Author,

I have included some lines where I think you could introduce some modifications. These are recommended suggestions, which are obviously based on my interpretations. I would not be offended if you presented an argument and decided not to use my suggestions. Also, I found some errors/typos that I have included below. Overall, I found your manuscript to be well written, informative, and engaging.

After reading through your paper, I wondered if you there is a torque involved or maybe conservation of angular momentum via the fields; Maxwell Stress energy tensor and the Poynting vector. Have you explored this idea?

A very interesting idea. I enjoyed reading your paper and look forward to the revisions!

LINES 31-32:

31 and Rostoker, 1983]. The onset aurora is a meso-scale form of discrete aurora referred to as
32 Westward Traveling Surge (WTS) (REF.?).

I believe there should be a reference at the end of the sentence for WTS.

LINE 37:

37 generated in the magnetosphere by the plasma instability [Forsyth et al., 2020]. ~~Or~~ CCW
38 rotations are generated in the ionosphere by shear flow instability of flux tubes

I think the 'Or' is a typo. If not, please re-work sentence.

LINE 42:

42 and Partamied, 2024]. The second type (CW) is called the S-aurora, where auroral vorticities
43 rotate in clockwise directions that are counter to the first type [Oguti, …

Insert comma (yellow highlight) after S-aurora. think you mean "form" not "from":

LINES 43-44:

43 … The onset aurora
44 showing the second type rotation is a meso-scale auroral form of S-aurora

Re-work sentence so your point is clear and concise. A possible change:

… The onset aurora,

showing the second type of rotation, is a meso-scale auroral form of the S-aurora. …

My added suggestions are highlighted in yellow.

LINES 44-48:

44 showing the second type rotation is a meso-scale auroral form of S-aurora. In this report, we
45 regarded auroral arc as negatively charged solitary area in the polar ionosphere or an "ion
46 hole."

Why are you regarding the auroral arc as a negatively charged solitary area in the polar ionosphere?

Why is this assumption needed?

Do you have a reference to backup this assumption or is this a new idea?

LINE 48:

48 in the collisional ionosphere by precipitating energetic electrons. Although flow shears in the …

Insert 'the' (yellow highlight) in the above sentence.

LINES 50-51:

50 we suggest flapping instability of the ion hole deforms the onset aurora with an opposite sense
51 of rotation.

Add 'an' (yellow highlight) in the above sentence.

LINE 69:

69 aurora are common features of the S aurora [Oguti, 1975].

Missing hyphen for S-aurora

LINE 70:

70 auroral form of S aurora.

Missing hyphen for S-aurora

LINE 95: Equation (1)

Possibly add a reference for Equation (1).

Define m_q in Equation (1).

Maybe change the symbol for speed from nu (ν) to v, to avoid any confusion for an unfamiliar reader who may do a dimensional analysis. They may take ν to be a frequency, rather than a speed. This is a suggestion.

Also, after looking at Equation (6), someone might be convinced that ν is a frequency in Equation (1). In Equation (6) a capital V is used for speed.

I would suggest using the same symbol for all speeds, either V or v.

LINE 100: Equation (2)

Same suggestion as above, LINE 95.

Possibly add a reference for Equation (2) or include (2) if a reference is added for Equation (1).

LINES 103-104:

101 … In the
102 case of upward electric fields, due to pitch angle disagreement between electrons and ions,
103 perpendicular temperature anisotropy of electrons becomes larger. While for ions, parallel

104 anisotropy becomes larger than the case without a parallel potential (Figure 4).

Maybe end sentence after 'larger'. This seems to me to be a natural place to end the sentence. Also, add 'a' in line 104:

LINES 119-120:

119 1964; Tohmatsu, 1990], we have ion drift velocities on the order of $1\ 119\ 5.9\square 10$ m/s for electric
120 fields of the order of 0.1 V/m.

Possibly change 'have' to 'obtain'??

LINES 120-121:

120 … Those drifting ions carry Pedersen currents of the order of
121 $1.0\ \mu Am^{-2}$ in the ionosphere…

Replace 'currents' with 'current densities'. Units used are associated with current density.

LINE 127: Equation (4)

Note that $\mathbf{J}_{||}$ is a current density.

LINE 168:

Possibly/maybe add M. H. Rees to your references: e.g., *Physics and Chemistry of the Upper Atmosphere*

LINE 180:

180 Here, ε_0 is dielectric constant in vacuum, and $x\,E$, $y\,E$ are electric field component …

I would strongly suggest that ε_0 should be referred to as the **Permittivity of Free Space**.

Calling the ε_0 dielectric constant could cause confusion or making a bad assumption.

Here are my arguments for not calling ε_0 the dielectric constant.

Recall, the following relationships for linear dielectrics:

$$\varepsilon = \varepsilon_0 \varepsilon_r = \varepsilon_0 \left(1 + \chi_e\right)$$

$$\varepsilon_r = \left(1 + \chi_e\right)$$

Where:

$\chi_e \equiv$ Electric susceptibility of some material,

$\varepsilon \equiv$ Permittivity of some material,

$\varepsilon_r \equiv$ Dielectric constant (or Relative permittivity) of some material,

$\varepsilon_0 \equiv$ Permittivity of free space.

For a vacuum: $\chi_e = 0 \;\; \varepsilon_r = 1$

Hence: $\varepsilon = \varepsilon_0$

Someone with the above knowledge could extrapolate that the dielectric constant for a vacuum is:

$$\varepsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N \cdot m^2}$$

and make the wrong assumption that a vacuum is a unique type of linear dielectric.

Also, the dielectric constant and the electric susceptibility are dimensionless.

LINE 211: EQUATION (6)

Same suggestion I made for Equation (1).

I would suggest using the same symbol for all speeds, either V or v.

LINE 234:

234 …shown in Figure 1 and to splitting motion of S aurora referred to as "peeling-off" [Oguti, 1981].

Missing hyphen for S-aurora.

LINE 237: SUMMARY

I think you should add a little more detail in the Summary, regarding the creation of the ion hole and its relation to the flapping instability.

FIGURE 1:

To the right of the red line at the bottom of the keogram (panel A) there are 2 black peaks, possibly from the magnetometer or some other plot. Panel A in Figure 2 does not have any type of plot line superimposed on the keogram.

FIGURES 1 AND 2:

Adding a N to S line, slice from auroral image which is used to construct the keogram, may be helpful for the reader. A reader may think/assume that the keogram is composed of vertical slices through the auroral images. Another suggestion would be to rotate the images so the N-S alignment on the auroral images is aligned with the N-S on the keogram. I am assuming that the N-S for the all-sky images is also along the geomagnetic meridian, since the keogram is composed from these images. Maybe include this in the captions for Figures 1 & 2 for someone not familiar with these types of plots.

It might be helpful put the km on the right side of the keogram plot (panel A) in parentheses.

LINES 383-384: CAPTIONS FOR FIGURE'S 1 AND 2:

383 **dipolarization onset at 0328:30 UT is marked by vertical bar in red. All-sky images in the**
384 **bottom are viewed from above the ionosphere (along the field lines). Poleward expansion of …**

I am not sure I understand what you mean in the statement that the "All-sky images are viewed from above the ionosphere …"

Were the all-sky images recorded from space?

LINE 412: CAPTION FOR FIGURE 5

412 (A): Altitude profiles of the upward electric fields in $\mu V / m$. (B): Upward current density in $\mu A / m^2$ ...

Add 'density" after current, units used are associated with current density.