

I. Correlation among RM, HI, FF, & Synch. Emissions

Y. Sofue

2014.8.8 @SKA_mag_meeting

1. DATA

All-sky RM, HI, FF, Synch (l, b) Tables by:
H. Nakanishi
H. Ichiki

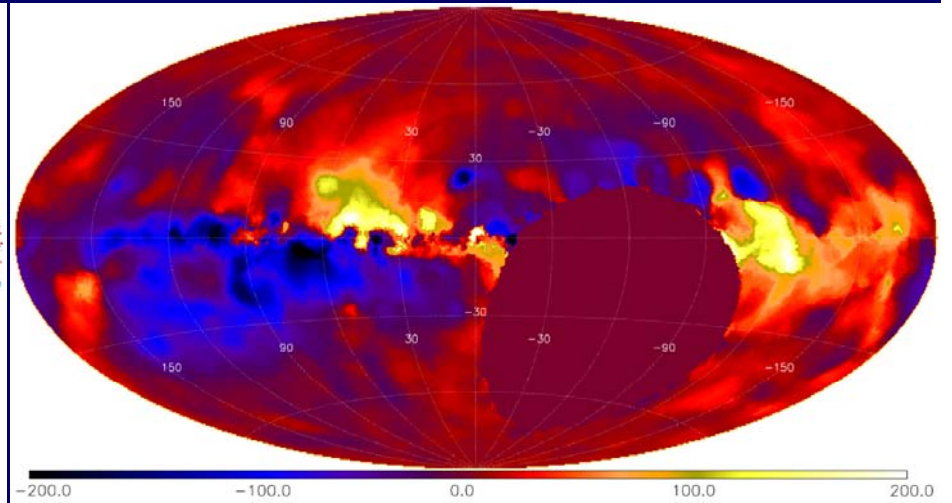
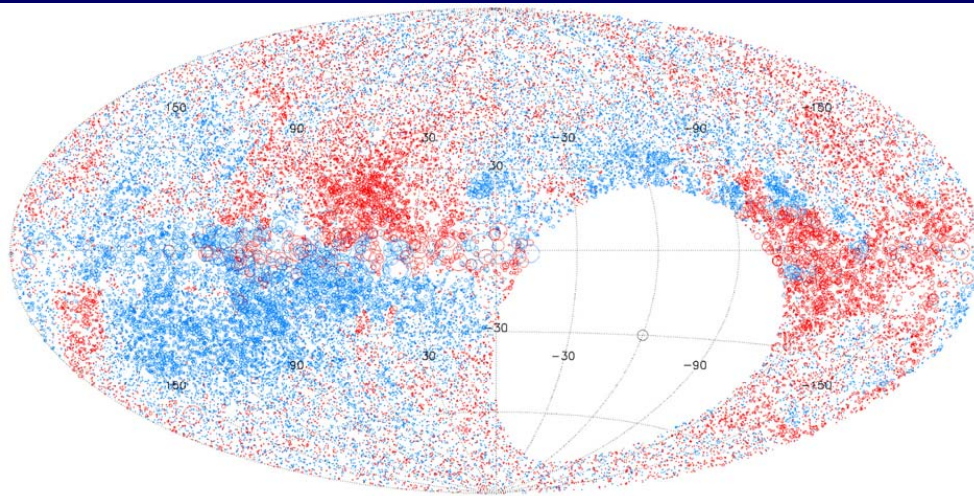
Data from:

