

Time-dependent electron transport calculations of Alfvénic precipitation, with some implications for NEIALs and auroral rays

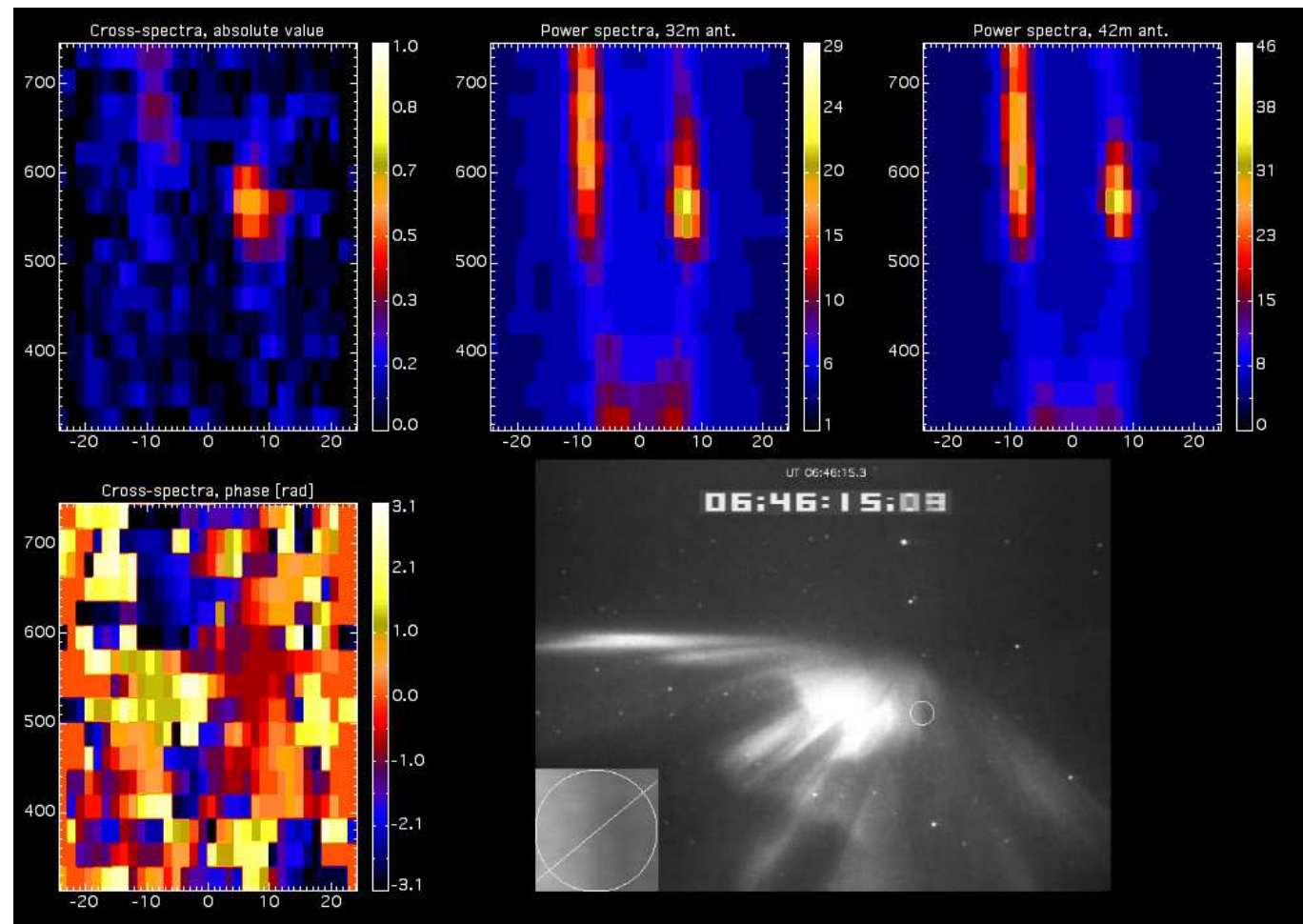
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November 14, 2019

NEIALs and Dynamic Auroral Rays

❖ NEIALs n Auroral Rays

- ❖ Previous Work
- ❖ Electron-fluxes
- ❖ TDMS-e-TRP
- ❖ Electron transport results
- ❖ Conclusion
- ❖ References



Observations and animation from Grydeland et al. (2004) and Blixt et al. (2005).

Bump-in-tail excitation of LT

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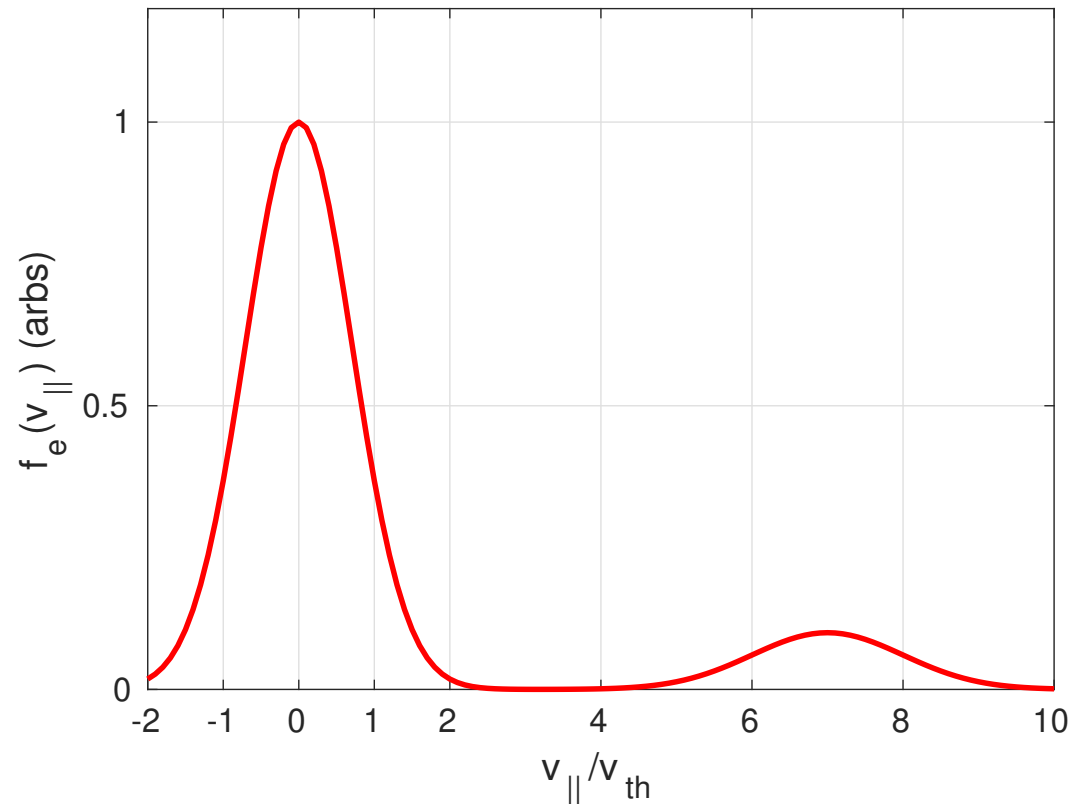
❖ TDMS-e-TRP

❖ Electron transport results

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Guio and Forme (2006) showed that low-energy electron beams can produce ion-line enhancements by inverse Landau damping excitation of Langmuir-waves (LW) that then cascades leading to production of ion-acoustic waves

