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Interactive comment on "Invariants of the Spatial-Energy Structure and Modeling of the Earth's Ion Radiation Belts" *by* Alexander S. Kovtyukh

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Specific comments

The invariants presented in Section 2 are not tied to any particular model (see above), but they can be used in works on the creation of both empirical and mathematical models of spatial-energy distributions of ERB ions. In particular, they were tested in many my works on modeling the pitch-angle distributions of protons, the empirical model of ion fluxes for region of the geosynchronous orbit (GSO), the daily course of ion fluxes on the GSO and in other problems. Points on fig. 1-9 were obtained from experimental radial profiles of differential ion fluxes. It was taken into account

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that, for different authors, these fluxes have different dimensions. For example, for ions with Z > 1, these fluxes are given in (cm2 s ster MeV/n)–1 or in (cm2 s ster MeV)–1; in the latter case the same ion flux will have a value of Z times less. Isolines in Fig. 1-9 are envelopes of experimental points (they are constructed by the method of the ïĄč2). It was important to choose a form of representation (space of variables) in which the results of different experiments (with different sets of the energy chennels) one could accommodate organically and without resorting to interpolations and extrapolations of the data. As such representation was chosen the space {E. L}. All other representations, such as radial profiles of ion fluxes for different energies, suggest interpolation and extrapolation of an experimental data; this is greatly complicates the solution of our problem and introduces large systematic errors and arbitrariness in the choice of curves approximation. To present the data obtained outside the equatorial plane, it was natural to use the space {B/B0, L} for ions of different energies. Here I had to resort to interpolation of data and Figs. 7–9 are less complete and accurate compared to Figs. 1–6. For comparison Figs. 1-2 with Figs. 3-4, specific values of proton and helium ion fluxes are given (lines 269-271). For Figs. 7-9 interpretation can be simplified, and then it is not necessary to put on these figures the dependences B/B0(L) for fixed heights. For the dependency of the radial diffusion rate on B/B0 a reference are added (at line 347). There are not enough data for CNO group ions and they are very fragmentary; build or them figures like to Fig. 7-9 while is impossible. One can only make assumptions on the basis of available data and general considerations. I changed the sentence at lines 362-364, made it more careful.

Technical corrections

I would correct the errors in the revised version of the manuscript. All dimensions of the MeV unit displayed in Cyrillic replaced by on Latino. In the caption to Figs. 1-6 added explanations to color lines. In Figs. 1–6, the color lines are show dependencies on L of the ion energies corresponding to the structure invariants (E ïĆţ ïĄ■L-3) and also the maximum energy of ions which can be trapped in the ERB(E ïĆţ L-4).

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