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ERRATUM: "FEASIBILITY OF HELIOSPHERIC IMAGING FROM NEAR EARTH" (2015, ApJ, 804, 126)

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We regret that there is a typographical error in an intermediate result given in Section 2.2 of the subject article. In Section 2.2, "Contamination by Photon Noise", the estimated photon count rate in *STEREO*/HI-2 is given incorrectly as $1.7 \times 10^3\ ph\ s^{-1}\ deg^{-2}$ in a sky region with radiance $10^{-13}\,B_\odot$. This number, an intermediate result leading to a derived photon count in a 5000 s exposure, is also inconsistent with the other numbers given in that paragraph. The final result (an estimated photon count of $1.2 \times 10^8\ ph\ deg^{-2}$ in a 5000 s exposure) is correct, and the conclusions of the section and the paper are therefore unchanged.

In this erratum we detail the derivation, report the correct intermediate value, and show that the error is only in the intermediate value and not the final result. We also provide an independent cross-check of the estimated photon count rate, using the newly-available starfield-based calibration of HI-2 recently published by Tappin et al. (2015).

We estimated the photon count rate in order to derive the noise level from Poisson statistics of photon-counting in the brightest (i.e., noisiest) part of the HI-2 image. The calculation begins with the accepted bolometric value of $B_{\odot,b} = 2.3 \times 10^7\ W\,m^2\ SR^{-1}$. HI-2 is not a bolometric instrument, and we therefore estimate that 2/3 of the energy falls in the visible wavelength range accepted by HI-2: $B'_\odot \equiv (2/3)B_{\odot,b} = 1.5 \times 10^7\ W\ m^2\ SR^{-1}$. From the 7 mm diameter of the HI-2 aperture, and the assumed 42% overall quantum efficiency of the HI-2 detector within its passband, we can find the solid-angle-normalized photon deposition rate ${}_{ph}R_\odot$, for an object as bright as the Sun. Using the familiar relation $E_{ph} = hc\,\lambda^{-1}$ and a central wavelength of 600 nm to convert to a photon count, and applying the correct factor to convert from steradians to degrees, we arrive at

$$ {}_{ph}R_\odot = Q\,A_{\mathrm{HI-2}}\,B'_\odot \frac{\pi^2 SR}{180^2 deg^2}\frac{\lambda\,ph}{hc}, \tag{1}$$

which has numeric value

$$ \begin{aligned} {}_{ph}R_\odot &= (0.42)\left(3.9 \times 10^{-5} m^2\right)\left(1.5 \times 10^7 \frac{J}{m^2 SR\ s}\right)\left(3.1 \times 10^{-4}\frac{SR}{deg^2}\right)\left(3.0 \times 10^{18}\frac{ph}{J}\right) \\ &= 2.3 \times 10^{17}\frac{ph}{s\ deg^2}. \end{aligned} \tag{2}$$

Therefore, in a region of the sky with radiance $10^{-13}\,B_{\odot,}$ we find that

$$ {}_{ph}R \equiv {}_{ph}R_\odot\left(10^{-13}\right) = 2.3 \times 10^4\ \ ph\ \ s^{-1}\ \ deg^{-2}. \tag{3}$$

This is the value that was erroneously listed as $1.7 \times 10^3\ ph\ \mathrm{s}^{-1}\ deg^{-2}$ in the original paper.

One further step in the derivation is to convert ${}_{ph}R$ to a photon count per unit solid angle in a 5000s exposure:

$$ {}_{ph}N = (5000\ s)\left(2.3 \times 10^4 \frac{ph}{\mathrm{s}\ deg^2}\right) = 1.2 \times 10^8 \frac{ph}{deg^2}, \tag{4}$$

which agrees with the photon count estimate in the original paper.

In the time since the original submission, Tappin et al. (2015) have published a more definitive photometric calibration of HI-2, using the measured starfield and its evolution over the course of the mission. This permits a second verification of the present derived ${}_{ph}R_\odot$. We include that derivation here as an independent check.

For HI-2A, Tappin et al. quote 15 photoelectrons per data number (their Section 2.1.4), with each photoelectron representing one detected visible photon. Near the instrument boresight, they quote a calibration coefficient of $4.4 \times 10^{-14}\,B_\odot\,DN^{-1} s$ in a single CCD pixel for HI-2A (their Table 4). These CCD pixels subtend 130 arcsec in linear dimension (their Section 4.2.1), so that a square degree of solid angle comprises 770 pixels. Therefore one can get an expression for the photon deposition rate ${}_{ph}R'_\odot$ entirely from the Tappin et al. description:

$$ \begin{aligned} {}_{ph}R'_\odot &= \frac{15\ ph\ DN^{-1}}{4.4 \times 10^{-14}\,B_\odot\ DN^{-1}\ s\ pixel}\left(770\ pixel\ deg^{-2}\right), \\ &= 2.6 \times 10^{17}\,ph\ \ s^{-1}\ \ deg^{-2}. \end{aligned} \tag{5}$$

The agreement between ${}_{ph}R'_\odot$ and our ${}_{ph}R_\odot$ is very good, especially considering that ${}_{ph}R_\odot$ includes a rather crude estimate of the spectral fraction of sunlight accepted by HI-2. That agreement provides an independent check that the derivation and subsequent inferences in our original Section 2.2 are correct, despite the regrettable typographical error.

Because the photon deposition rate is used by us *only* as an intermediate step to arrive at the per-exposure photon count and, as we have demonstrated, subsequent steps including the estimated photon count were correct, the error affects neither the rest of the discussion nor the conclusions of the original article.

REFERENCES

Tappin, S. J., Eyles, C. J., & Davies, J. A. 2015, Sol. Phys., 290, 2143