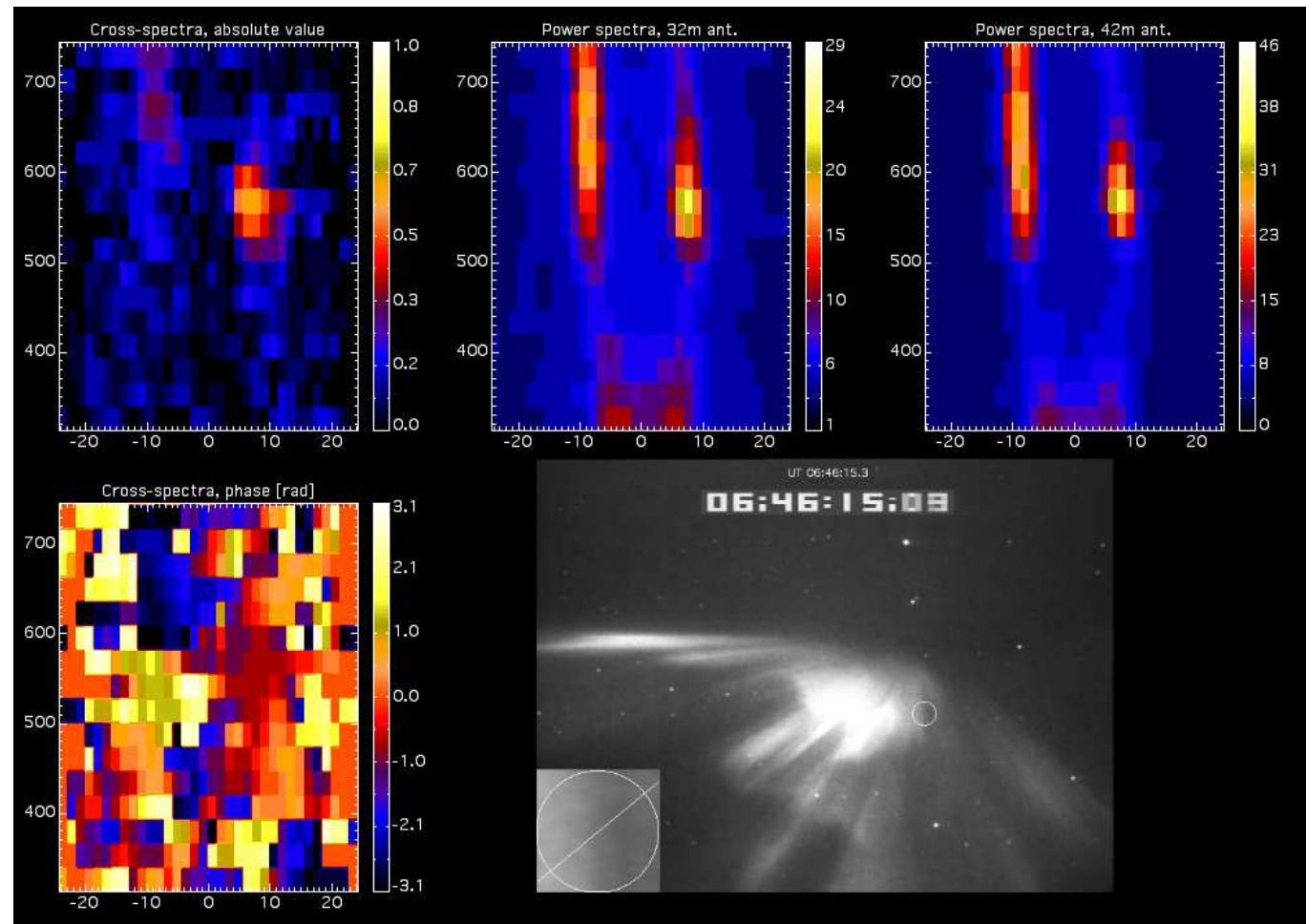


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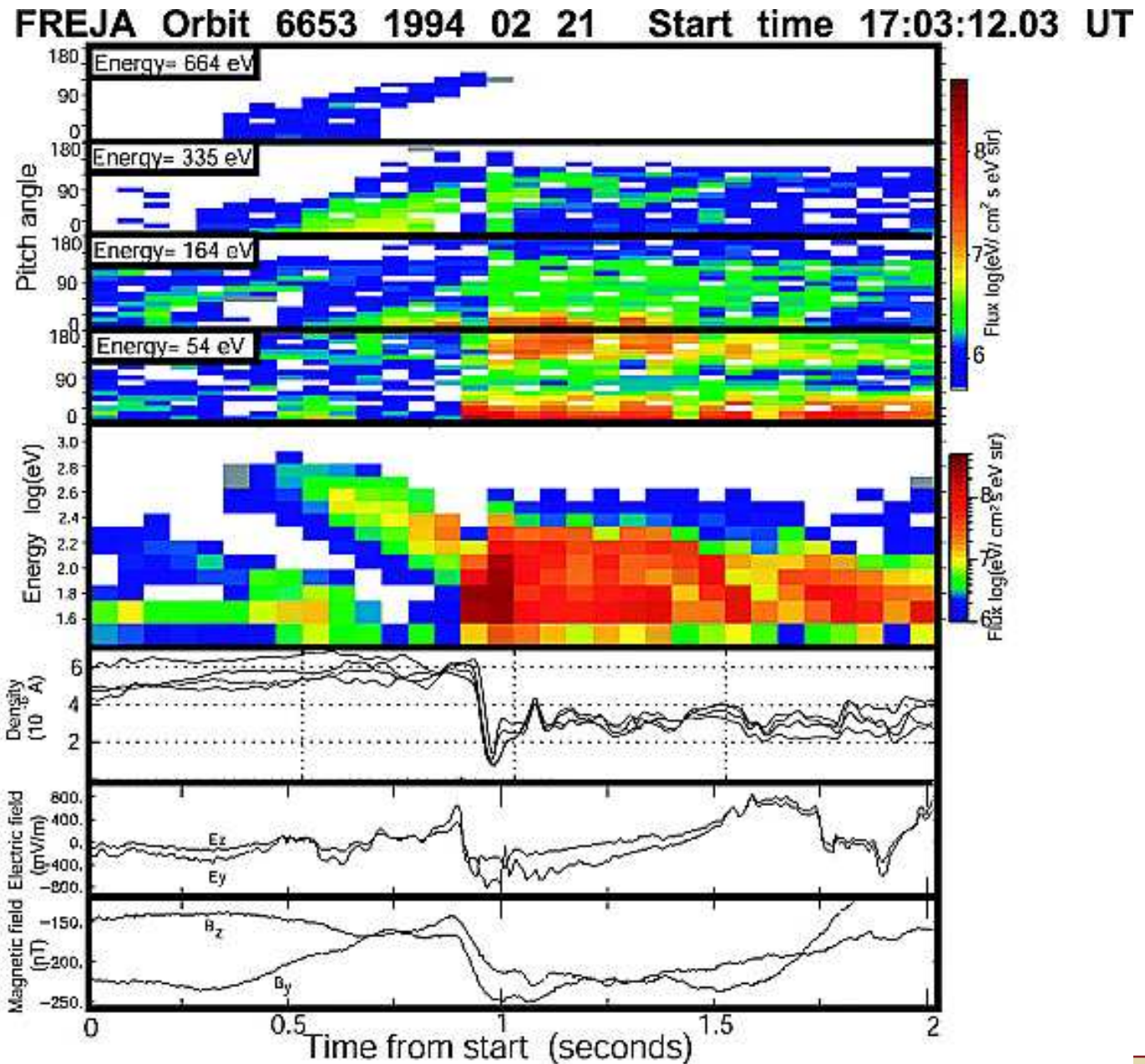
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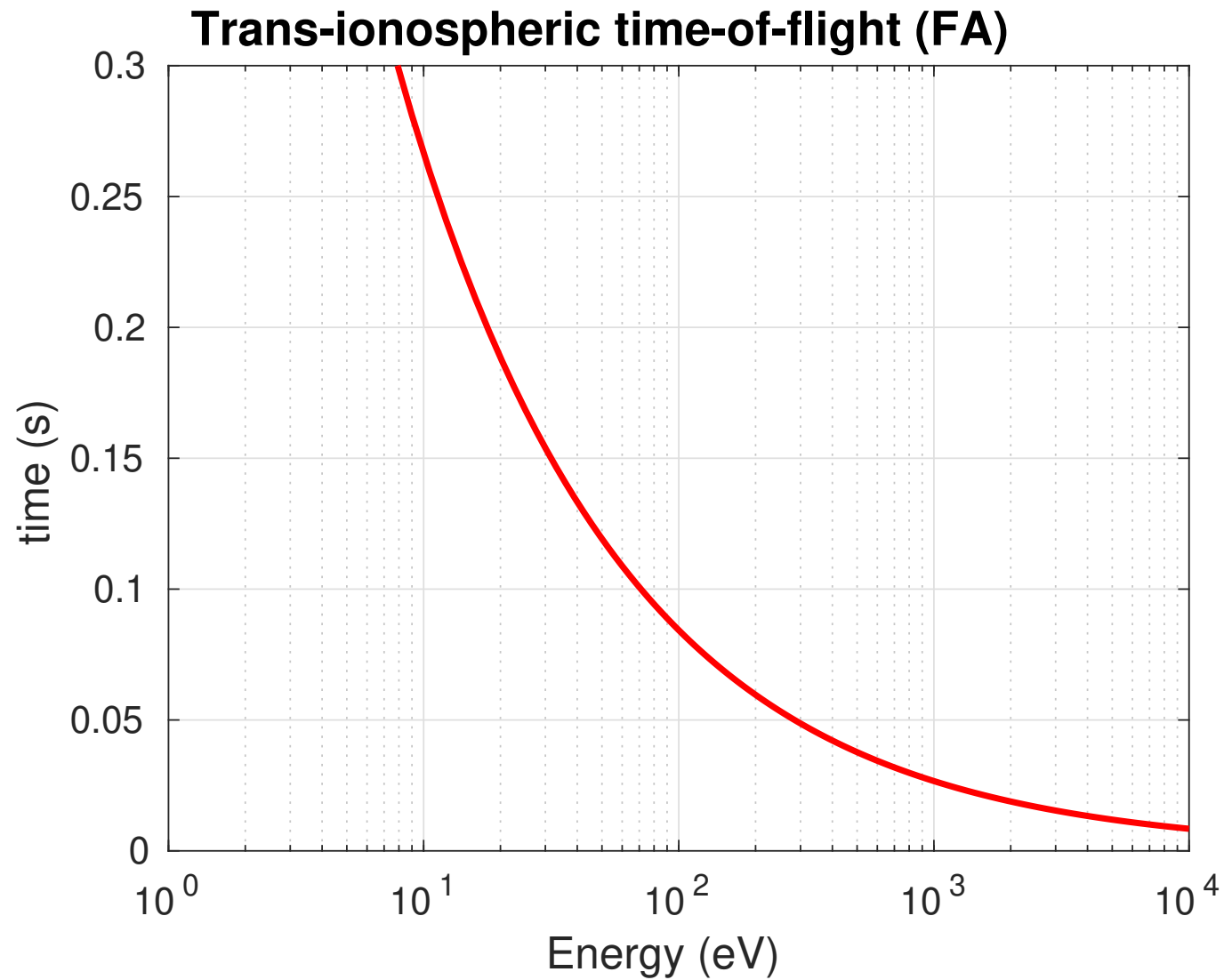
