

Review of “Calculations of the Integral Invariant Coordinates I and L^* in the Magnetosphere and Mapping of the Regions where I is Conserved, using a particle tracer (ptr3D v2.0), LANL*, SPENVIS, and IRBEM”

This manuscript describes a systematic examination of the second and third adiabatic invariants I and L^* calculated with two models available to the community as well as a particle-tracing model written specifically for the study. The results are interesting and highlight the importance of utilizing adiabatic invariants with care.

The authors have addressed my concerns with a previous version and assuming the following minor issues are addressed, the manuscript is suitable for publication.

Minor Comments/Technical Corrections

- 1) Line 8: “adiabaticity” \rightarrow “conservation”. I think this may be more precise, but if the authors feel strongly about it adiabaticity is fine.
- 2) Line 15: Insert “ptr3D,” before “a 3D particle tracing code...”.
- 3) Line 16: “purpose” \rightarrow “study”.
- 4) Line 18: “starting” \rightarrow “initial”.
- 5) Line 22: Ibid.
- 6) Line 27: Insert “line” after “magnetic field”.
- 7) Line 28: Ibid.
- 8) Line 31: “associated with each” \rightarrow “defined”.
- 9) Lines 33 and 39: Either capitalize second invariant or don’t.
- 10) Equation 1: make the upper or lower integration limit s'_m , so it can’t be thought that the integration is over a null range.
- 11) Line 44: I is NOT just the length of the field line (i.e., $\int_{s_m}^{s'_m} ds$). The radical factor is important! The wording should be changed to reflect that it has units of length and depends on the path length, but isn’t approximately that!
- 12) Lines 48–49: See comment 9.
- 13) Line 81: IRBEM-lib or IRBIM-LIB, pick one.

- 14) Line 87: "integrant" → "integrand".
- 15) Line 88: See comment 13.
- 16) Line 107: "purpose" → "study".
- 17) Line 109: Omit "the" before "TS05".
- 18) Line 120: ", for 4" → ". Four".
- 19) Line 121: "(4–8 R_E)." → "(4–8 R_E in steps of 1 R_E) were used."
- 20) Line 123: Insert "in a" before "static magnetic field)".
- 21) Line 128: Insert "UT" after "17:55" (Assuming this is in UT).
- 22) Line 130: Ibid.
- 23) Line 143: "0 MLT" → "midnight MLT".
- 24) Line 159: Ibid.
- 25) Line 169: Omit "(L-star-max)".
- 26) Line 173: Omit "For" and "the calculated maximum L^* ".
- 27) Line 190: See comment 1.
- 28) Line 222: insert "(p.a.)" after "initial eq. pitch angle" (or otherwise make clear the use of "p.a." in the subsequent lines).
- 29) Line 230: "attempted to quantify" → "quantified".
- 30) Line 284: Omit "in this paper".
- 31) Lines 286–291: This casts doubt on the entire study. What is meant by "tuned"? Why can't you just release it, with that caveat?