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Interactive comment on "On heating of solar wind protons by the breaking of large amplitude Alfvén waves" *by* Horia Comişel et al.

Anonymous Referee #1

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This manuscript describes a hybrid kinetic simulation study of a parametric instability in which two counter-propagating Alfven waves couple with a spectrum of ion acoustic modes to transfer fluctuation energy from the former into the latter. This is an interesting configuration to examine, but the manuscript is incomplete because it does not clearly discuss the physical consequences of the computation.

The central problem here is that Figure 3 and the associated discussion is not clearly defined. I do not agree that Figure 3 shows that the velocity distributions are "different for the three analyzed systems";

to my eye the six panels of Figure 3 are qualitatively all the same.

I disagree that "the final distribution functions for the 3D system. . .report a larger per-

pendicular acceleration."

To substantiate this claim, the authors should do the velocity integrations to compute T_|| and T_perp as functions of time through the simulation. The sentence ". . .these arcs coincide with the most obliquely parts of contour lines while the outer contours are better overlapped than the inner ones" is confusing, and I find the subsequent discussion through page 6 difficult to follow. Add the t=0 contours to Figure 3, and compute the T_|| and T_perp values as functions of time to quantify the statements in the discussion.

A central point of this manuscript is that the 3D simulations yield better results than the corresponding 1D and 2D results. This point should be made in the Abstract and repeated in the Conclusion section.

The proton velocity distributions measured from spacecraft in the fast solar wind often show a beam component and a core component with different relative densities and relative flow velocities parallel to the background magnetic field. Figure 3 of this manuscript shows two proton components of equal densities with relative flow velocities perpendicular to B_0. The Abstract claims the results of the simulations are in agreement with in situ measurements; to justify this claim, the authors need to explain these differences.

Title: There is no discussion or demonstration of wave "breaking" here, this word should be deleted from the title.

Page 2, Line 9: Delete "so".

Page 2, Line 23: "Low-beta"?

Page 2, Line 31: "in directions perpendicular". . .

Page 3, Line 12: Replace "circularly" with "circular".

Page 3, Line 15: Replace "transversal" with "fluctuating".

Page 3, Lines 18-19: “The parametric decay modeled here is a 3-wave process involving a large-amplitude monochromatic Alfven pump wave propagating parallel to B_0, a spectrum of electrostatic ion acoustic waves also at parallel propagation, and a spectrum of Alfven daughter waves at anti-parallel propagation.”

Page 3, Line 22: Delete “linear” (saturation is a nonlinear process).

Page 3, Line 23: Delete “nonlinear”; it is unnecessary.

Page 3, Line 33: “. . .and the lower panels correspond to the end of the simulation (t Omega_cp =600).”

Page 6: Insert the definitions of the solid lines and the dashed lines in the caption to Figure 3.

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