Aflvénic electron fluxes

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Time-of-flight

- ❖ NEIALS n Auroral Rays
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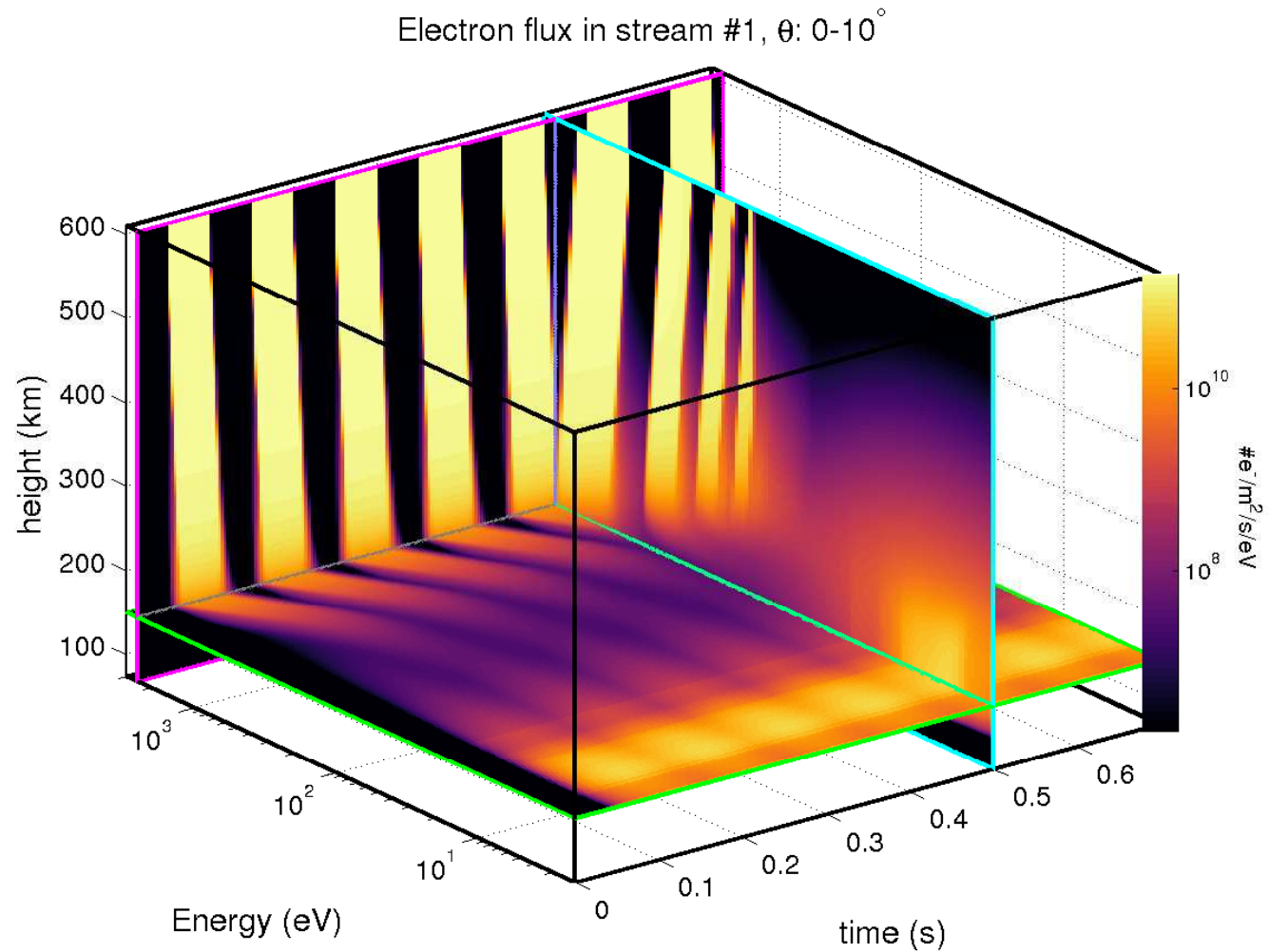
Time-dependent electron-transport

