

Author response to Anonymous Reviewer #1

Reviewer #1 comments are in black and author comments are in **blue**.

I enjoyed very much reading the manuscript entitled "Pre-launch calibration and validation of the Airborne Hyper-Angular Rainbow Polarimeter (AirHARP) instrument". The contribution is well written, interesting and significant, and is scientifically sound. The subject is both timely and highly relevant for the community.

The authors thank reviewer #1 for the kind words, recommendation for publication, and remarks on the text and figures. We address their comments individually below.

I have only two significant remarks for the authors to consider:

On page 7, it is mentioned: "In sensitivity studies on AirHARP dark image data, the dark counts do not depend on integration time, but are sensitive to operating temperature." This confuses me. The longer the integration time, the more dark counts should be registered, or what am I missing here? Or is meant that the dark counts per second does not depend on the integration time?

This is a good catch and as phrased, could be a little misleading. Dark counts are sensitive to integration time in general for CCDs. However, at the range of integration times we use operationally in flight (10-20ms), we do not see a significant variation in dark counts at a given temperature. In-flight detector temps were often on the colder side (< 25 C, and in the lab we typically saw > 35 C), so the dark values were closer to the ADC bias level. During both LMOS and ACEPOL campaigns, we kept the instrument at a single 20ms integration time as well. We will change this sentence to discuss temperature only.

In section 3.5.1, an Avantes spectrometer is used to correct the AirHARP measurements for any variation in Ekspla laser power over the course of the testing period. Is it only used to monitor temporal variations of the laser power at a fixed wavelength, or also to check (and correct for) the difference in power between different wavelengths when scanning the Ekspla over one of the spectral bands of AirHARP? In the latter case, the spectral response of the Avantes itself should be taken into account. This could be explained in more detail.

The use of the Avantes in the SRF testing was the latter: to correct the AirHARP signal for the laser power of the integrating sphere at fixed Ekspla wavelengths. The spectral response of the Avantes was accounted for prior to this test and correction. We hesitate to go into any further detail about the Avantes for brevity and focus, but this will be updated in the text.

Apart from that, I only have minor, mostly textual remarks:

Some acronyms, while probably standard in the community, are not explicitly explained in the text, such as FPA, SRF, and VZA. For all clarity, they should be written out at least once when they are used for the first time.

The authors will go through the manuscript and address any acronyms that do not have a prior explicit reference.

At the end of page 3 it is mentioned "...NASA PACE mission in 2023.", whereas earlier it is mentioned that the PACE mission will be launched in 2024.

This may be an artifact of when the paper was written versus submitted. The NASA PACE mission will launch in January 2024. This date throughout the paper will be harmonized.

Section 2 on page 4: AirHARP has three detectors, not one. This is a bit unclear in the beginning of this section, where it is mentioned that the four channels are selected passively using a custom stripe filter on top of a charge-coupled device (CCD) detector FPA. It could be made clear from the beginning that AirHARP has three detectors each capturing a different angle of polarized light.

While it is mentioned later down the page and shown in Figure 2, I agree that an explicit mention of this in the first paragraph would be best. This will be updated in the text.

At the top of page 20, a reference is made to Eq. 17, but I think Eq. 16 is meant: "It is convention to sometimes include an extra term in the denominator of Eq. (17) to account for the view zenith angle."

Labels (a) and (b) are missing in Fig. 3

Figure 10: Unity is the black dashed line, but a black solid line is indicated in the legend.

Minor typo's: Double space in section 1 on page 2 "improving our knowledge of microphysical properties", typo in Fig. 1 caption: "... which carries the same the 1.5U instrument", section 3.2 on page 8: "...will vignette photons toward the edge the FPA.", on page 9: "...where f is the value of the flatfield correction", section 6 (Appendix): "in the above text defined as R and and DOLP is described below", strange page break in the middle of a sentence on page 32: "we found that the intercomparison with AirHARP did not...", on page 35: "Martjin Smit".

We thank reviewer #1 for these notes, and we will correct the text and figures to reflect them.

Caption of Fig. 4: it is not explicitly mentioned what is shown in panel (c).

The panel (c) shows the residual of the image counts after the normalized flatfield is applied to its generating dataset a la Eq. (3). This will be added in the caption with a identifier (c).