Taylor, et al. 2009

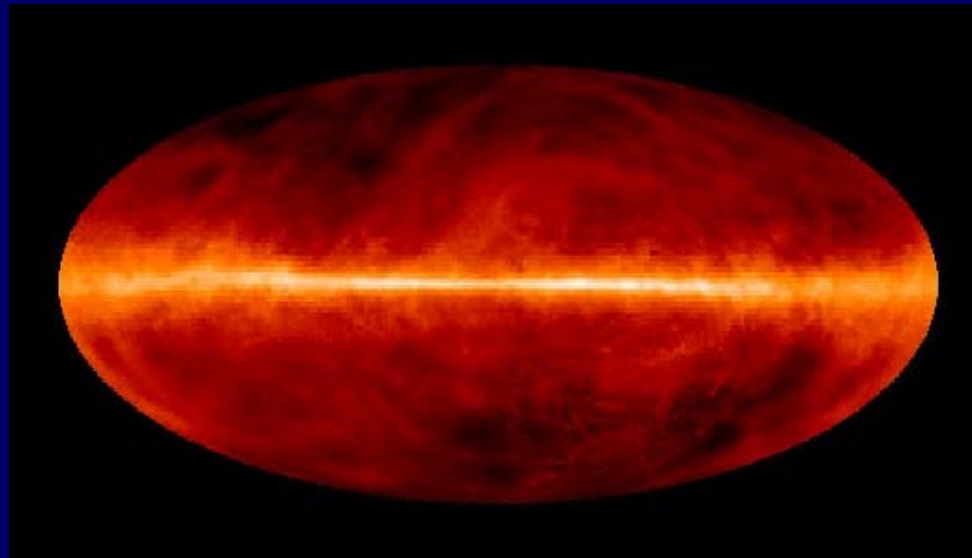
Kalbella et al. 2008

Gold et al. 2012 WMAP7

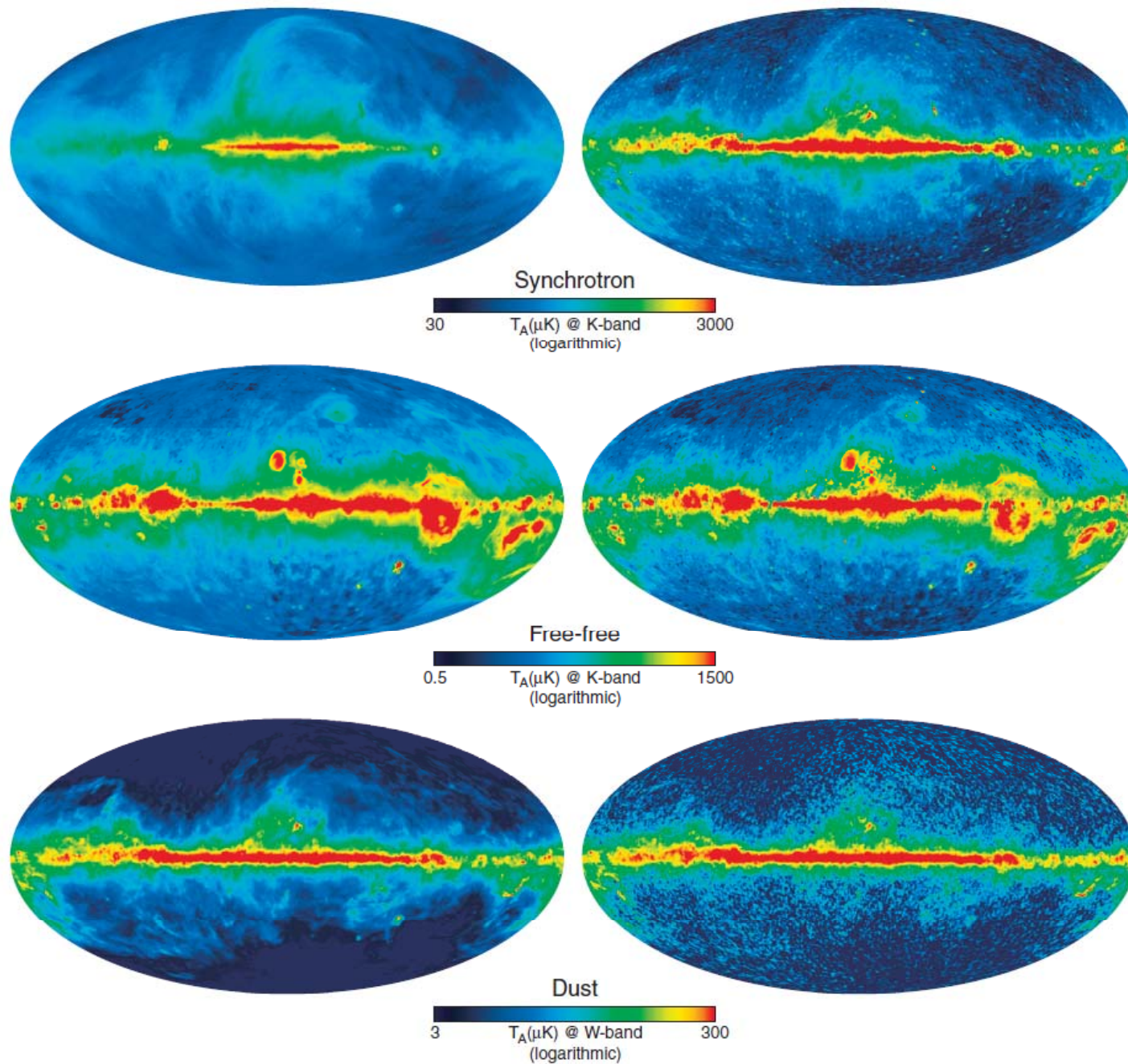
RM Sky (Taylor 2009)



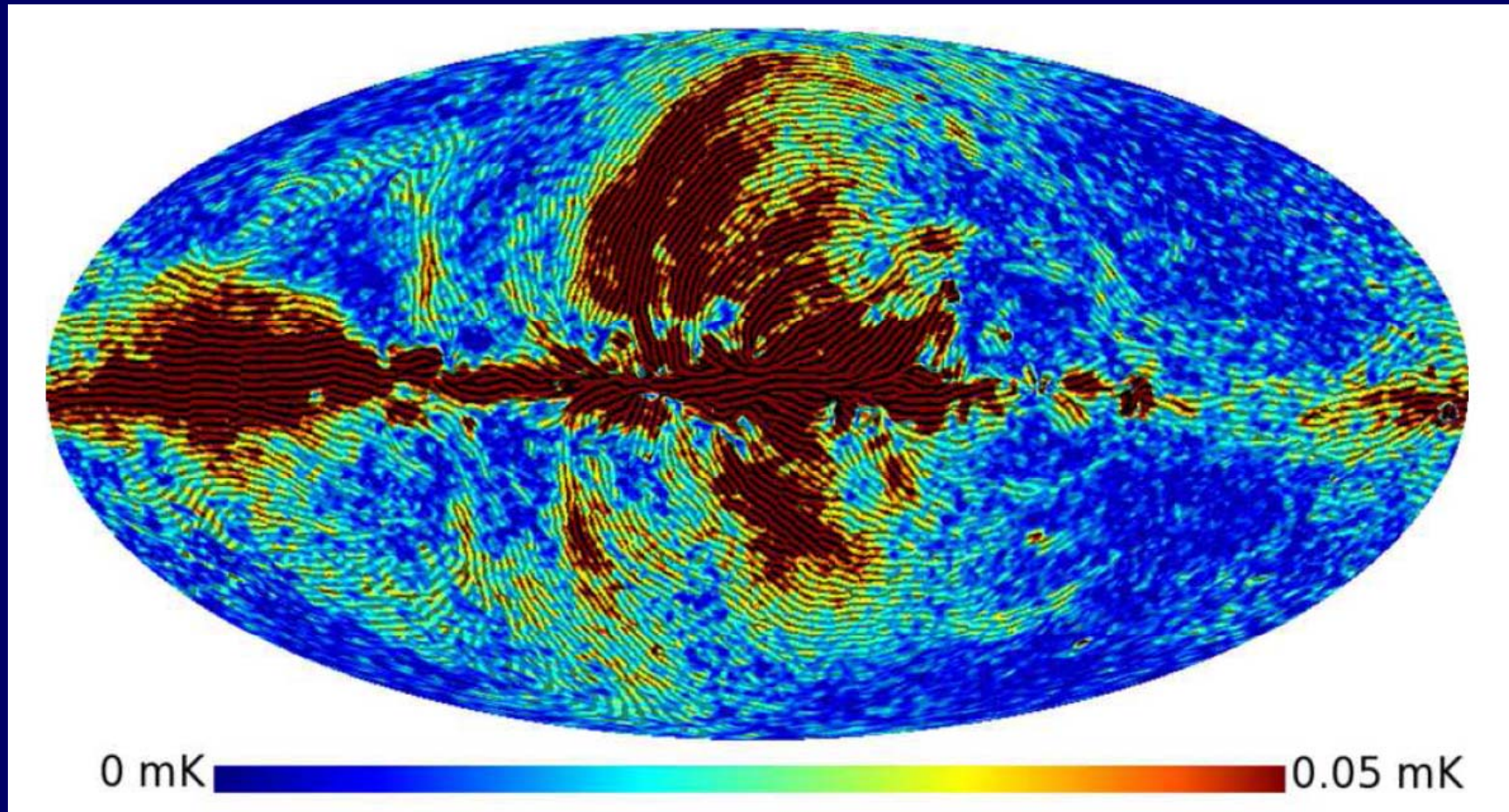
HI sky (Kalbella et al. 2011)