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$$\begin{aligned} \frac{1}{v(E)} \frac{\partial I(E, s, \mu, t)}{\partial t} + \mu \frac{\partial I(E, s, \mu, t)}{\partial s} = & - A I(E, s, \mu, t) \\ & + B(E, s, \mu, t, I) \\ & + Q(E, s, \mu, t, I) \\ & + n_e \frac{\partial (L_{ee}(E) I(E, s, \mu, t))}{\partial E} \end{aligned}$$

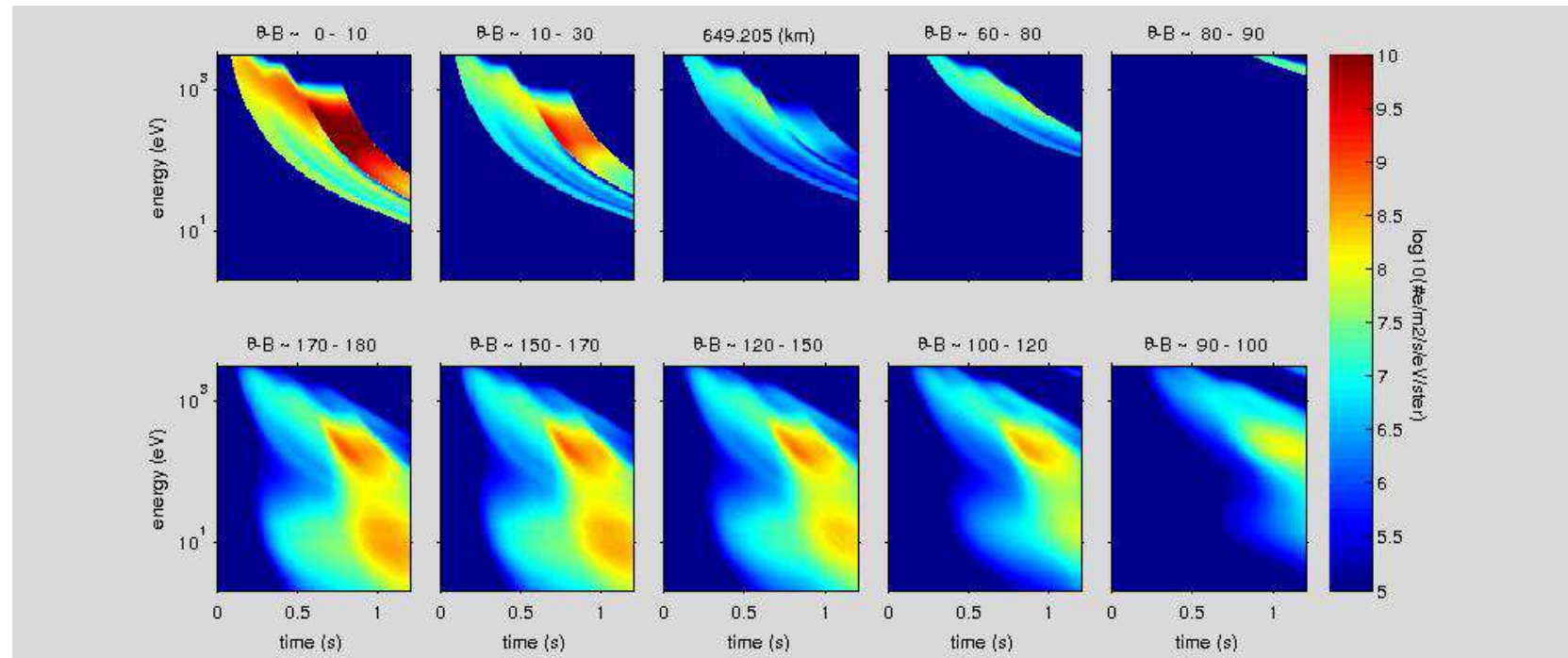
Electron transport results 0

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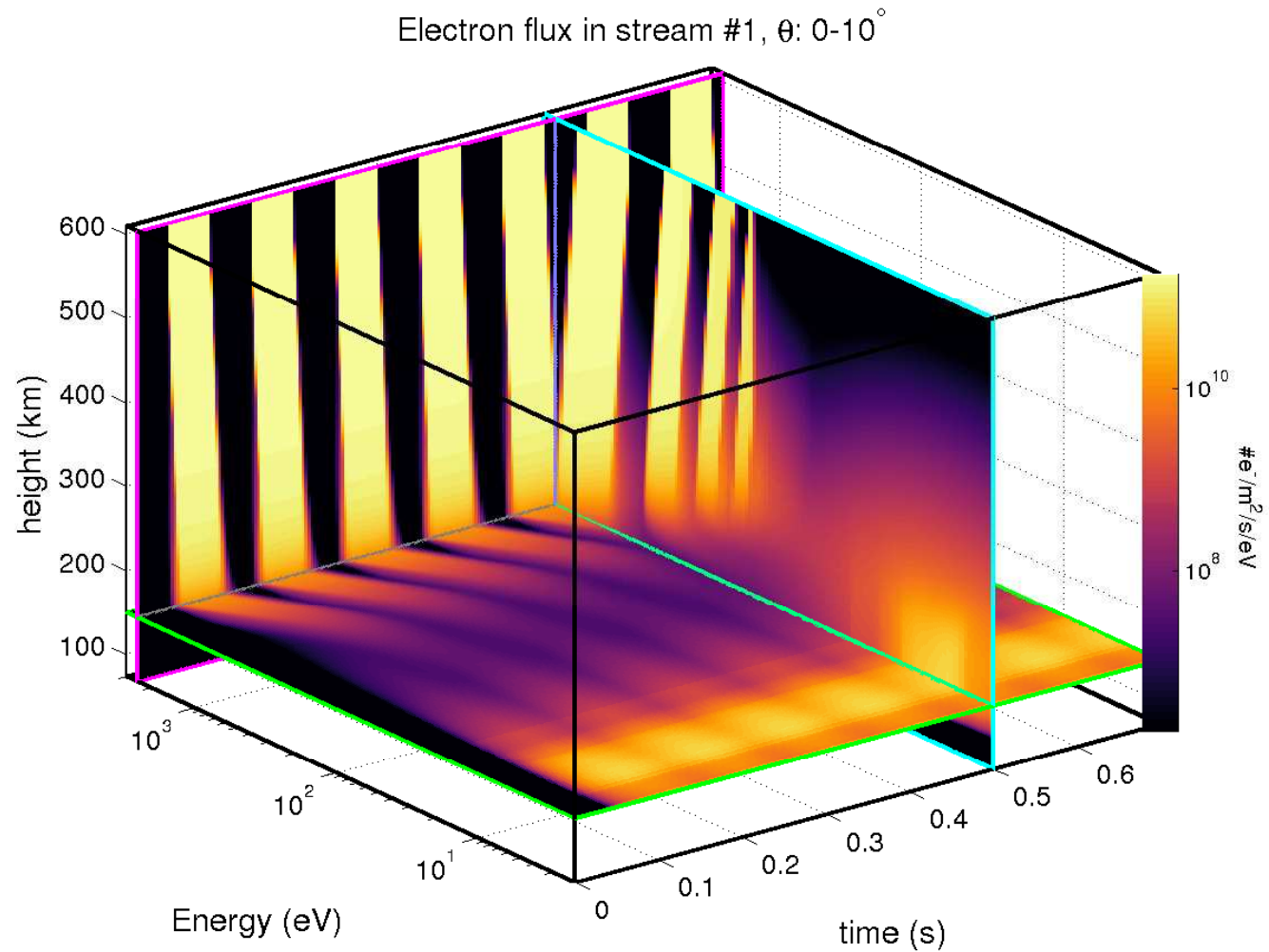
Electron transport results I

