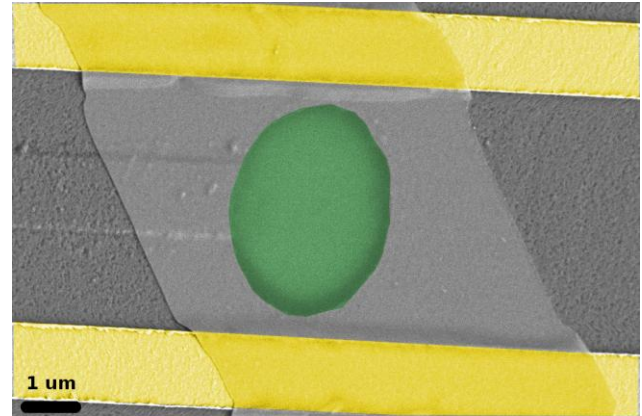
## Abstract

We report enhancement of mechanical response in MoS<sub>2</sub> drum resonator using parametric amplification and achieve ~ 10 dB gain [1]. NEMS resonators based on 2D materials have very poor quality factor ~ 100 at room temperature and worse at higher temperature. We show quality factor enhancement in the resonator with parametric amplification at 397 K (Figure 2). The signal enhancement is similar to the recently reported NEMS devices [2]. However, the amplification is significantly lower as compared to the reported MEMS devices [4]. We investigate the effect of Duffing (cubic) non-linearity in the current work and show that it plays significant role in the maximum achievable gain from NEMS devices using parametric amplification. The experiments are performed using direct capacitive measurement technique on near insulating ~ 1GΩ device. This shows the ability to perform electrical capacitive actuation and detection technique in very high resistance NEMS devices.

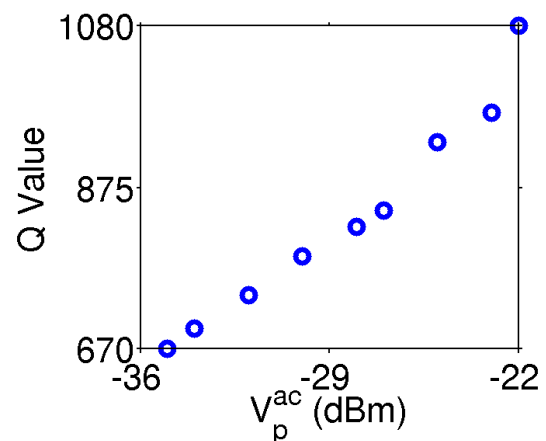
## References

- [1] Ruger D. et al, Phys. Rev. Lett.(1991) 699-702
- [2] Mathew John P. et al, Nat. Nano. (2016) 747-751
- [3] Karabalin R. B. et al, App. Phys. Lett. (2010) 97

## Figures



**Figure 1:** False Coloured Scanning Electron Micrograph of the MoS<sub>2</sub> drum resonator



**Figure 2:** Enhancement of quality factor with applied pump force