Io-Jupiter interaction during Io's volcanic event in 2015

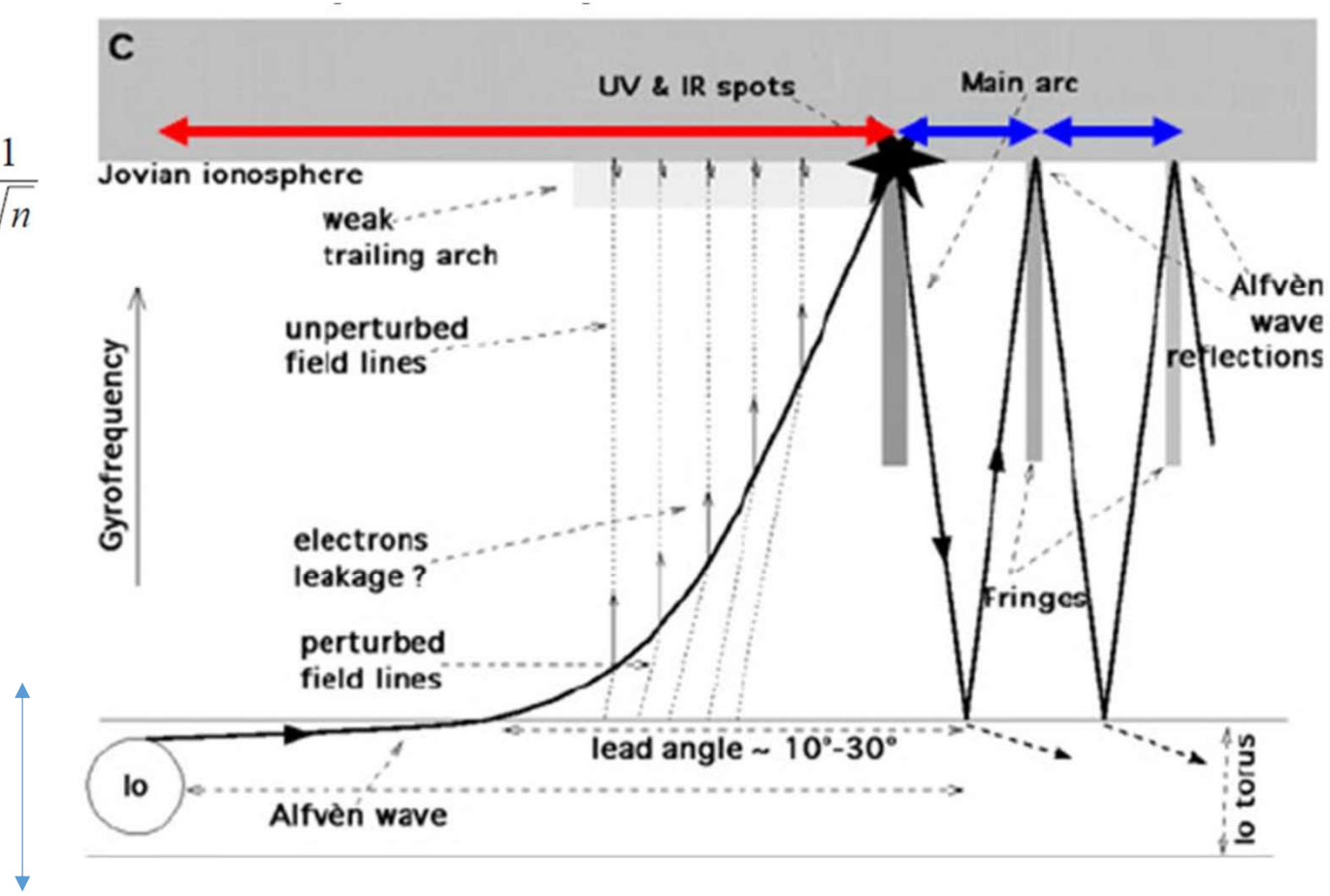
Change in on density and ion temperature derived from HISAKI

Change in Alfven transit time from Io to ionosphere

Alfven velocity

$$V_A = \frac{B}{\sqrt{\mu_0 mn}} \propto \frac{1}{\sqrt{n}}$$

➔Timing of main arc (decrease)
Repetition freq. of arcs (decrease)