Synchrotron & Free-Free emissions (WMAP 7, Gold et al. 2012)



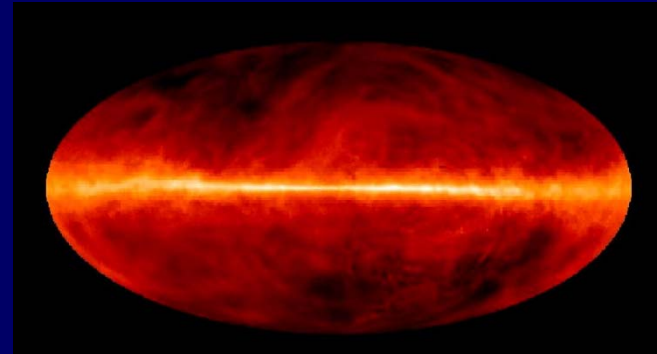
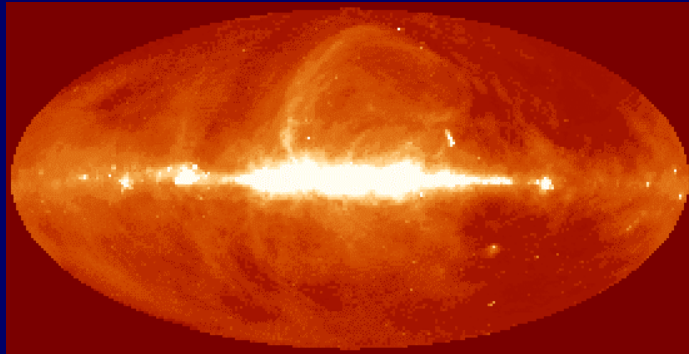
WMAP B vectors: (Jansson et al. 2012)



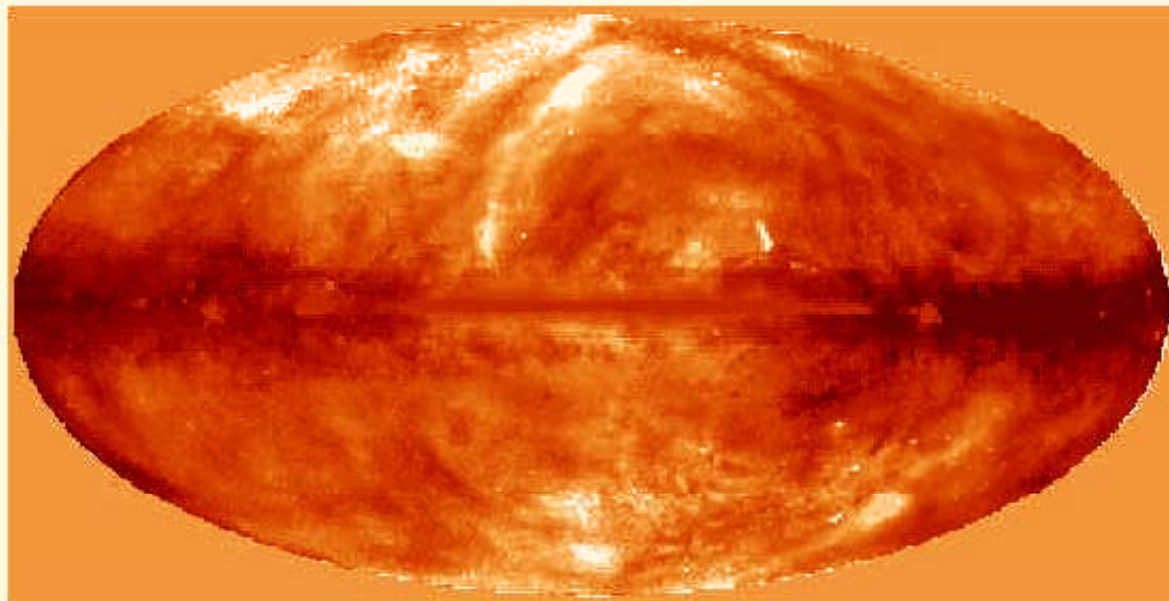
Map(radio) – Map(HI, etc)

408 MHz – HI total = not uniform:

Not frozen-in, at least some regions.



