



Erratum: “Inferences from Surface Brightness Fluctuations of Zwicky 3146 via the Sunyaev–Zel’dovich Effect and X-Ray Observations” (2023, *ApJ*, 951, 41)

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In the course of continuing work on surface brightness fluctuations the authors found an error in how the particle background was subtracted from XMM-Newton images. In particular, a slightly smoothed background image (used to generate Poisson realizations) was subtracted instead of the background image directly produced by ESAS (Snowden et al. 2008).

In addition, we realized that the bias due to a multi-Gaussian point-spread function (PSF) noted in the published article lacked a minus sign in the exponent. The correct equation is given below:

$$\frac{\tilde{P}}{P}(k_r) = \frac{\Gamma(n/2 + 2 - \alpha/2)}{\Gamma(n/2 + 2)} 2^{\alpha/2} \times \left[\sum_{i=1}^N \sum_{j=1}^N c_i c_j \left(\frac{2x_i^2 x_j^2 + x_i^2 + x_j^2}{2x_i^2 x_j^2} \right)^{-(n/2+2-\alpha/2)} \right]. \quad (\text{B9})$$

We also wish to clarify that in this case, $\tilde{P}$ is the power spectrum as directly measured with the Delta variance method in Arévalo et al. (2012), and P is the underlying (unconvolved) 2D power spectrum. Thus, in correcting for the power contribution from the PSF, P_{PSF} , terms (P_{PSF}) cancel out and one is left with the bias correction in Equation (B9). These bias corrections were correctly calculated for the MUSTANG-2 PSF, but had been incorrectly calculated for the XMM PSF, where Figure 16 shows the updated corrections.

Therefore, the SZ (pressure) spectra remain unchanged, while making these corrections alters the resultant X-ray (density) amplitude spectra (see Figure 1). Table 1 presents key quantities that we recover from the 3D amplitude spectra. We note that the Table 1 now employs a significance threshold of $\sigma = 2$, whereas the published article employed a threshold of $\sigma = 3$. In particular, Ring 1 still has well-constrained values in the X-ray, but the spectra in Ring 2 and Ring 3 now only show points of modest significance at the lowest wavenumber being probed. Mach numbers, inferred from the amplitude spectra, are presented in Table 2.

Notwithstanding reduced significances, we recalculate the hydrostatic mass bias with the updated values of the amplitude spectra and we derive $-b_M = 0.30 \pm 0.11$ within the central region. This is larger than previously derived, where the dominant factor in this change is the increased Mach numbers in both Ring 1 and Ring 2.

Our results are still consistent with the picture originally presented wherein we are predominantly seeing fluctuations due to a sloshing core in the central region. Although this motion is not fully turbulent, the gas in the inner region (Ring 1) may incur some rotational pressure support due to this sloshing. Our updated results change our effective thermodynamic regime for the central region (within Ring 1), where our new results are perhaps more consistent with expectation insofar as we now see a predominantly isobaric characterization at large scales (expected for cool-core sloshing), with a slight trend to isothermal/adiabatic fluctuations at moderate scales (with large uncertainties).



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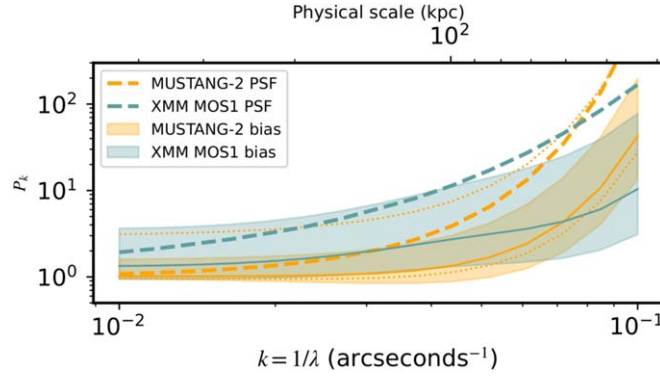


Figure 16. The bias induced by the PSF (shaded regions) relative to the PSF correction (dashed lines). The solid lines indicate the bias when $\alpha = 3$ for XMM and $\alpha = 2$ for MUSTANG-2. The shaded regions encompass the bias between $\alpha = 1.5$ and $\alpha = 4.5$ for XMM and between $\alpha = 0.5$ and $\alpha = 3.5$ for MUSTANG-2. For a full comparison the orange dotted lines show the biases for $\alpha = 1.5$ and $\alpha = 4.5$ with the MUSTANG-2 beam.

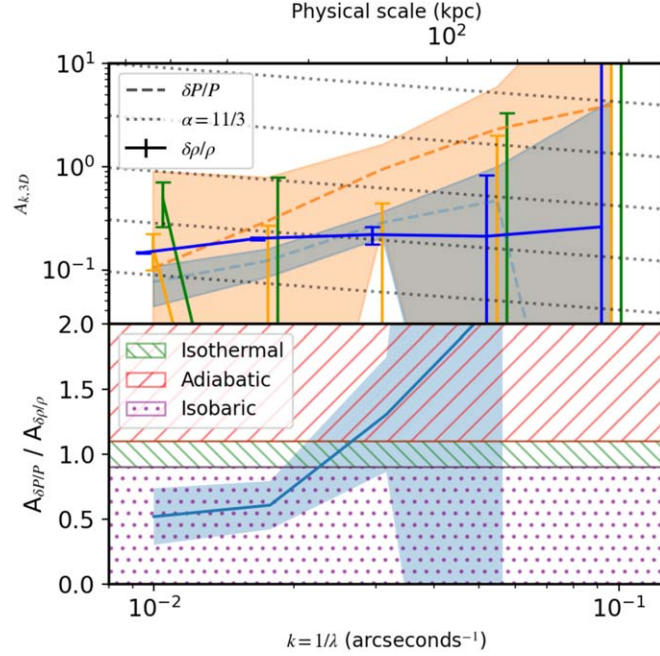


Figure 1. The updated (3D) amplitude spectra (top) and ratio of the two amplitude spectra (bottom), which indicates the effective equation of state. The SZ ($\delta P/P$) fluctuations are the same as previously.

Table 1
Properties of Amplitude Spectra

Region		α_k	$A_{3D}(k_{\text{peak}})$	σ_{3D}	k_{peak} (arcsec $^{-1}$)	λ_{peak} (kpc)
Ring 1	$\delta\rho/\rho$	1.9 ± 0.1	0.22 ± 0.04	0.26	0.03	140
	$\delta P/P$	0.6 ± 0.8	0.29 ± 0.08	0.33	0.03	140
Ring 2	$\delta\rho/\rho$	...	0.16 ± 0.06	...	0.01	440
Ring 3	$\delta\rho/\rho$	...	0.49 ± 0.23	...	0.01	440

Note. Inferred spectral indices (logarithmic slope) and peaks of the amplitude spectra. The spectral indices assume a single power law across our sampled range. The peaks of amplitude spectra are taken with a signal-to-noise cut of 2.

Table 2
Derived Mach Numbers

Region		$\mathcal{M}_{3D,peak}$	$\mathcal{M}_{3D,int}$
Ring 1	$\delta\rho/\rho$	0.88 ± 0.17	0.55
	$\delta P/P$	0.69 ± 0.19	0.80
Ring 2	$\delta\rho/\rho$	0.65 ± 0.25	...

Note. Inferred Mach numbers (1) based on the peak of the magnitude spectra, $\mathcal{M}_{3D,peak}$ and (2) as inferred from the integral of the spectra (i.e., variance: σ^2) and radially averaged relations in Zhuravleva et al. (2023), $\mathcal{M}_{3D,int}$.

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