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Atmospheric Measurement Techniques Discussions

Interactive comment on "A novel rocket borne ion mass spectrometer with large mass range: instrument description and first flight results" *by* Joan Stude et al.

Anonymous Referee #1

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This manuscript proves the description of the ROMARA instrument, which is a cryo-cooled quadrupole mass analyzer. ROMARA is an updated version of a successful instrument flown a few decades ago. The manuscript presents the basic operation principle and characteristics of the instrument, along with preliminary data. This article will be a good introduction for the more detailed analysis of the data and their interpretation and thus its publication is recommended. With that said, I do have some constructive feedback that I encourage the authors to consider.

- Line 30/31. Particles with masses of 'tens. . .of atomic mass units' are called MSP particles. I would think that these masses would fall under atomic or molecular ions,

instead of MSPs.

- Fig. 1. I find it strange to talk about the density of particles with masses down to 10 u.

- Line 107. Perhaps it would be better talking about fractions (e.g. percentages) of ions passing through the quadrupole, instead of 'few ions'.

- Line 134. The unit of data rate would be kbits/sec. Either call it data volume, or provide the actually rate.

- Line 144. m/z 5 – 2075. The = sign is missing.

- Line 160. It would be useful to provide some key information about the conditions for the launch. For example, the Sun elevation angle, or the orientation of the payload wrt to the Sun. Later in the manuscript scattered UV photons are mentioned.

- Line 172. Maybe I have missed it, but was there a numerical analysis that considered the effect of the angle of attack on the transmission of ions through the quadrupole filter? This would be useful to discuss to some extent.

- Fig. 6&7 and the text describing them present the data in the units of count rates. It would be useful to provide an estimate how to such rates convert to number density.

- As a general comment, I have missed some level of discussion of how the CEM detection probability varies with the mass of the ions. Is there any information on this? Apologies if it is there and I have missed it.

- Lines 208 and 244: It appears that the instrument measures significantly more negatively charged ions/particles than positively charged ones. This is a potentially significant issue that in my opinion needs to be treated carefully. In particular, the quasi-neutrality of the plasma is not discussed. What would possibly be the cations or positive charge carriers that remain undetected? I am not sure if I can agree with the statement starting on line 244 that the neutralization of positive MSPs due to free electrons is a

viable mechanism. The large number of negative particles already suggest that the electrons are scavenged from plasma. Several models have been published on the charge balance of MSPs that could provide some guidelines on how to interpret the observation for the given condition (solar elevation angle, for example). It is probably a good idea to briefly mention or discuss these models, just to provide a background for reader. If there is a significant disagreement between the models and the data, it should be stated.

- Another general comment: I am not sure if I have seen a discussion how heavy neutral MSP particles could possibly affect the measurements. Such particles may pass through the Q/m filter unaffected and be detected. Any information of this that is worth discussing? My guess is that at higher altitude and the corresponding higher angles of attack this become less of an issue, but perhaps at the lowest $\sim$2 degree angle they have a direct path to the detector from the orifice.

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