408MHz - HI



2. B-Frozen-in / Energy Equipartition, or else?

If ISM energy equipartition:

$$n_e \sim n_{\text{HI}} \sim N_{\text{CR}} \sim B^2$$

$$\text{RM} \sim n_e B_{\parallel} L \sim n_{\text{HI}}^{3/2} L$$

$$\text{HI} \sim n_{\text{HI}} L$$

$$\text{FF} \sim n_e^2 L \sim n_{\text{HI}}^2 L$$

$$\text{Synch} \sim N_{\text{CR}} B^2 L \sim B^4 L \sim n_{\text{HI}}^2 L$$

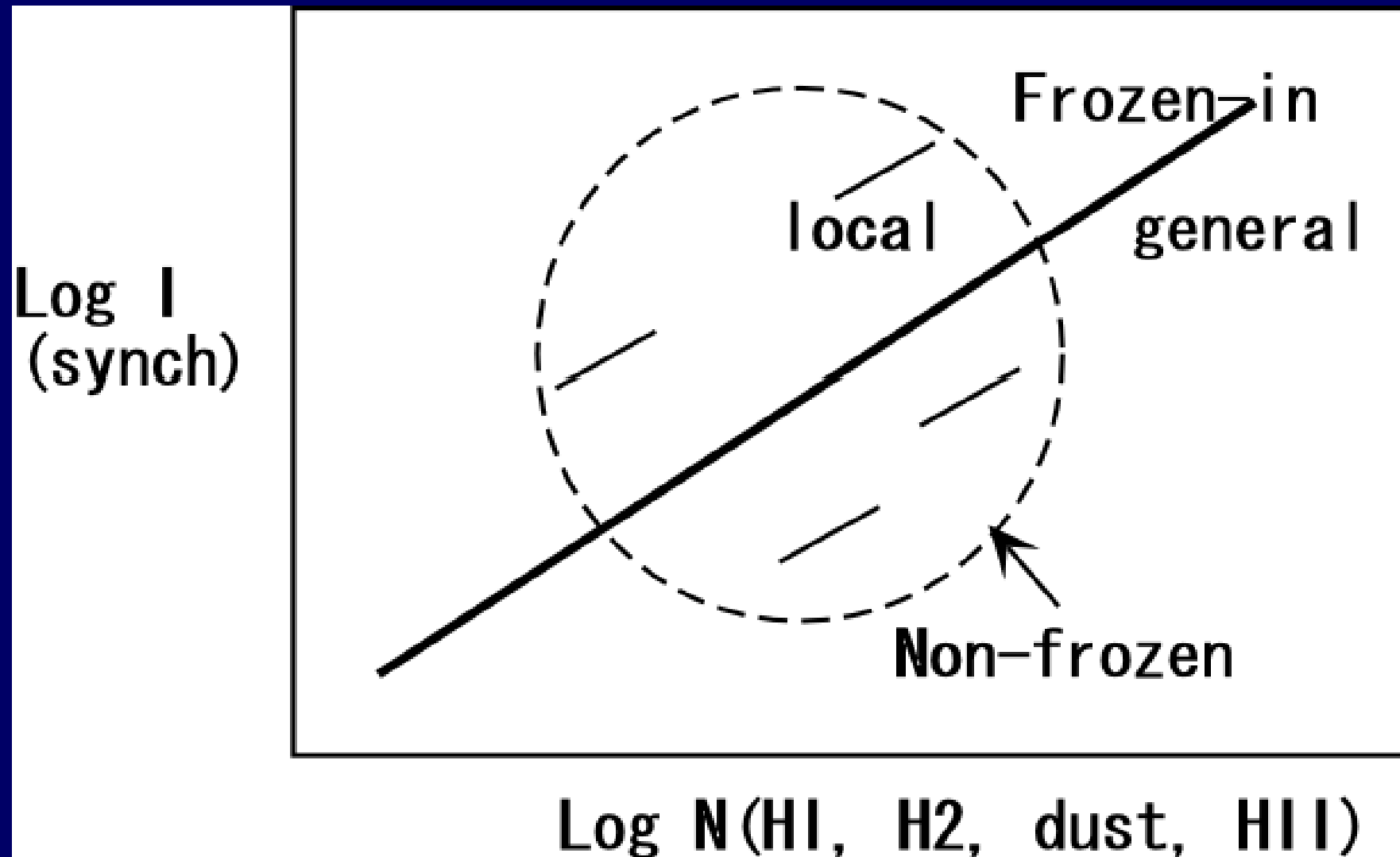
If B frozen in ISM (n_e , n_{HI}):