Data analysis: Derivation of brightness scale height

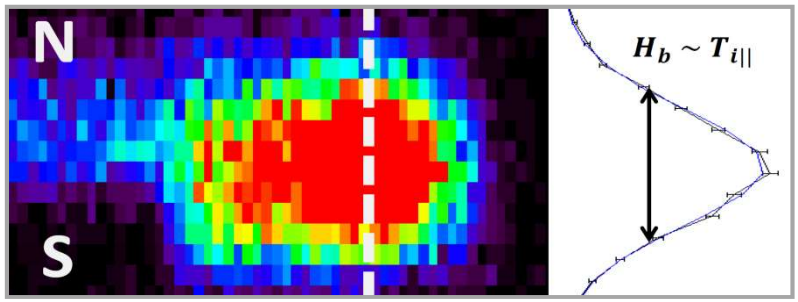


Fig. Image of S^{2+} emission observed by EXCEED.

The brightness scale height H_b is $\sqrt{2}$ smaller than common scale height H_i when the intensity is $\propto n_i\, n_e$. [Hill and Michel, 1976]

$$H_i = \sqrt{\frac{2k(T_{i\|} + ZiT_{e\|})}{3M_i\Omega^2}},$$

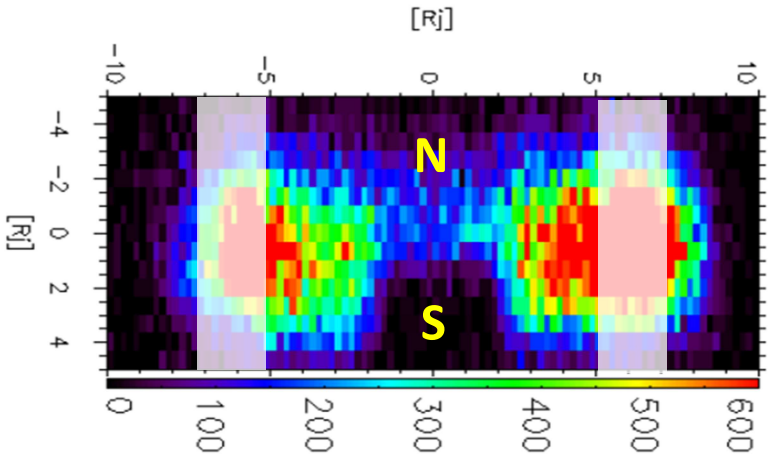
M_i : mass of ion
Ω : angular velocity
Z_i : average charge state
$T_{i||}$, $T_{e||}$: Ion and electron temperature parallel to magnetic field line

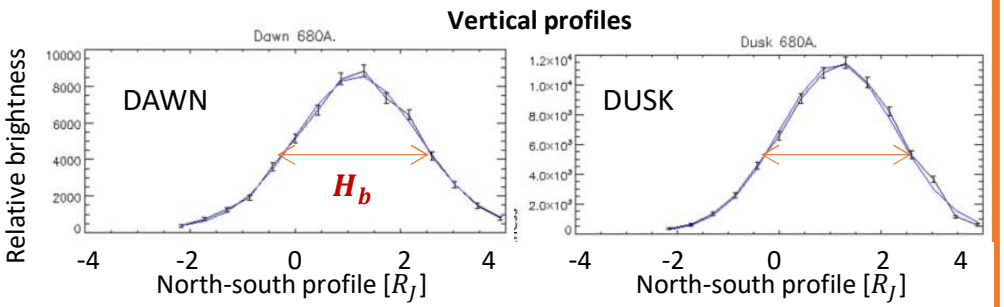
Thus, ion parallel temperature $T_{i||}$ is proportional to H_b .

$$T_{i||} \propto H_i^2 \propto 2H_b^2$$

→ Ion parallel temperature can be derived from the brightness scale height

■ Data obtained with EXCEED





- Gaussian fitting to the vertical profile (north-south, integrated along radial direction from 5 – 7 R_J).
- The effect of line-of-sight integration has not excluded.

