Erratum: Ultralow-Noise SiN Trampoline Resonators for Sensing and Optomechanics [Phys. Rev. X 6, 021001 (2016)]

Christoph Reinhardt, Tina Müller, Alexandre Bourassa, and Jack C. Sankey
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Our original manuscript on Si₃N₄ “trampoline” optomechanical systems [1] missed some important works on low-noise mechanical force sensors [2–4]. Specifically, the statement that our measured force noise (16.2 ± 0.8 aN/Hz^{1/2}) was the lowest among solid-state sensors was incorrect; the inferred force noise for some “bottom-up” fabricated devices, namely, silicon nanowires [2] and carbon nanotubes [3], can be as low as 6 aN/Hz^{1/2}, and that of electron-beam patterned graphene [4] (16.3 ± 0.8 aN/Hz^{1/2} reported, 11.7–21.7 aN/Hz^{1/2} listed in supporting information) is also comparable at room temperature.

In light of this, the phrase “the lowest among solid-state mechanical sensors” (sentence 3 of abstract and sentence 2 of paragraph 3) should be replaced with “comparable to that of electron-beam patterned graphene layers [4], and approaching that of silicon nanowires [2] and carbon nanotubes [3].” Below is a list of further changes that correctly incorporate this information into the Introduction.

We hope that this erratum draws sufficient attention to the aforementioned works and that it helps more accurately position Si₃N₄ trampoline optomechanical systems within the context of force sensors.

I. ADDITIONAL WORDING CHANGES

In this section, we suggest four changes to the introductory text that will correctly incorporate the key results of Refs. [2–4]. The second sentence,

“Cantilevers sensitive to attonewton forces at room temperature have been fabricated from silicon (50 aN/Hz^{1/2} [5]) and diamond (26 aN/Hz^{1/2} [6]) using “top-down” techniques, while at cryogenic temperatures, “bottom-up-fabricated” devices (e.g., carbon nanotubes) have achieved 1 zN/Hz^{1/2} [7].

should first be changed to include these references:

“Cantilevers sensitive to attonewton forces at room temperature have been fabricated from silicon (e.g., 50 aN/Hz^{1/2} [5]) and diamond (26 aN/Hz^{1/2} [6]) using “top-down” techniques, while “bottom-up” fabricated devices can, in principle, achieve below 10 aN/Hz^{1/2} at room temperature (e.g., approaching about 5 aN/Hz^{1/2} for silicon nanowires [2] or carbon nanotubes [3]), and 1 zN/Hz^{1/2} at low temperatures (nanotubes [7]).”

Second, since some bottom-up devices have competitive force noise at room temperature, “low-temperature” should be removed from sentence 3, so that it simply reads

“Whereas bottom-up techniques can assemble a small number of atoms to produce exquisite sensors, the technology is comparatively young, and it is difficult to incorporate additional structures and/or probes”.

Similarly, the statement about relative performance at higher temperatures in sentence 5,

“Top-down devices are currently not as sensitive at low temperatures (e.g., about 500 zN/Hz^{1/2} [6] for diamond at 93 mK) but outperform at higher temperatures; they are compatible with a wide variety of probes and naturally integrate with other on-chip systems”.

is not always (but commonly) true, so this statement should be modified to read

“Top-down devices are currently not as sensitive at low temperatures (e.g., about 500 zN/Hz^{1/2} for diamond at 93 mK [6]) but often outperform at higher temperatures; they are compatible with a wide variety of probes and naturally integrate with other on-chip systems”.

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Finally, sentence 3 of paragraph 3,

“Furthermore, this is accompanied by spring constants $K_{\text{eff}} \sim 1$ N/m that are 2–4 orders of magnitude higher than existing devices of comparable sensitivity [5,6]”.

can also draw attention to Refs. [2–4], along with an appropriately extended range of spring constants (about 2–5 orders of magnitude) to encompass these (low-spring-constant) systems:

“Furthermore, this is accompanied by spring constants $K_{\text{eff}} \sim 1$ N/m that are about 2–5 orders of magnitude higher than those of competing devices [2–6,8]”.

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