Referee's Comments Concerning
"Isotropy Restoration Toward High-Beta Space Plasmas"
by Comişel, Narita and Motschmann

General Comments

This manuscript is an extension of Narita et al. [2014]. Both this manuscript and that paper describe the use of Cluster spacecraft measurements as well as two-dimensional hybrid simulations to study the wavevector anisotropy of magnetic turbulence at ion scale wavelengths. Both methods show that the anisotropy is in the sense of k_perp >> k_||, where "perp" and "||" refer to directions relative to the background magnetic field, and that the anisotropy is reduced as the plasma beta increases. The new element in this manuscript is that the wavevector anisotropy from the simulations displays a power-law scaling as a function of the plasma beta. There is modest new content here, but substantial rewriting and clarification are necessary before I would regard the manuscript as appropriate for publication.

Specific Comments

Title: The present title is poor. "Wavevector anisotropy of plasma turbulence at ion kinetic scales: Solar wind observations and hybrid simulations" would be much more informative.

Overall: The terms "beta" and "plasma beta" are not clearly defined. From the beginning it is necessary to state the mathematical definition of this term, define the appropriate symbol, and then use this term and its symbol consistently throughout the manuscript. I believe the definition used here is the ion beta, that is, $\beta_i = 8\pi n_i k_B T_i / B_o^2$, and that symbol should be used uniformly in the text and in the figures.

Abstract: The phrase "isotropy is gradually restored toward higher values of beta" is inappropriate because all of the figure panels show high degrees of anisotropy. It would be clearer to say that "higher values of the ion beta lead to reduced values of the anisotropy."

1. Introduction: The first sentence should read "Wavevector anisotropy appears in collisionless plasma turbulence whenever a large-scale magnetic field is present." The first paragraph is a comprehensive statement of relevant papers, but does not describe the conclusions of these papers. To establish the background for the new results here, discussion of content of the previous papers must be provided. That discussion should include the result that, in all the simulation papers except Valentini et al. (2010), the wavevector anisotropy corresponds to k_perp >> k_||. Furthermore, it is necessary to discuss the previously published results that particle-in-cell simulations show the wavevector anisotropy of whistler turbulence at electron scale wavelengths decreases with increasing electron beta [Gary et al.,

2010; Saito et al., 2010; Chang et al., 2013; Saito and Gary, Phys. Plasmas, Vol. 19, 012312 (2012) should also be cited.].

2.1 Multi-spacecraft measurements: The observed values of T_e/T_i should also be stated in Table 1, because the turbulence simulations of Valentini et al. (2010) indicate that the wavevector anisotropy is also a function of this parameter.

2.2 Direct numerical simulation: As a supplement to Figure 3, it would be informative to plot the A factor as a function of time in the simulations. Fig. 3 of Chang et al. (2013) shows that the asymptotic state of whistler turbulence anisotropy is reached more quickly at higher β_e; is the same true for the Alfvenic turbulence simulated here?

3. Results and discussion: The third paragraph is generally wordy and unclear and needs to be rewritten. "The anisotropy index plotted...(Fig. 3) shows a monotonic trend toward reduced anisotropy with increasing β_i." Delete the sentence beginning "The wavevector anisotropy from the simulations..." Delete the phrase "law of anisotropy as" and the sentence "Namely, the slope value is close to -0.3." In line 12, replace "the scaling law explains" with "Equation (2) represents".

The fourth paragraph ("What is the reason...") is not useful and should be deleted. Particle velocities in the simulations are in full three dimensions, so that the statement "motion around the large-scale magnetic field is forbidden" is simply wrong. The remainder of the paragraph is unclear and vague (What is a "non-eddy spatial structure"?) and does not contribute to the physical understanding. Delete the whole paragraph.

4. Conclusions: "Our observational and computational studies extend the results of NCM14, providing additional evidence that the wavevector anisotropy of plasma turbulence at ion-scale wavelengths becomes weaker with increasing β_i. Furthermore, our two-dimensional hybrid simulations provide a new power-law scaling relation between the wavevector anisotropy and β_i. This fact, however, should not be taken..."

Technical Corrections

Page 1320, line 22 (Section 3, first paragraph): "lager" should be "larger".
Page 1323, line 16 (Section 4, third paragraph): "logics" should be "logic".