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Erratum: How well can charge transfer inefficiency be corrected? A parameter sensitivity study for iterative correction

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The article 'How well can charge transfer inefficiency be corrected? A parameter sensitivity study for iterative correction' was published in MNRAS 453, 561 (2015). We identified several incorrectly placed decimal points in Table 1 of that article that arose from presenting several curves in the related Fig. 2 scaled up by a factor of 10, as a visual aid. Table 1 details the parameters of a heuristic fit,

$$A + D_{\rm a}\,\mathrm{atan}((\log\tau - D_{\rm p})/D_{\rm w}) \\ +G_{\rm a}\exp\left(-(\log\tau - G_{\rm p})^2/2G_{\rm w}^2\right), \quad (14)$$

to the effects caused by a species of charge traps in a CCD, created by the degradation of its silicon lattice due to striking cosmic rays outside the Earth's atmosphere, on the measured photometry, astrometry and ellipticity of simulated galaxy images. In the published article, there is a typing error such that equation (14) lacks the negative sign in the argument of the exponential. The amended equation (14) above provides the correct form that we have been using for all fits.

The article lacks a clear notice that the effects of a single trap species given in Table 1 and Fig. 2 have to be multiplied by a factor of $2051/(464 \times 0.94) \sim 4.155$ in order to reproduce the sensitivity study presented in Section 5 (Figs 3–9) correctly. The scaling factor applies to the three amplitude parameters, i.e. A, $G_{\rm a}$ and $D_{\rm a}$. Appendix A3 explains how the scaling factor arises when constructing the baseline trap model informed by laboratory analyses of an irradiated CCD. However, its relevance for reproducing our results using Table 1 should have been stated explicitly.

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To alleviate this difficulty, we again present the coefficients of the fit to the single trap species data, but with corrected orders of magnitude and the scale factor included. We also flipped the signs of the amplitudes in the rows of Table 1 that show the results for the ellipticity offset Δe_1, compared with the published version. The fit in Fig. 2 was made to $|\Delta e_1|$ and the new table reflects the correct sign.

Moreover, independently, we made a sign error when deriving equation (20) from the more general equation (17). Equation (20) quantifies the residual effect $\Delta f^{\rm Pr}$ on a galaxy observable if charge transfer inefficiency has been corrected using a biased or uncertain trap density, while equation (17) considers both incorrect trap densities and release time constants. The correctly derived version of equation (20) reads

$$\Delta f^{\rm Pr}(\rho_i + \Delta\rho_i) = \sum_i \rho_i f^{\rm resid}(\tau_i) - \sum_i \Delta\rho_i f(\tau_i), \quad (20)$$

where ρ_i and $\Delta\rho_i$ are the densities and errors in the densities of the trap species with time constants τ_i, while $f(\tau_i)$ and $f^{\rm resid}(\tau_i)$ are the effects of a single trap species before and after correcting the charge transfer inefficiency (to be taken from the corrected Table 1 presented in this Erratum).

The correct equation (20) has been used to fit the sensitivity experiments, the findings of which are shown in Figs 5 and 9. None of the mistakes affects the results or conclusions of the original article; they are simply errors in the manuscript.

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Table 1. Parameters of fitting functions to illustrate the effect on measurements of galaxy fluxes F and F_S, astrometry y and morphology R^2, e_1 of charge traps of different species. In all cases, the measurements assume a density of one trap per pixel and the astrophysical measurement is fitted as a function of the charge trap's characteristic release time τ as $A + D_a \,\mathrm{atan}((\log\tau - D_p)/D_w) + G_a \exp(-(\log\tau - G_p)^2/2G_w^2)$. Values after correction highlight the efficacy of CTI mitigation.

