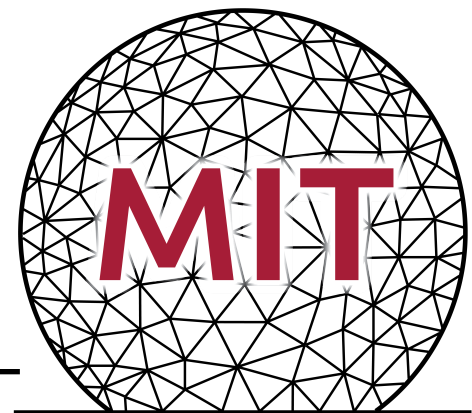

Ionospheric and sensor models:

An investigation of the ISR ion temperature and composition ambiguity

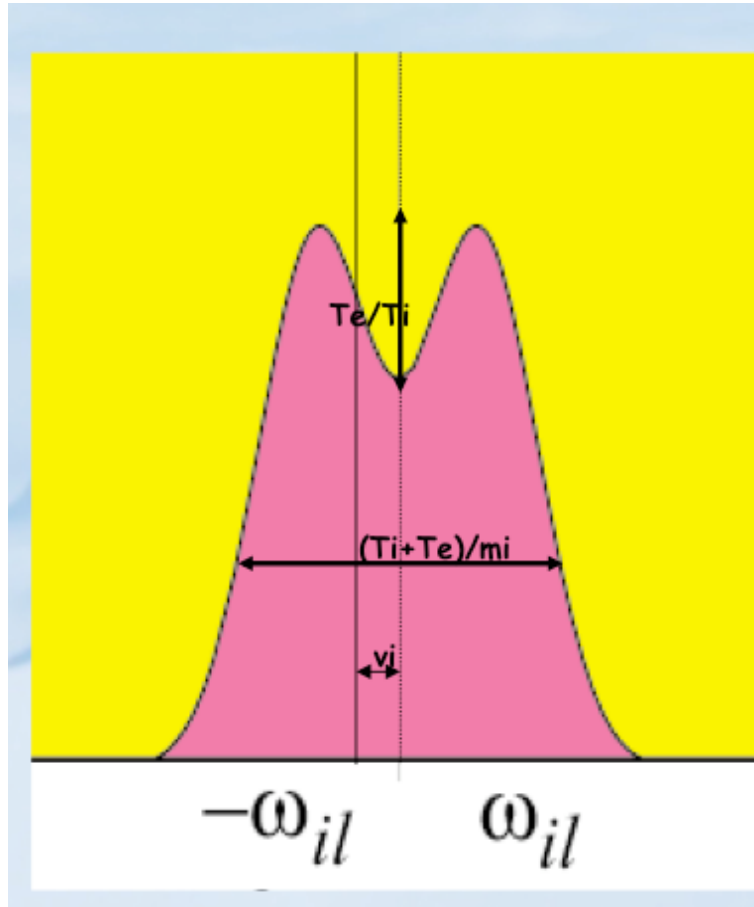