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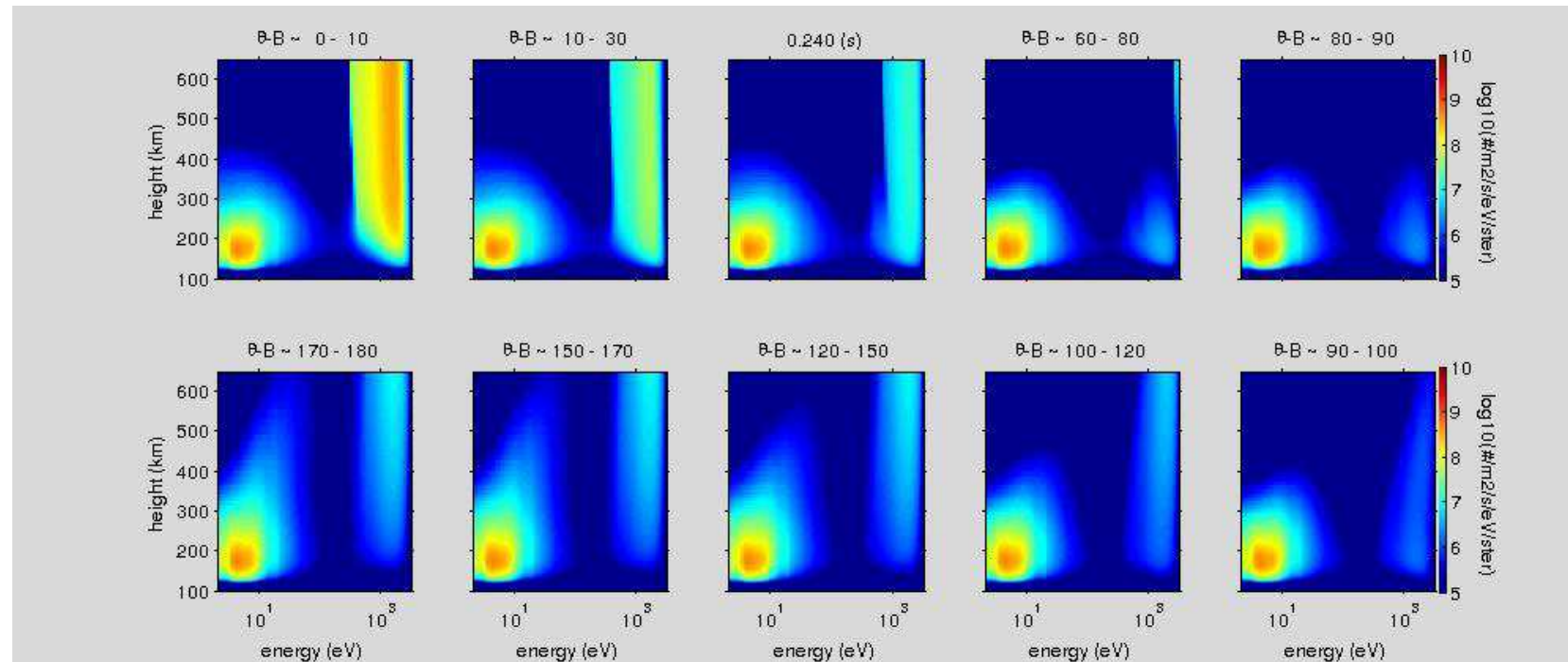
Electron transport results 0

- ❖ NEIALS n Auroral Rays
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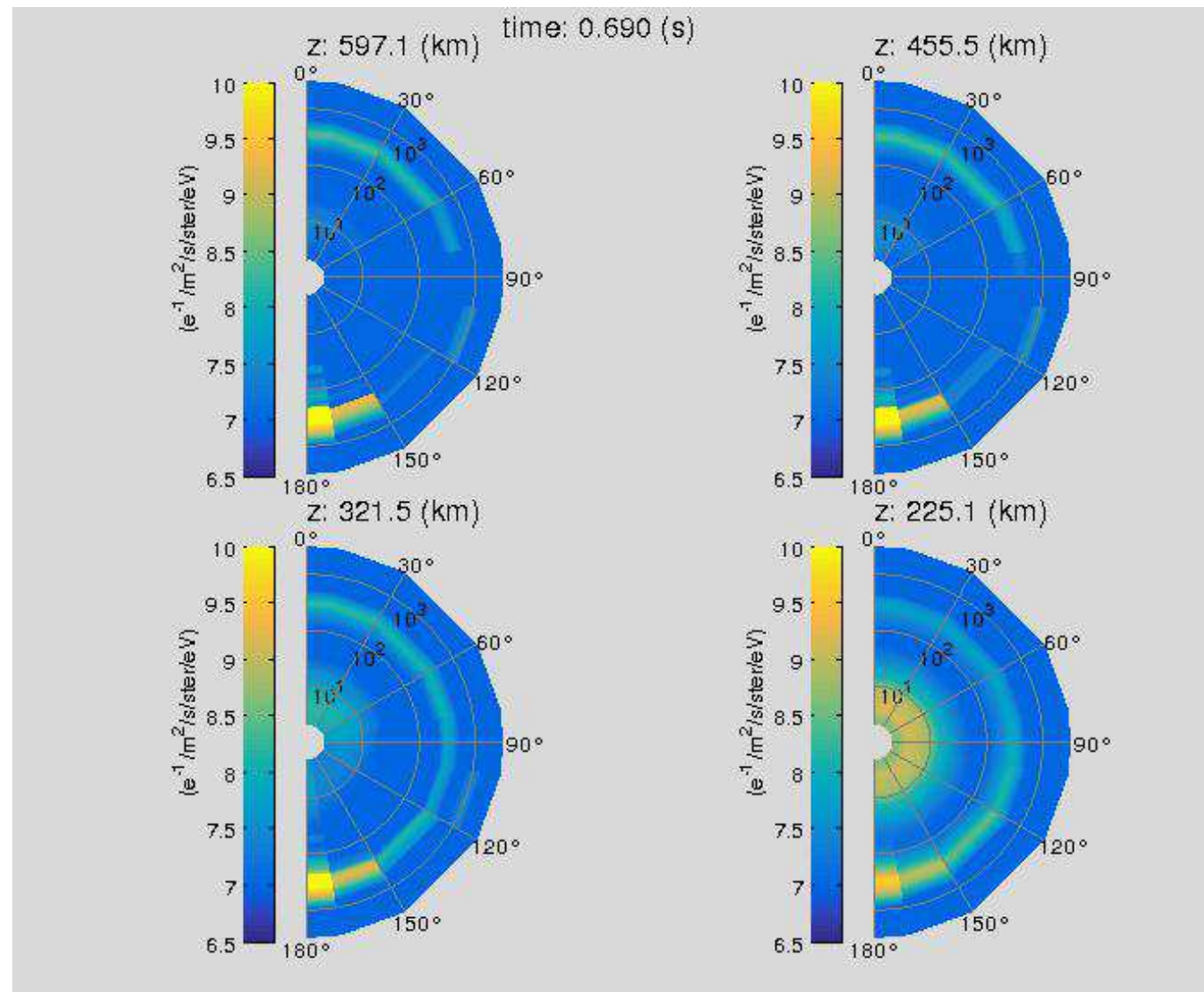
Electron transport results II

