



SDI Review Form 1.6

Journal Name:	Physical Science International Journal
Manuscript Number:	Ms_PSIJ_29210
Title of the Manuscript:	Ion distribution functions and transport properties in collision-free auroral ionosphere under arbitrary electric fields
Type of the Article	

General guideline for Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty**', provided the manuscript is scientifically robust and technically sound.

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PART 1: Review Comments

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)
Compulsory REVISION comments		
Minor REVISION comments	<ol style="list-style-type: none"> 1. The references shouldn't be appeared in the "Abstract". The authors should correct it. 2. The authors can explain more what is the ultimate objective with this manuscript? 3. Figure 2 is unclear and authors can change it clearer. 4. I think the contents of Abstract can be increased more. The content is not enough to describe the subject of this manuscript. 	<ol style="list-style-type: none"> 1. Thanks! The reference occurring in the abstract was removed; and it was corrected by the phrase "previous work". 2. Yes. Following sentences were added in the last paragraph of Section 1, Introduction, to explain more the ultimate purpose of this paper, which was highlighted: the purpose of this paper is to expand our knowledge beyond the early work (Ma & St.-Maurice 2008, 2015) to answer the following question: in the presence of large electric fields (in the order of 50 mV/m) in the collision-free ionospheric F with arbitrary shears in the cylindrical geometry (applicable to altitudes higher than 140 km), how the non-Maxwellian ion velocity distributions and bulk properties evolve. The ultimate goal of this study is to set up a data-fit modelling to the on-going and future high-resolution observations like FAST, Cluster, for elucidating what an interplay is between the auroral ionospheric plasma and the $E \times B$ drift which affects the ion velocity distribution and transport properties in the presence of the observed arbitrary transverse electric fields that change radially in regimes where the electric field changes in different shapes in space. Compared with the previous work, the new consideration 3. Thanks! Figure 2 is now much more clearer by expanding it with a factor of 1.8. 4. Thanks! The new abstract is expanded to describe the subject of this manuscript by more materials. The complete is given as follows: Filamentary space-charge aurorae bring about cylindrical structures symmetric to local geomagnetic field lines in auroral ionosphere. It produces arbitrary structured electric fields. Developed from previous work on a backward



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		<p>mapping technique to solve ion velocities and transport properties under both collision-free and collisional conditions in cylindrically symmetric, uniformly charged auroral ionosphere, this paper studies the collision-free case by numerically solving the Boltzmann-Vlasov equation in the presence of three arbitrarily chosen electric field configurations: (1) an electric field which is proportional to the radius inside a space charge cylinder but drops off slowly outside the cylinder; (2) an electric field which is still proportional to the radius inside the space charge cylinder but drops off more quickly out side the cylinder; and, (3) an electric field which is localized at the edge of the cylinder. Various shapes of non-Maxwellian ion velocity distributions and associated transport properties are obtained. In regimes where the electric field dropped outside the space-charge region, the evolving velocity distribution with time is found to have many possible types of shapes, such as, deformed pancake, horseshoe, teardrop, core-halo, etc. If the electric field drops sharply on both sides of the boundary of the region, the distribution develops into an ear-collar appearance with time. Under all electric field structures, the non-Maxwellian distributions and related transport parameters are localized to the region where the electric field permeates. The results are expected to be applicable to account for ongoing and future high-resolution observations.</p>
<u>Optional/General</u> comments		