$$B \sim \rho^{2/3} \sim n_{e/\text{HI}}^{2/3}$$

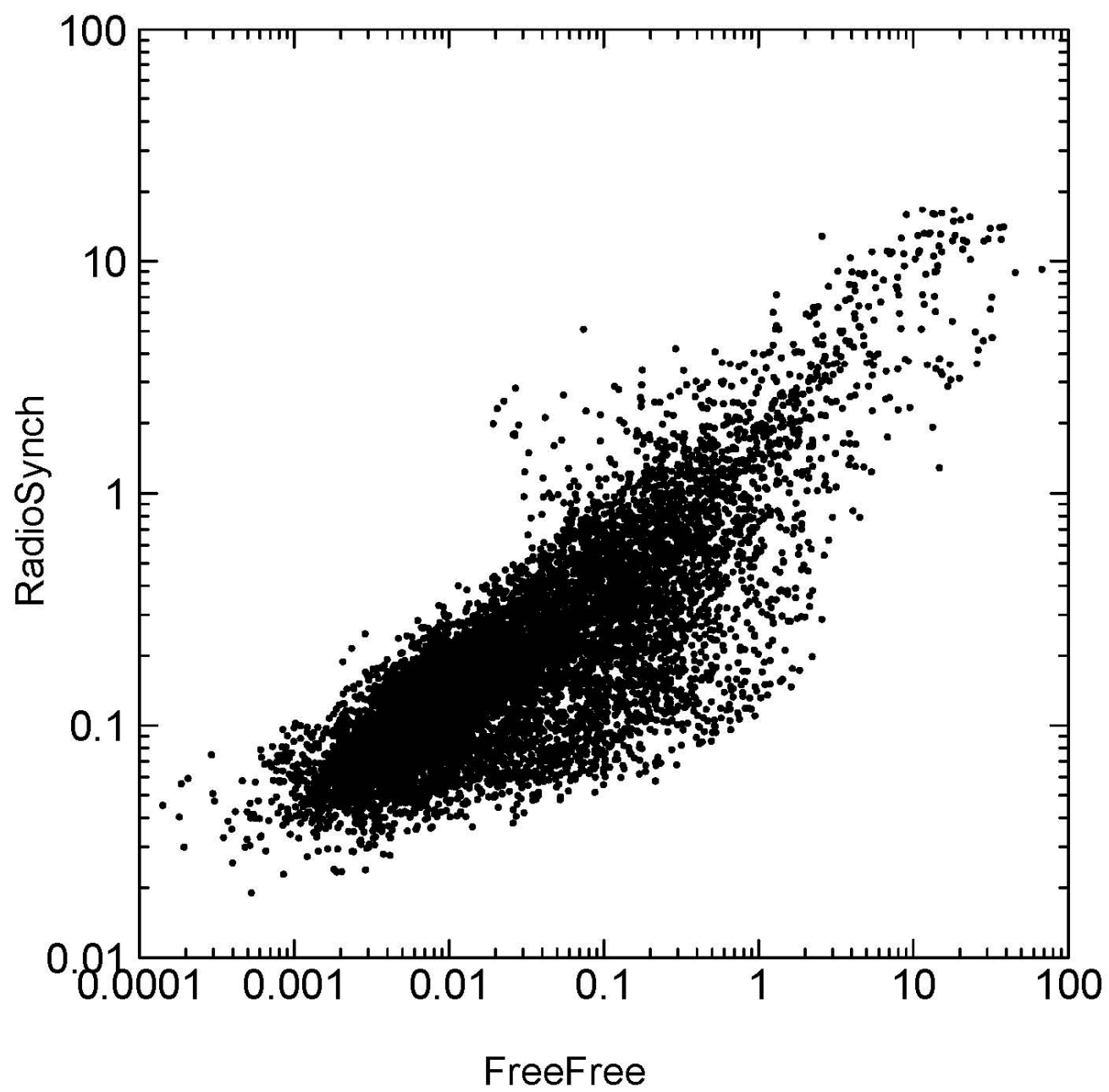
$$(B\text{-CR Eq.par.} \Rightarrow B^2 \sim N_{\text{cr}})$$

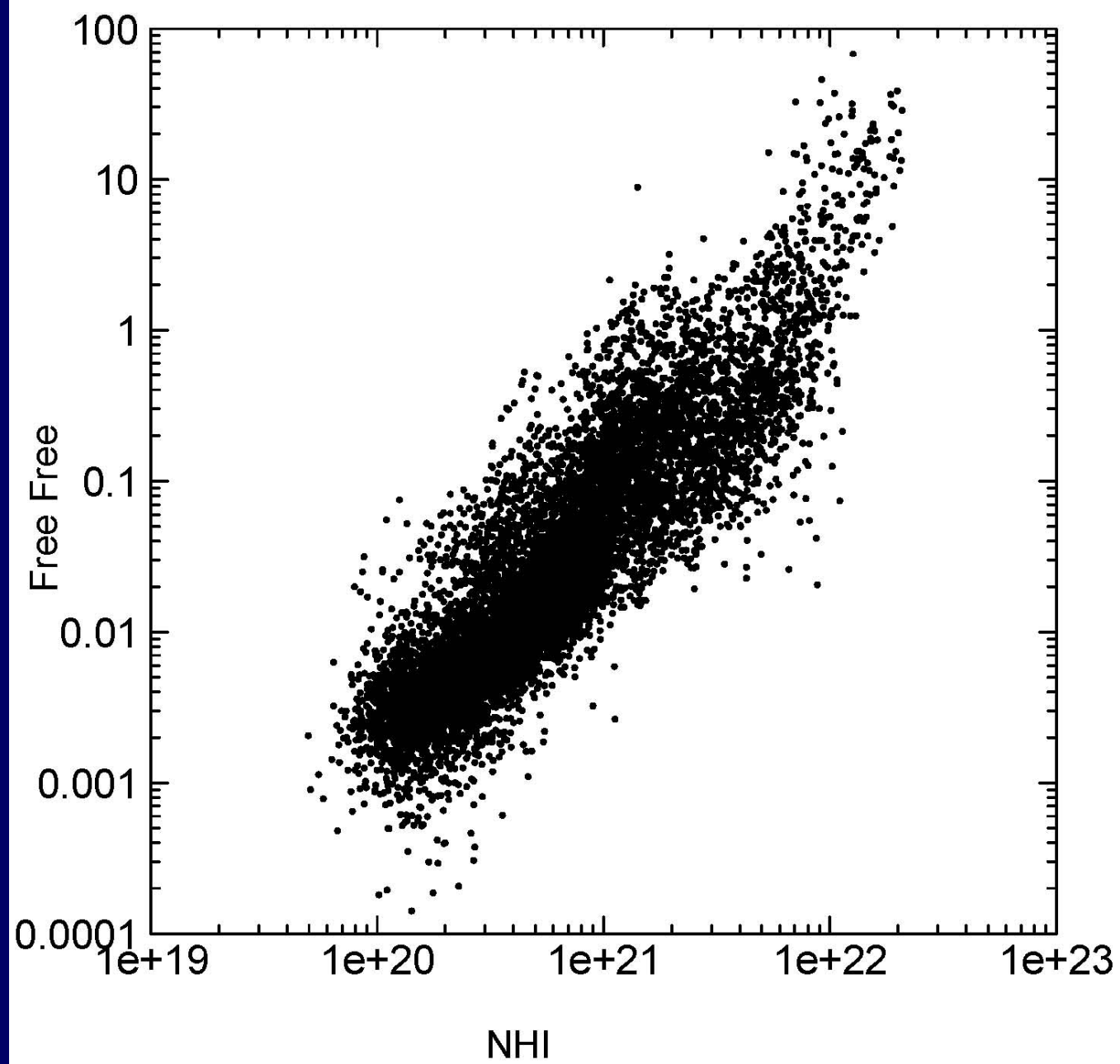
$$\text{Synch.} \sim B^2 N_{\text{cr}} L \sim B^4 L \sim n_{\text{HI}}^{8/3} L$$