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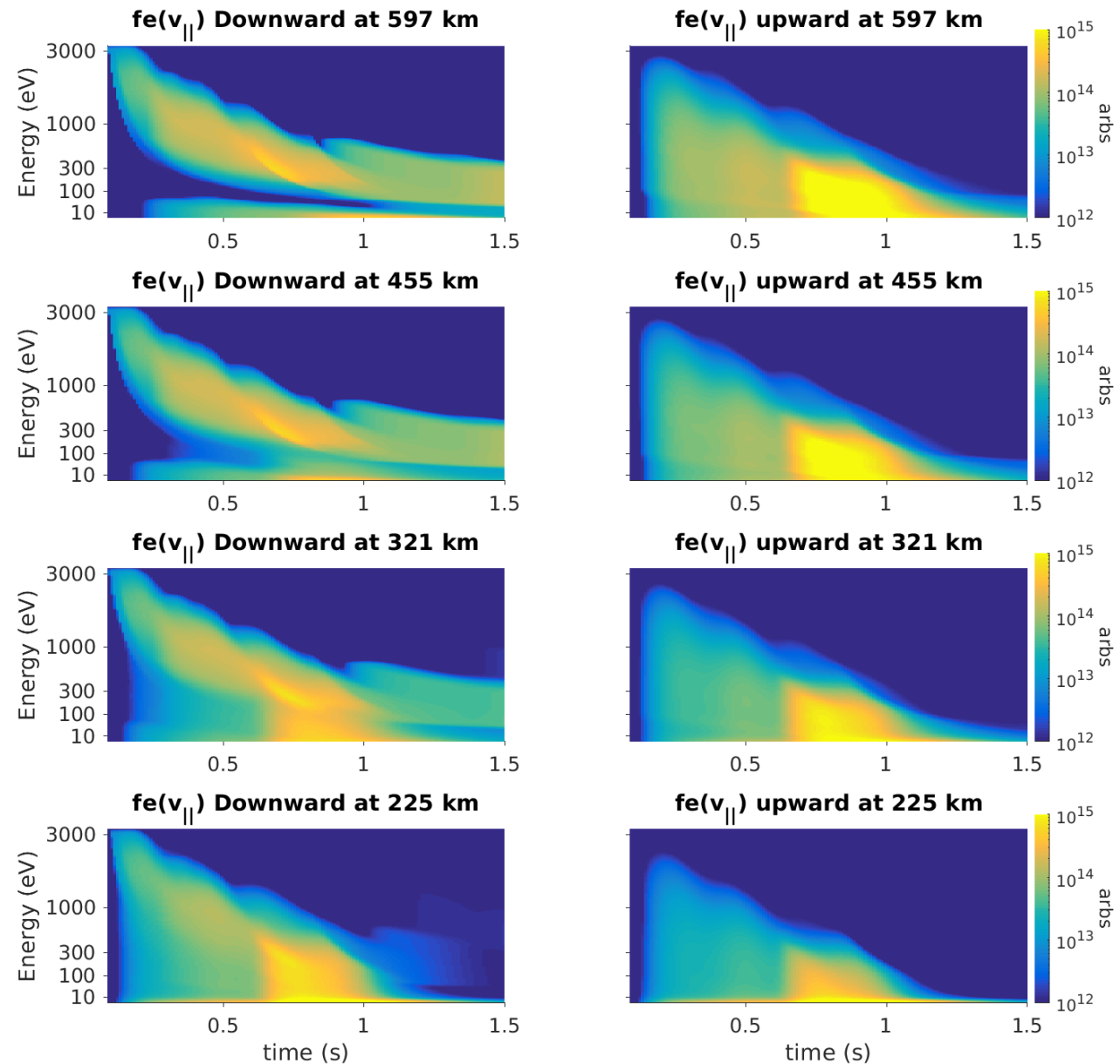
Electron transport results III

- ❖ NEIALS n Auroral Rays
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- ❖ Electron-fluxes
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- ❖ **Electron transport results**
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- ❖ References