	A	D_a	D_p	D_w
Galaxy simulation: in degraded images, including readout noise				
$\Delta F/F_{true}$	-0.2230 ± 0.0041	-0.1307 ± 0.0035	0.620 ± 0.004	0.464 ± 0.026
Δy	0.4611 ± 0.0006	-0.2198 ± 0.0012	0.839 ± 0.008	0.211 ± 0.023
$\Delta R^2/R^2_{true}$	0.1756 ± 0.0011	-0.1603 ± 0.0016	1.572 ± 0.018	0.258 ± 0.037
Δe_1	-0.2216 ± 0.0007	0.1395 ± 0.0011	1.628 ± 0.022	0.295 ± 0.033
Galaxy simulation: after correction in software post-processing (perfect knowledge of charge traps)				
$\Delta F/F_{true}$	-0.0231 ± 0.0001	$(1.853 \pm 0.114) \times 10^{-3}$	1.296 ± 0.137	0.260 ± 0.134
Δy	$(3.981 \pm 0.420) \times 10^{-3}$	$(2.147 \pm 0.462) \times 10^{-3}$	0.56 ± 0.89	0.22 ± 0.46
$\Delta R^2/R^2_{true}$	-0.0963 ± 0.007	0.0184 ± 0.008	0.759 ± 0.250	0.285 ± 0.110
Δe_1	$(-5.743 \pm 4.758) \times 10^{-4}$	$(-1.6 \pm 2.8) \times 10^{-4}$	1.218 ± 1.932	0.100 ± 0.000
Star simulation: in degraded images, including readout noise				
$\Delta F/F_{true}$	-0.0934 ± 0.0010	-0.0605 ± 0.0008	1.075 ± 0.026	0.551 ± 0.010
Δy	0.1809 ± 0.0001	-0.0773 ± 0.0001	1.731 ± 0.004	0.292 ± 0.007
$\Delta R^2/R^2_{true}$	0.0394 ± 0.0004	-0.0267 ± 0.0004	2.888 ± 0.047	0.187 ± 0.045
Δe_1	-0.0513 ± 0.0003	0.0330 ± 0.0004	2.667 ± 0.024	0.175 ± 0.039
Star simulation: after correction in software post-processing (perfect knowledge of charge traps)				
$\Delta F/F_{true}$	$(-1.462 \pm 0.099) \times 10^{-4}$	$(1.121 \pm 0.107) \times 10^{-4}$	1.102 ± 0.105	0.422 ± 0.200
Δy	$(6.250 \pm 0.027) \times 10^{-3}$	$(4.028 \pm 0.028) \times 10^{-3}$	1.246 ± 0.186	0.273 ± 0.155
$\Delta R^2/R^2_{true}$	$(-6.784 \pm 1.593) \times 10^{-4}$	$(-7.578 \pm 1.501) \times 10^{-4}$	1.269 ± 0.329	0.25 ± 0.48
Δe_1	$(-5.084 \pm 9.972) \times 10^{-5}$	$(-1.573 \pm 5.817) \times 10^{-5}$	0.22 ± 5.09	0.100 ± 0.000

	G_a	G_p	G_w
Galaxy simulation: in degraded images, including readout noise			
$\Delta F/F_{true}$	0.0879 ± 0.0081	4.953 ± 0.164	4.154 ± 0.239
Δy	0.1272 ± 0.0077	0.694 ± 0.040	0.708 ± 0.021
$\Delta R^2/R^2_{true}$	0.4515 ± 0.0186	0.438 ± 0.005	0.378 ± 0.016
Δe_1	-0.4114 ± 0.0084	0.455 ± 0.005	0.413 ± 0.008
Galaxy simulation: after correction in software post-processing			
$\Delta F/F_{true}$	$(5.405 \pm 0.505) \times 10^{-3}$	0.735 ± 0.068	0.568 ± 0.052
Δy	$(3.4 \pm 4.9) \times 10^{-3}$	0.28 ± 0.54	0.32 ± 0.28
$\Delta R^2/R^2_{true}$	0.0227 ± 0.0095	0.413 ± 0.161	0.353 ± 0.091
Δe_1	$(-4.074 \pm 1.140) \times 10^{-3}$	0.573 ± 0.206	0.535 ± 0.205
Star simulation: in degraded images, including readout noise			
$\Delta F/F_{true}$	0.0478 ± 0.019	4.966 ± 0.032	3.436 ± 0.044
Δy	0.2118 ± 0.0007	0.672 ± 0.002	0.439 ± 0.002
$\Delta R^2/R^2_{true}$	0.8408 ± 0.030	0.944 ± 0.002	0.502 ± 0.002
Δe_1	-0.6861 ± 0.019	0.949 ± 0.002	0.526 ± 0.002
Star simulation: after correction in software post-processing			
$\Delta F/F_{true}$	$(0.024 \pm 1.125) \times 10^{-3}$	1.826 ± 0.713	0.035 ± 1.000
Δy	$(9.069 \pm 0.141) \times 10^{-3}$	0.738 ± 0.102	0.506 ± 0.072
$\Delta R^2/R^2_{true}$	$(8.236 \pm 6.060) \times 10^{-4}$	0.508 ± 0.346	0.379 ± 0.386
Δe_1	$(-1.108 \pm 0.253) \times 10^{-3}$	0.846 ± 0.180	0.538 ± 0.165

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