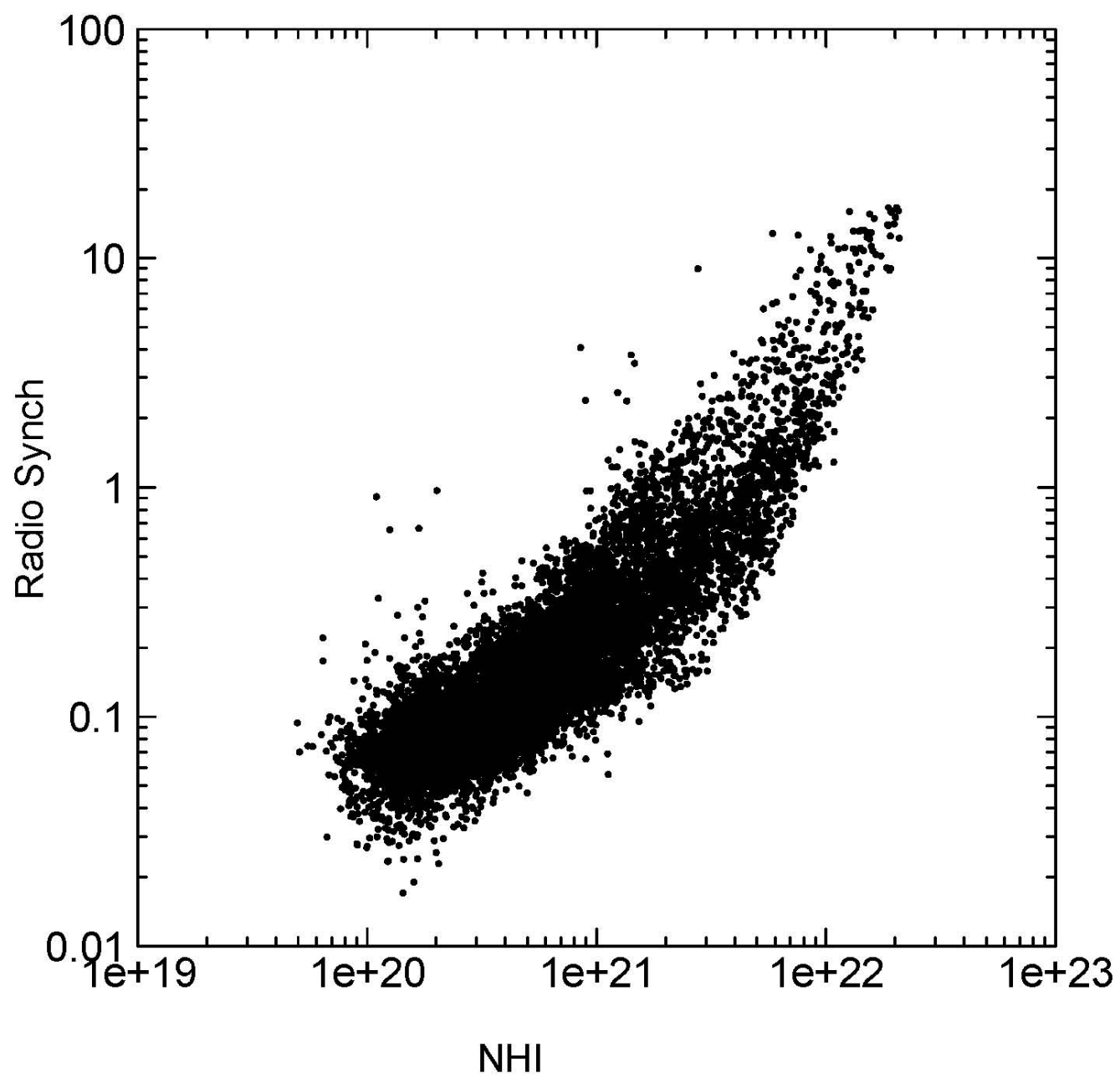
Log I(radio) - Log N(HI,H2,dust) plot.