Shunrong Zhang

MIT Haystack Observatory

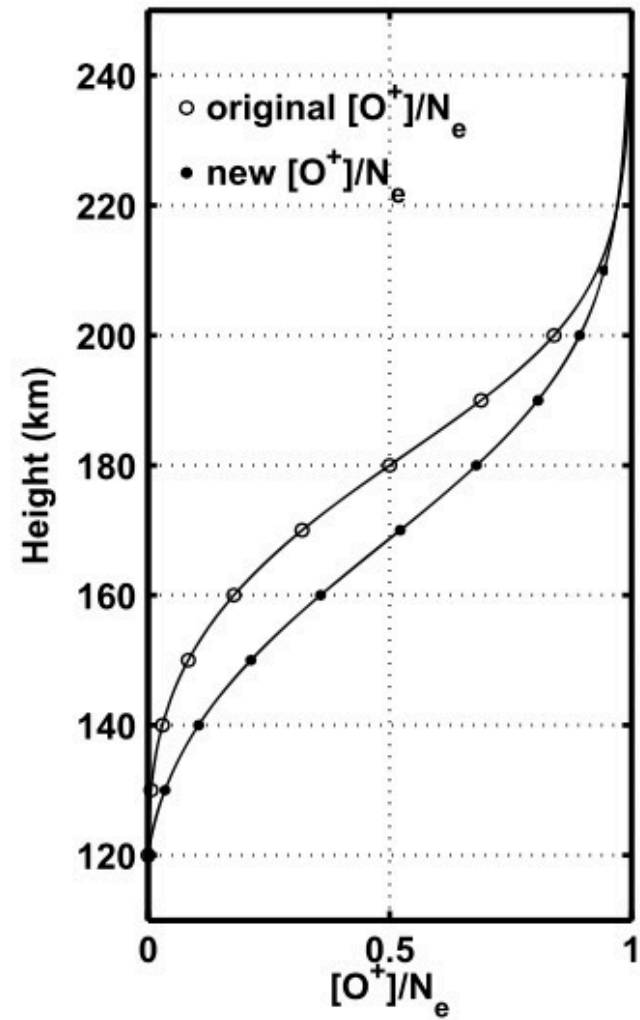
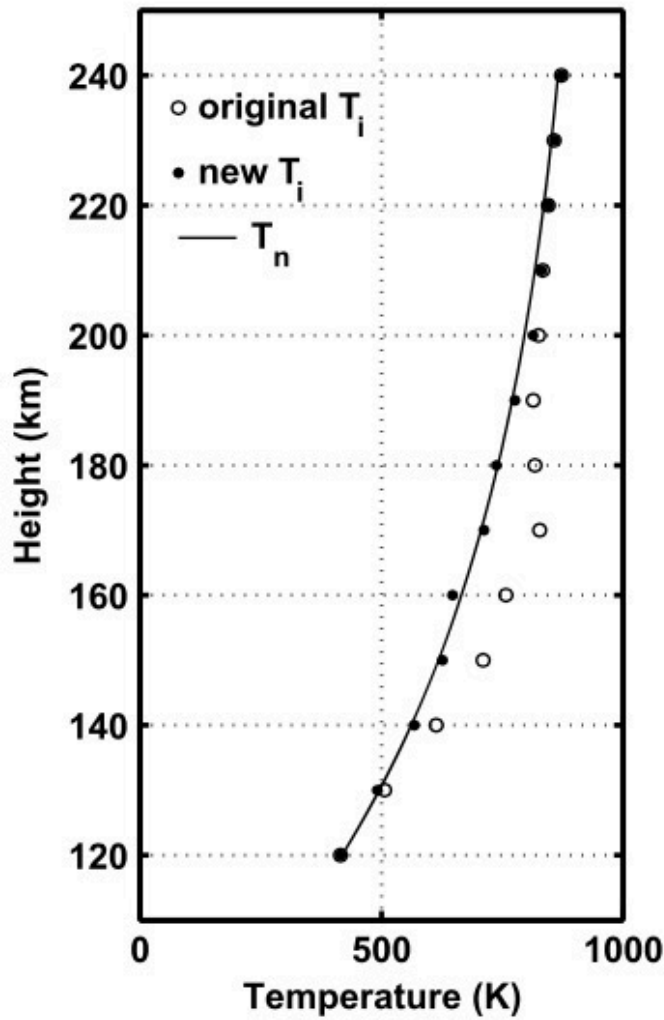


August 13, 2021

IS spectrum (ion-line)