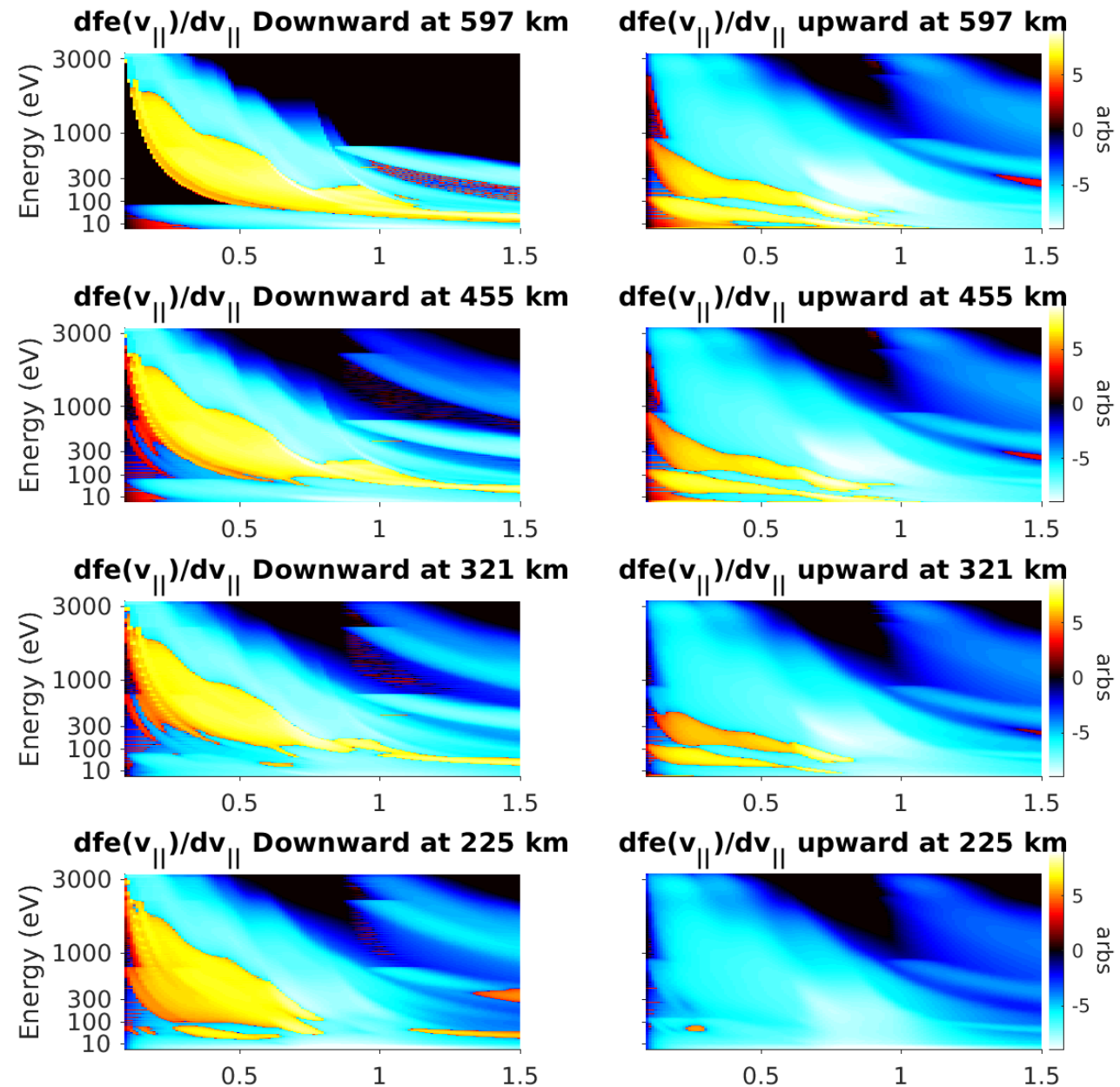
Electron transport results IV

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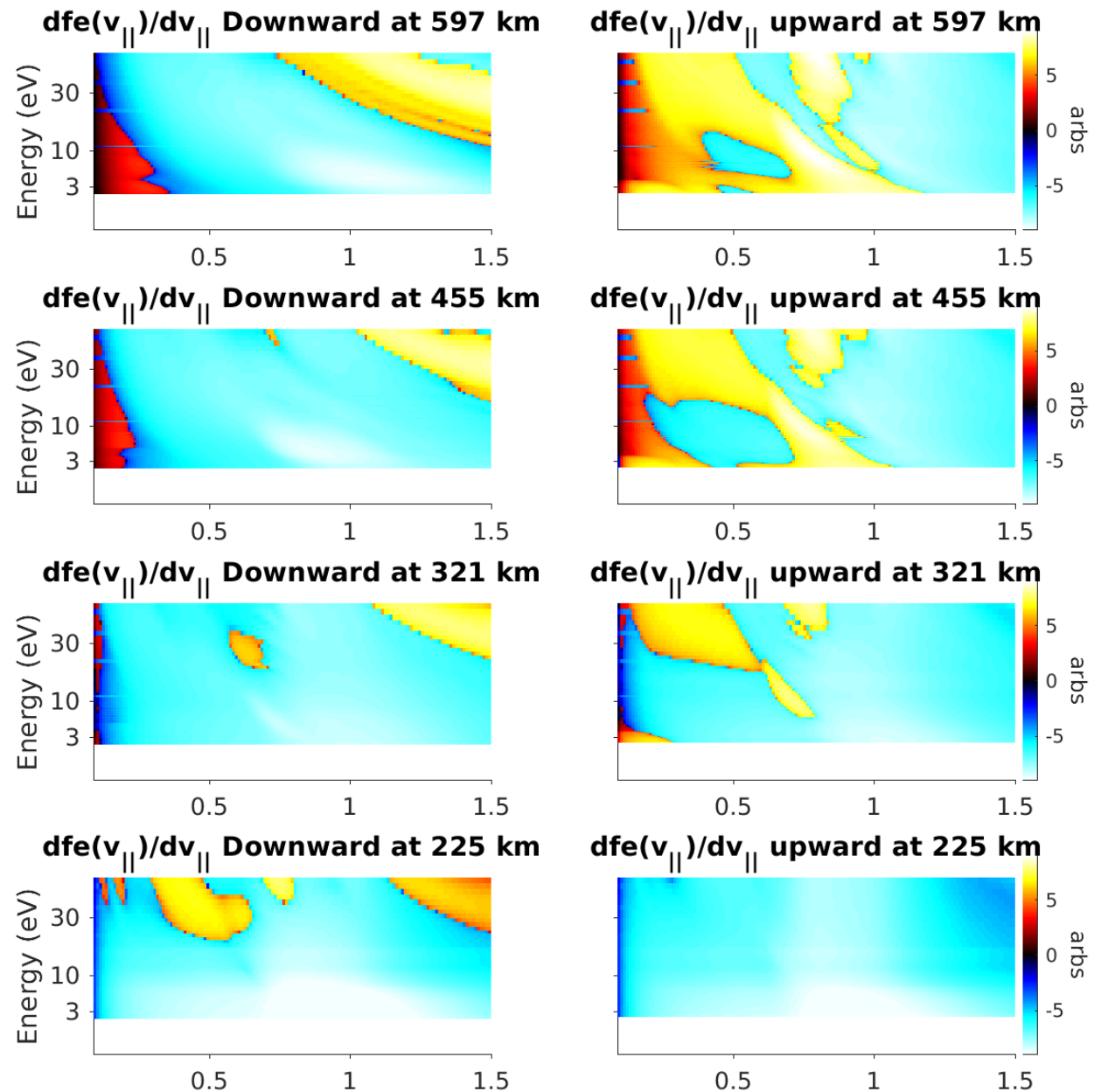
Electron transport results IVb

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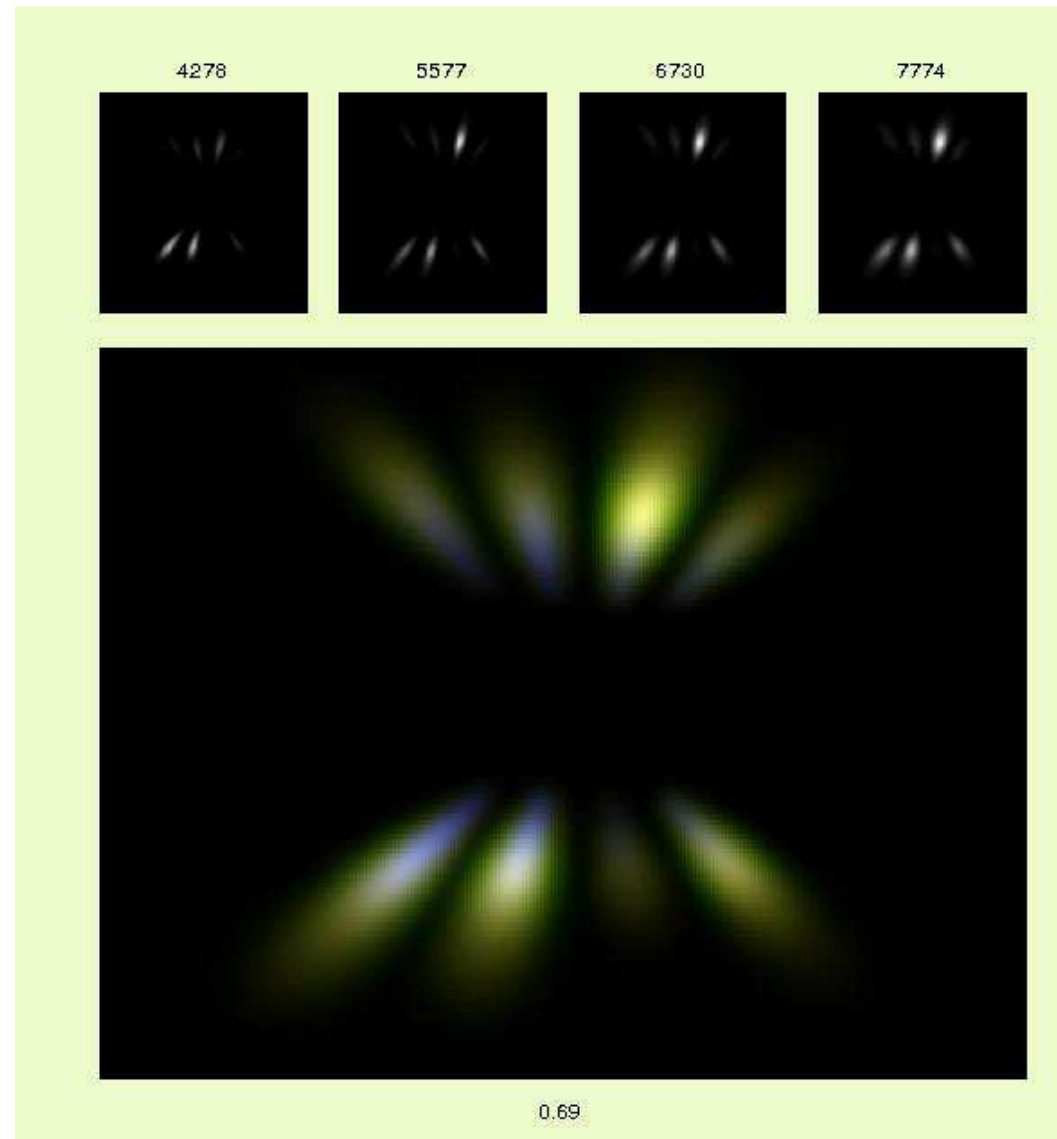
Electron transport results IVc

