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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Lifetime estimate for plasma turbulence" *by* Yasuhito Narita and Zoltán Vörös

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- *In this innovative paper the authors introduce the Breit-Wigner spectral distribution function in order to fit the observed data and extract the underlying turbulence decay rate. I believe that this is a worthwhile approach that should be made aware to the space physics community in general, since this method may be useful for unraveling some underlying physical processes. I have some questions, which I suggest the authors to consider in order to clarify the model.*

  (Question) From the comparative plots of spectral distributions in Figure 1, Breit-Wigner distribution appears to have a superficial similarity with the kappa distribution. It seems to be that one may alternatively use the kappa spectral

  distribution to fit the data in Figure 5. So, the question is, why should one prefer BW distribution over the kappa or Lorentzian spectral function? Is there a rationale for choosing Breit-Wigner distribution over other models?

  - Thank you very much for the positive evaluation. Underlying physical models are different between the kappa distribution and the Breit-Wigner distribution. The use of kappa distribution is developed for describing non-extensive statistical mechanics (e.g., non-extensive entropy), and is developed for discrete particles that have long-range interactions and correlations. Its application to the energy spectra for continuous turbulent fields is still in question, in particular, in interpreting the control parameter kappa in the distribution . On the other hand, the use of a Breit-Wigner (or Lorentzian) distribution has a solid background with a physical model in that the decay rate (appearing as an imaginary part of the frequency) can be measured experimentally and then immediately compared to wave or turbulence models.

    We added a paragraph on the above reply comment ("It is worthwhile to note ...") at the end of section 1 after the Breit-Wigner distribution is first introduced (page 2, lines 11–19).

- *(Question) Please specify what xxx's are in the following: Lines 19-20: wavenumber of xxx and a frequency of xxx? Line 21: mean flow speed, xxx km/s*

  - Oops. Done. "a wavenumber of 0.002 rad km^{-1} and an angular frequency of about 0.75 rad s^{-1}, indicating a phase speed of about 375 km s^{-1}. (page 5, lines 3–4) and "373 km s^{-1}" (page 5, line 6).

- *(Question) In Figure 4, can the angular frequency versus wave number plot be fitted with some known dispersion relations? Fast, slow, or Alfven mode?*
  - Done. We corrected for the Doppler shift and compared the rest-frame frequencies with the obliquely-propagating whistler mode and the kinetic Alfvén mode. The whistler mode seems to be the best candidate to explain the measured frequencies, but the kinetic Alfvén mode can still remain a like candidate within the error bar. We added a subsection "Dispersion relation" on pages 7–8 (from page 7, line 6 to page 8, line 5) and a figure of the dispersion relations (figure 7 on page 8). Correspondingly, sentences are added in section 4 (page 10, lines 10—15) and rerefences to Gary (1993), Hollweg (1999), Lysak and Lotko (1996), Lysak (2008), and Perschke et al. (2014) are added.

Please also note the supplement to this comment:
http://www.nonlin-processes-geophys-discuss.net/npg-2017-24/npg-2017-24-AC1-supplement.pdf

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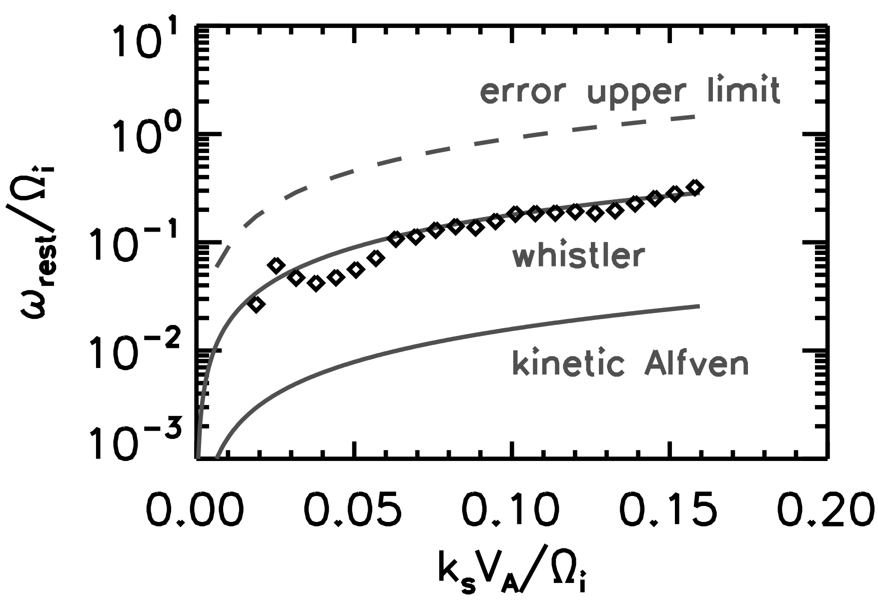

Fig. 1.