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Discussion: Time variations in torus composition

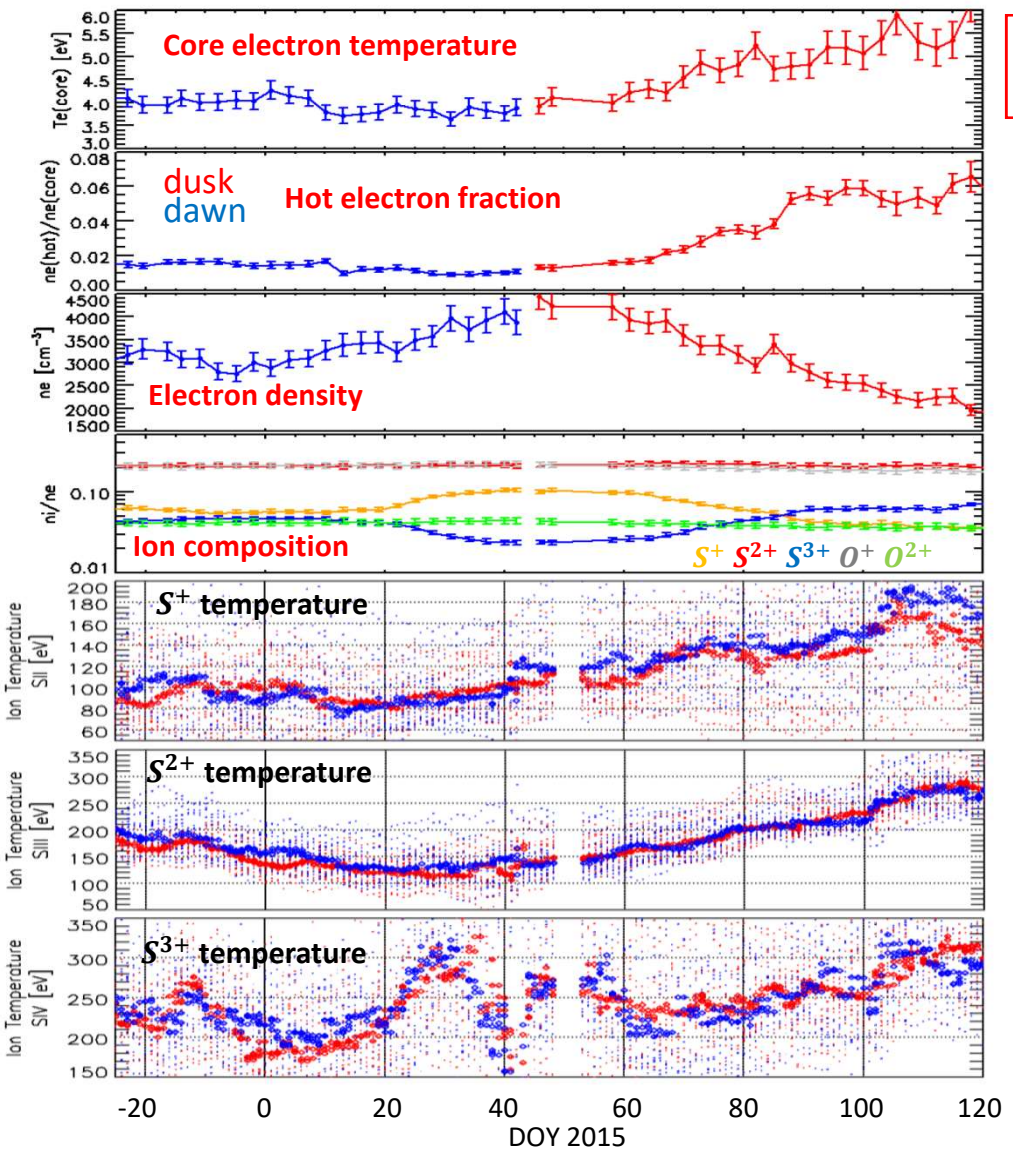

Fig. (Top three panels) Time variations of plasma diagnosis derived from EXCEED data by Kagitani [2016]. (Bottom three panels) Time variations in temperature of sulfur ions (SII, SIII, and SIV) derived from EXCEED data.

Electron density (3000/cc to 4500/cc) and S+ composition increased during Io's volcanic event.
$T_{//}$ slightly increased.
Composition of major ion did not show significant change (O+, S2+)

It is expected that Alfven transit time increased at leased one-and-a-half times.

A.I.
-Detail calculation of change in Alfven transit time considering HISAKI data during the volcanic event.
-Comparison with the ExPRES analysis

torus.

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