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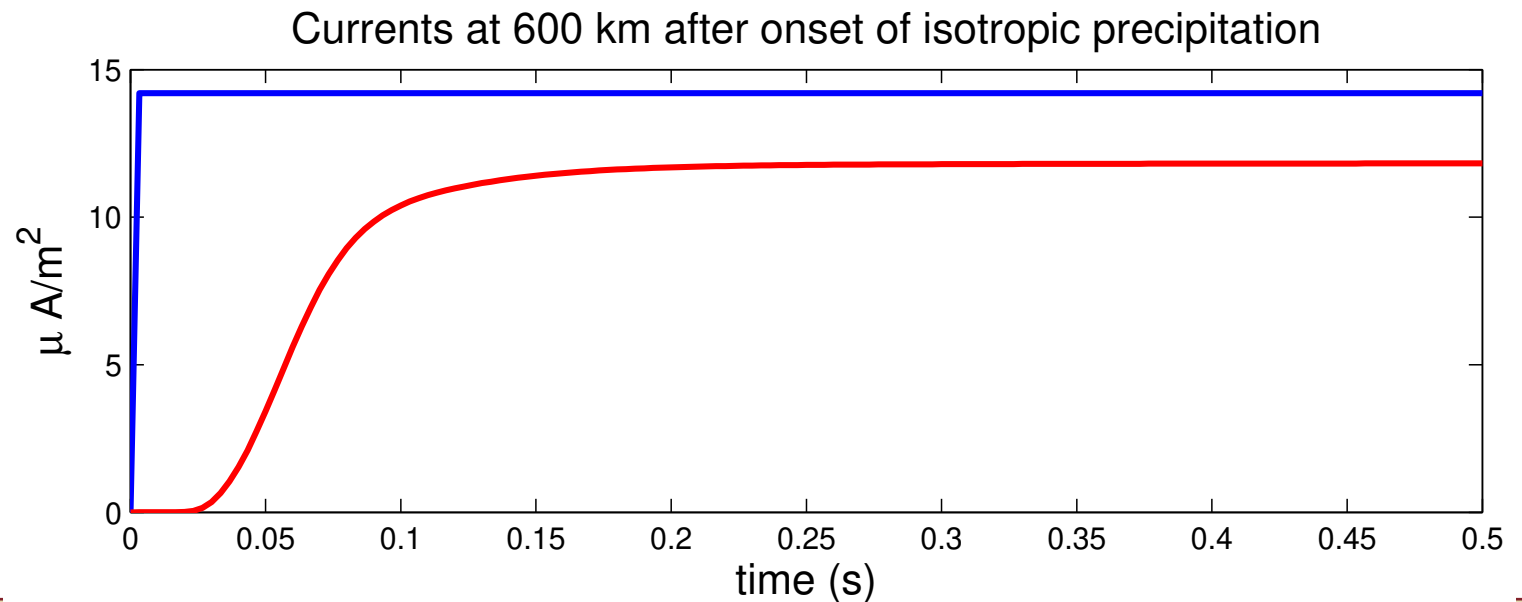
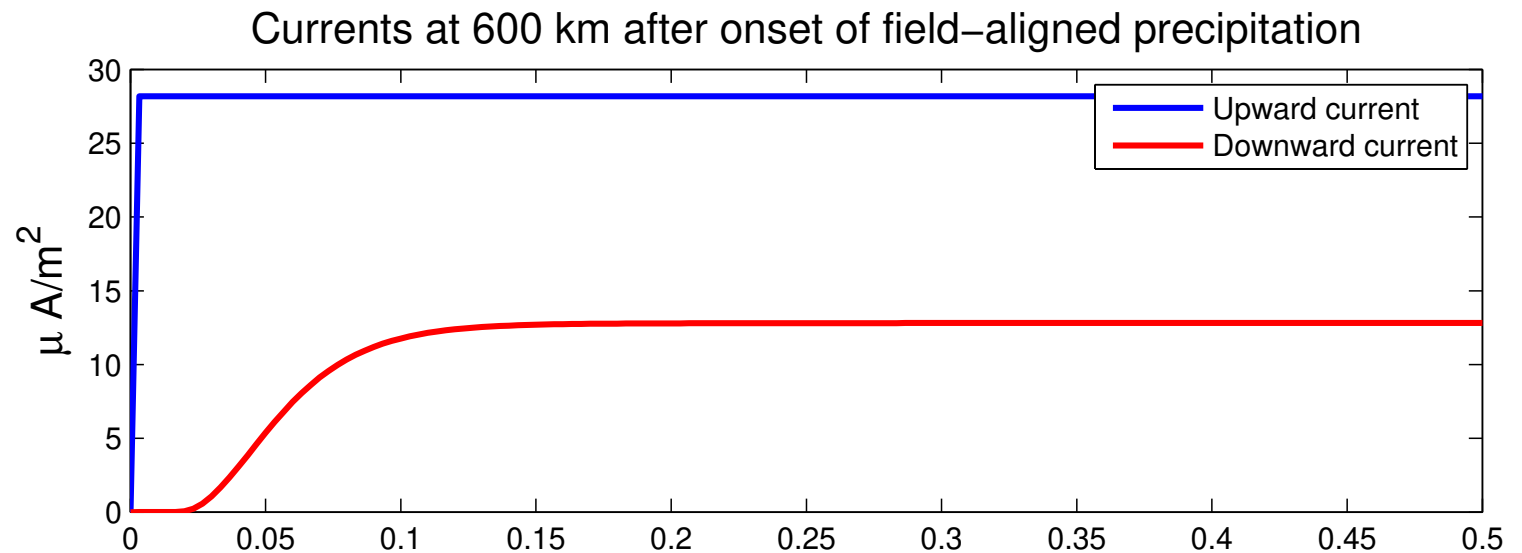
Electron transport results V

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Time-variation of albedo-electrons

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Summary and Conclusion

- ❖ NEIALS n Auroral Rays
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- Alfvénic precipitation, should as has been shown with
- Time-dependent electron-transport modeling, produce
- electron distributions with bi-directional bump-in-tails.
- Altitude and time-variations of positive $\partial f_e(v_{||})/\partial v_{||}$ can be calculated, provided
- time-energy resolved electron fluxes.
- Modeled auroral rays don't look to shabby either.

References

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- Guio, P., and Forme, F. Zakharov simulations of Langmuir turbulence: Effects on the ion-acoustic waves in incoherent scattering, *Physics of Plasmas*, 13, 122902-.