BoloCalc: a sensitivity calculator for the design of Simons Observatory (Erratum)

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Publisher's Note: This article [SPIE Conference Series. 10708, 1070842 (2018) doi: 10.1117/12.2313916] was originally published online on 9 July 2018 which had a typo in equation 4, which is in subsection 2.2 Photon noise, and labeled as equation 4 in the original publication. Below is the original equation identified as 4a and the corrected equation identified as 4b.

2.2 Photon noise

Photon noise in bolometric detection is the result of fluctuations in the arrival times of photons at the absorbing element[26,31,32]

$$\mathrm{NEP}_{\mathrm{ph}} = \sqrt{2\int_0^\infty \left[h\nu \sum_{i=1}^{N_{\mathrm{elem}}} p_i(\nu) + \left(\sum_{i=1}^{N_{\mathrm{elem}}} p_i(\nu)\right)^2\right] B(\nu)\,\mathrm{d}\nu} \tag{4a}$$

$$\mathrm{NEP}_{\mathrm{ph}} = \sqrt{2\int_0^\infty \left[h\nu B(\nu) \sum_{i=1}^{N_{\mathrm{elem}}} p_i(\nu) + \left(B(\nu) \sum_{i=1}^{N_{\mathrm{elem}}} p_i(\nu)\right)^2\right] \mathrm{d}\nu}\,. \tag{4b}$$

Equation 4b is a corrected version of Eq. 4a that was added via a 2023 erratum to the original 2018 publication.

There are two contributions to $\mathrm{NEP}_{\mathrm{ph}}$. The first term represents shot noise $\mathrm{NEP}_{\mathrm{shot}}$, which dominates when the photon occupation number $\ll 1$ (e.g. optical wavelengths) and is $\propto \sqrt{P_{\mathrm{opt}}}$. The second term represents wave noise $\mathrm{NEP}_{\mathrm{wave}}$, which dominates when the photon occupation number is $\gg 1$ (e.g. radio wavelengths) and is $\propto P_{\mathrm{opt}}$. For ground-based experiments, the photon occupation number at ~ 100 GHz is ~ 1, and therefore a careful handling of both terms is necessary for an accurate NET estimate.

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