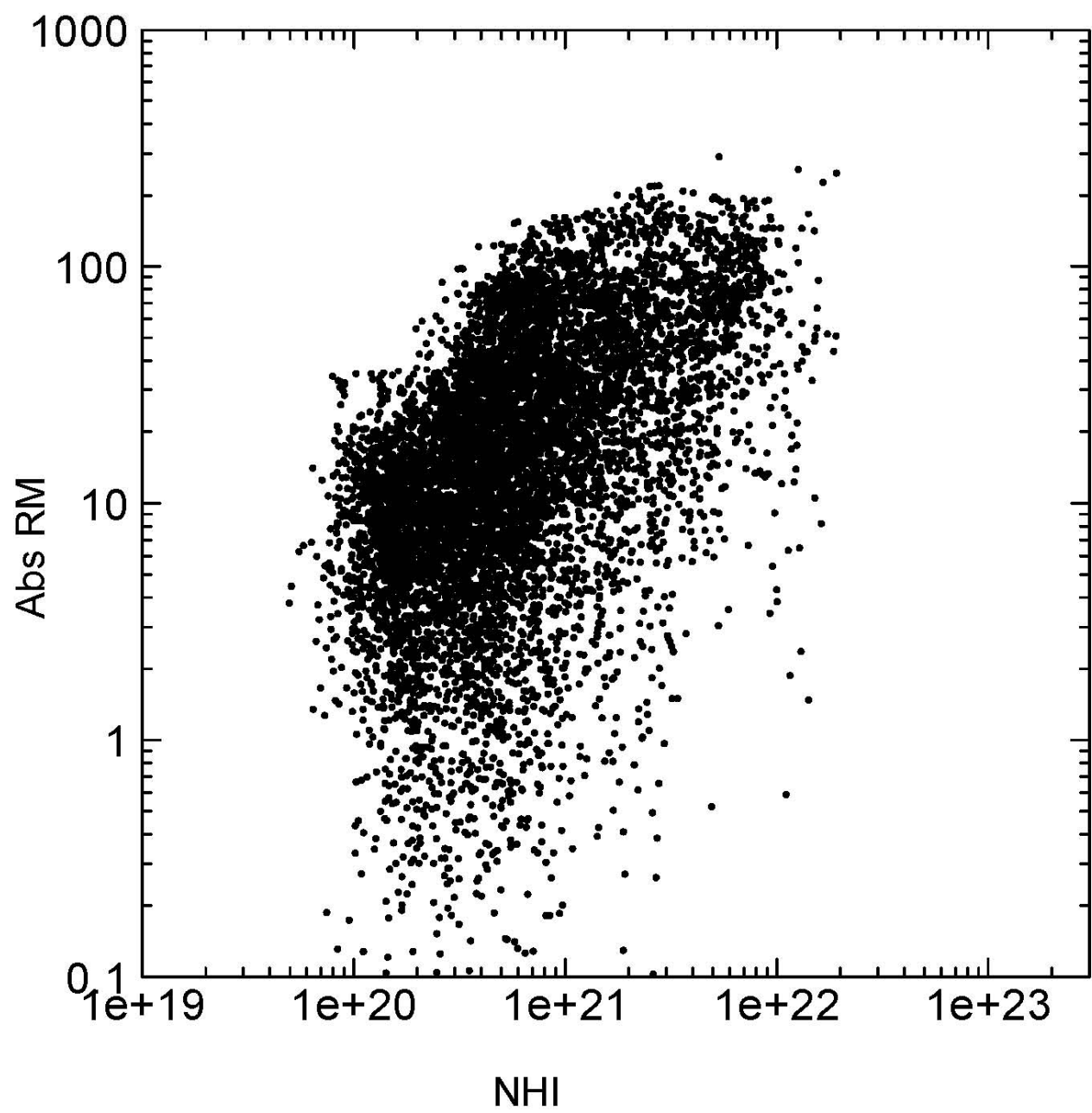


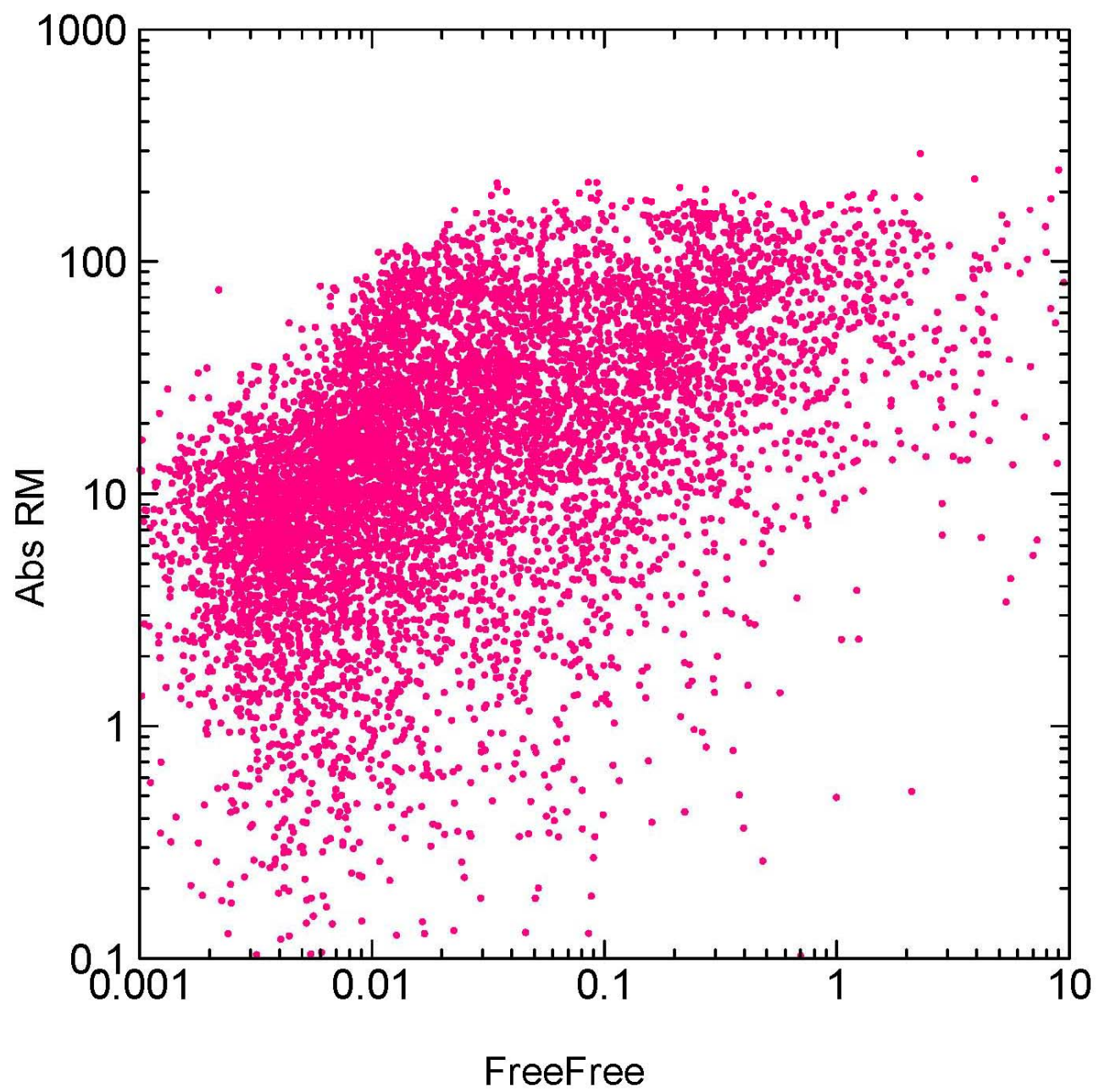