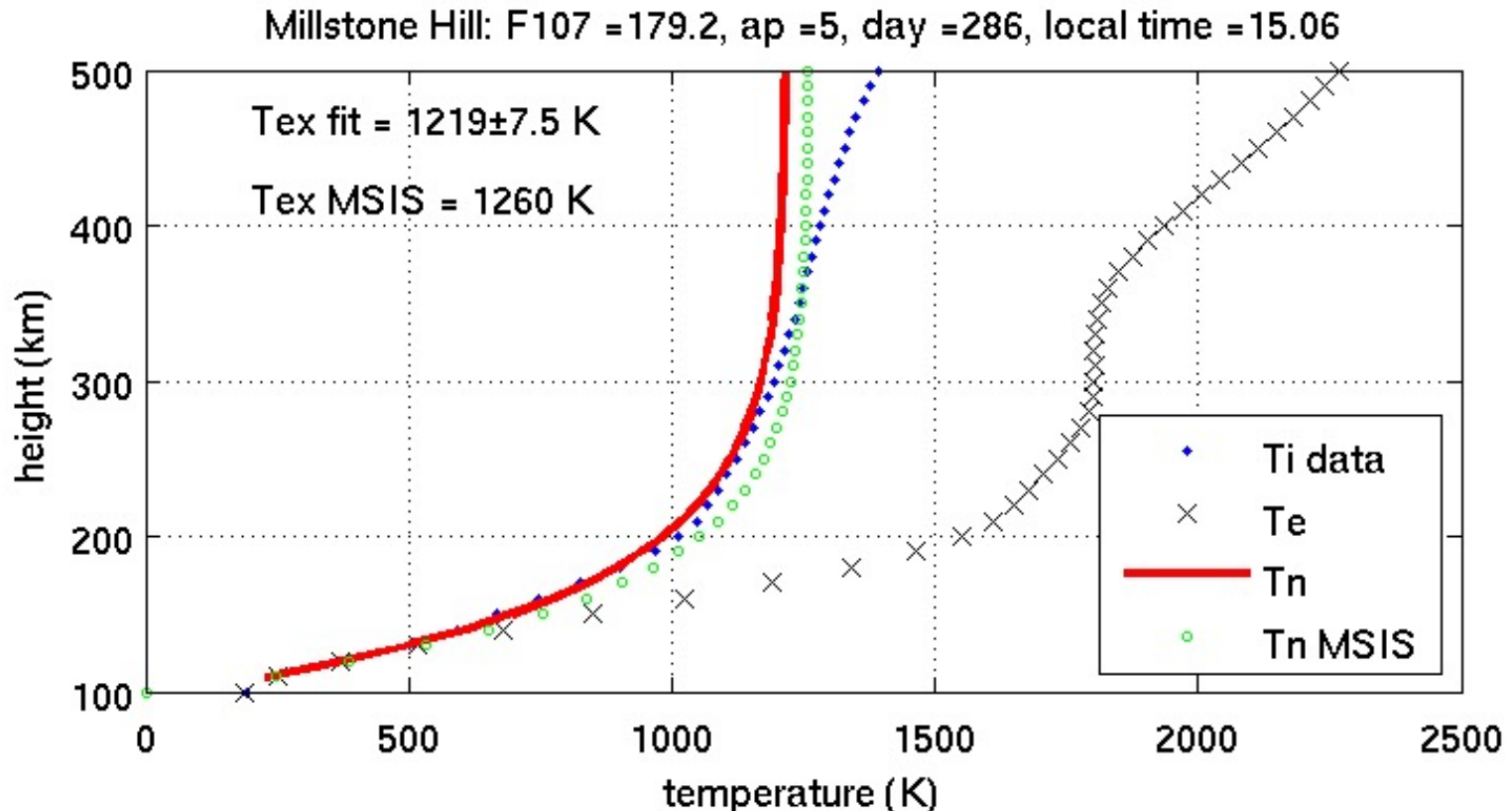


- Ion (and electron) temperature (T_i and T_e) to ion mass (m_i) ratio from the width of the spectra
- Electron to ion temperature ratio (T_e/T_i) from “peak_to_valley” ratio
- Electron (= ion) density from total area (corrected for temperatures)
- Ion velocity (v_i) from the Doppler shift



Oliver et al. (2014)

