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Interactive comment on "Steepening of magnetosonic waves in the inner coma of comet 67P/Churyumov-Gerasimenko" *by* Katharina Ostaszewski et al.

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Referee Report Ostzszevski et al. Title: Steepening of magnetosonic waves in tne inner coma of comet 67P?Churyumov-Gerasimenko

This paper deals with the very interesting topic of so-called "steepened waves" that have been observed in the Rosetta magnetometer data, in the inner coma of comet 67P. These objects also have a corresponding signature in the plasma data (even in the diamagnetic cavity, i.e. without a magn0etic field), and therefore it is necessary to understand the characteristics of these waves. The authors make a thorough investigation of the data, where they show the various details of the waves in a statistical

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way. They find that the waves travel almost perpendicular to the magnetic field and are thus most-likely fast-mode waves. Unfortunately, the plasma velocity vector cannot be determined, and thus, using minimum variance analysis, this leaves a sign ambiguity. The authors then use a 1D MHD description to model these waves and compare these results with the characteristics determined from the data.

This paper is well written, rather long (maybe a 2-papers version would have been an idea?), and goes deep into the material. It is definitely a great resource for further studies of these waves. There are some (mostly minor) comments that I have listed below.

Line 50: It would be nice to give the date of perihelion, so "(13 August 2015)" instead of "(August)"

Line 78: Is it really necessary to cite Glassmeier et al. a through g? I do not see much use in the references to these PSA documents.

Line 132: forgotten space between distance and (Biermann

Line 137: we use THE locally . . .

Line 147: The authors state that "after which the detection rate stagnates" referring to figure 3, after a mass-loading M > 2 kg km-3 s-1. Another interpretation could be that the detection rate does not "stagnate", which can imply that Rosetta would not be able to measure more waves for some reason, but that the generation mechanism (which is not discussed in the paper) saturates. That somehow, above a certain mass-loading rate the generation of "solitons" (?? Like the input in the numerical part later in the paper) reaches a limit. Of course, finding the source for the steepened waves is rather difficult with the limited data that Rosetta delivered, if it is actually "solitons" or not, but those waves do steepen as shown later in the paper.

Line 167: The authors here discuss the direction of the field, which only slightly changes, and then two magnetic vectors are shown. This is difficult to interpret, I

would rather see either normalized vectors or angles.

Line 189: The authors have looked at differences in cometary outgassing activity to see how that influences the detection of the steepened waves. Later, they find differences in the correlation between mass-loading and skewness and amplitude. In the modeling section the authors assume a pure mass 18 plasma. However, we also know that CO and CO2 are major components in the outgassing, also depending on which hemisphere is more active. Indeed, Heritier et al (2017) say that the cops instrument is less sensitive for CO2 than for the water group, but it still is a significant species. Figure 8: In order to be able to really compare the top and bottom rows of plots, the Y-axes should be normalized by total number of points in each row.

Line 279: forgotten "," after Narita (2017)

Line 420: Here I am not sure if the authors have looked at this or not. From the simulations the width of the waves is determined and in the simulation the velocity is also know. Thus one could calculate the duration in seconds of these steepened waves and compare them with the observed width in seconds.

Line 444: A More complex . . .

Line 473: "above" should read "more than"

Line 475: Here I do not understand the comparison. The authors write: "This yields a main resistivity eta, which is slightly larger than the value for the warm electron population but still significantly smaller than the viscosity." How do the authors compare values of completely different units, resistivity and viscosity, and then determine which is "smaller"?

Line 514: at an angle of pm 35 to the comet and at an angle of pm 65 to the sun. I think here some more direction information is needed, than just these angles, e.g. "to the comet-rosetta direction" or the "sun-rosette/comet direction".

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