

Interactive comment on “Contribution of patchy reconnection to the ion to electron temperature ratio in the Earth’s magnetotail” by Chuxin Chen and Chih-Ping Wang

Anonymous Referee #2

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The manuscript deals with ion to electron temperature ratio in the Earth’s magnetotail. The authors present an analytical model to investigate the role of patchy reconnection from the near-Earth tail to mid-tail.

Specific comments:

1) Heating in reconnection I have significant concerns about how the authors treat (or actually seem to neglect) plasma heating in reconnection. The authors state on p5, lines 3-4: “Equation (23) indicates that the ratio T_i/T_e is preserved after a patchy magnetic reconnection. However, this is only true when the temperature of both the ions and electrons in Eqs. (16) and (20) are constant during the patchy reconnection.”

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Plasma temperature does not stay constant during reconnection, patchy or extended.

Heating (i.e., increase in temperature) during reconnection has been the focus of several previous studies. For example, Drake et al. (JGR 2009; see also references therein) considered how ions get heated when they enter a reconnection exhaust (BBF). This has been further investigated by, e.g., Haggerty et al. (GRL 2015). I don’t think this aspect of reconnection can be ignored when considering the ion to electron temperature ratio.

2) Discussion on the limitations of the model The present discussion is not comprehensive enough. Topics that should be discussed in much more detail than in the present manuscript include: a) dawn-dusk asymmetry The discussion on asymmetry should include both the exclusion of particle drifts in the model (already mentioned, but more detail needed), as well as the observational fact of “dusk side is more active” (more reconnection and reconnection-related phenomena are observed to take place on the duskside than on the dawnside, but this difference of occurrence rates is also not included in the model; (Raj et al., JGR 2002; Frey et al., JGR 2004; McPherron et al., JGR 2011; Nagai et al., JGR 2013; Liu et al., JGR 2013; Genestreti et al., JASTP 2014; Gabrielse et al., JGR 2014; Kiehas et al., JGR 2018)). b) scattering Waves are not included in the model, but what would be scattering’s likely effects?

Technical corrections:

Figure 1: Does the x-axis in Figure 1 point towards the Earth or away from the Earth? In other words, is the flux tube shown in the figure Earthward or tailward of the X-line?

Figure 3: The figure requires several improvements so that comparisons could be made with the observations in Figure 4. The axis limits should match those of Fig. 4, and matching colors added. Furthermore, the labels should be bigger and overall resolution higher.

page 7, line 25: much -> very page 8, line 15: moving -> moves

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