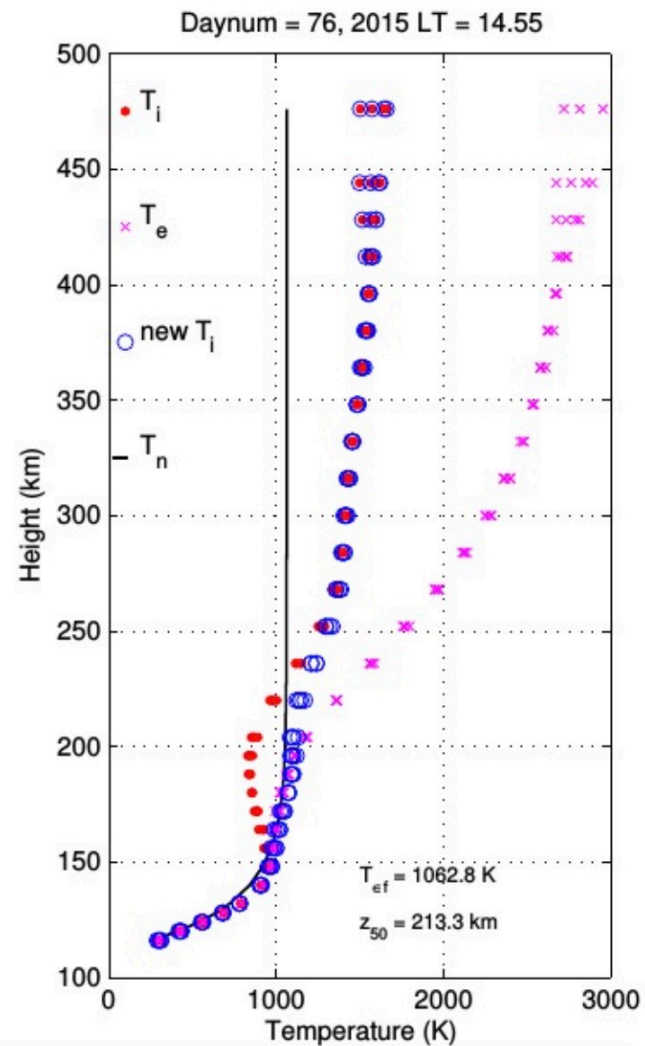
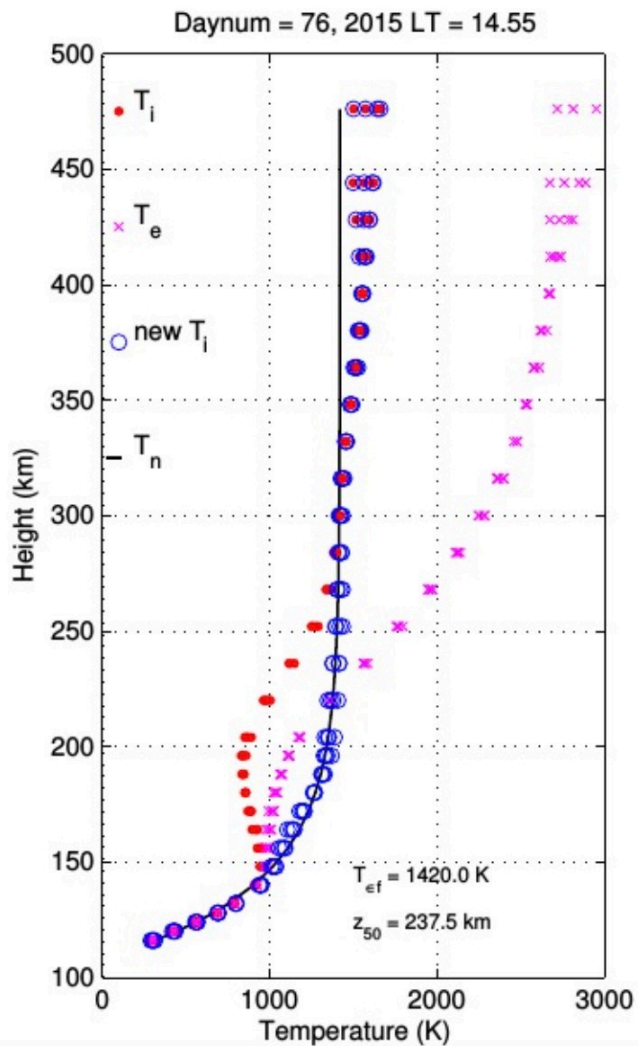
Ti, Te, Tn



$$a (Te - Ti) = b (Ti - Tn)$$

$a = 7.6 \times 10^{20} N_i N_e T_e^{-3.2} \text{ Wm}^{-3}$, the coefficient of energy transfer from electrons to ions

$b = 3.36 \times 10^{-28} F N_i [O] (T_i + T_n)^{1/2} \text{ Wm}^{-3}$ the coefficient of energy transfer from ions to neutrals.



$$F + a (T_e - T_i) = b (T_i - T_n)$$

$a = 7.6 \times 10^{20} N_i N_e T_e^{-3.2} \text{ Wm}^{-3}$, the coefficient of energy transfer from electrons to ions

$b = 3.36 \times 10^{-28} F N_i [\text{O}] (T_i + T_n)^{1/2} \text{ Wm}^{-3}$ the coefficient of energy transfer from ions to neutrals.