2. Global Correlation

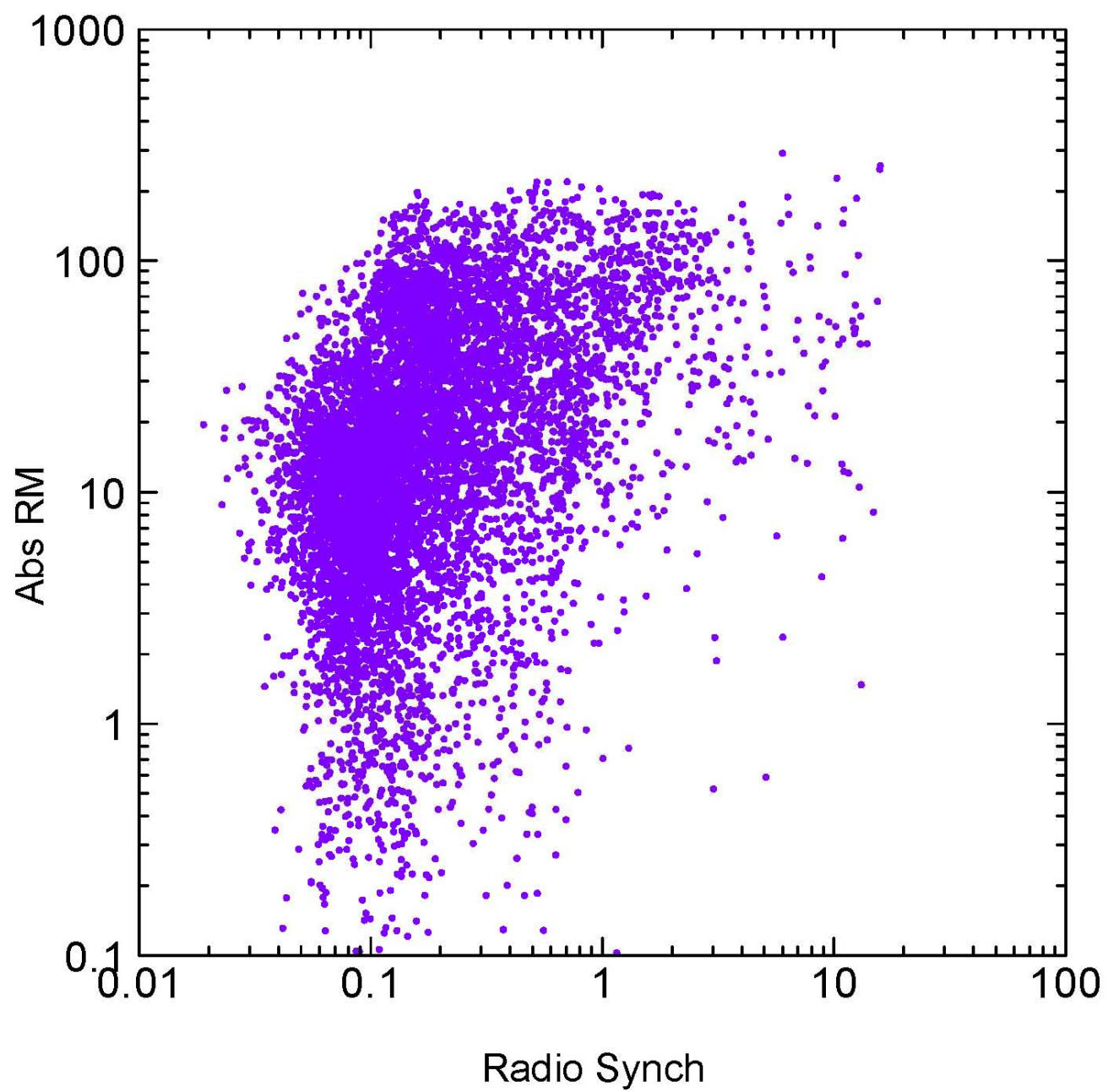


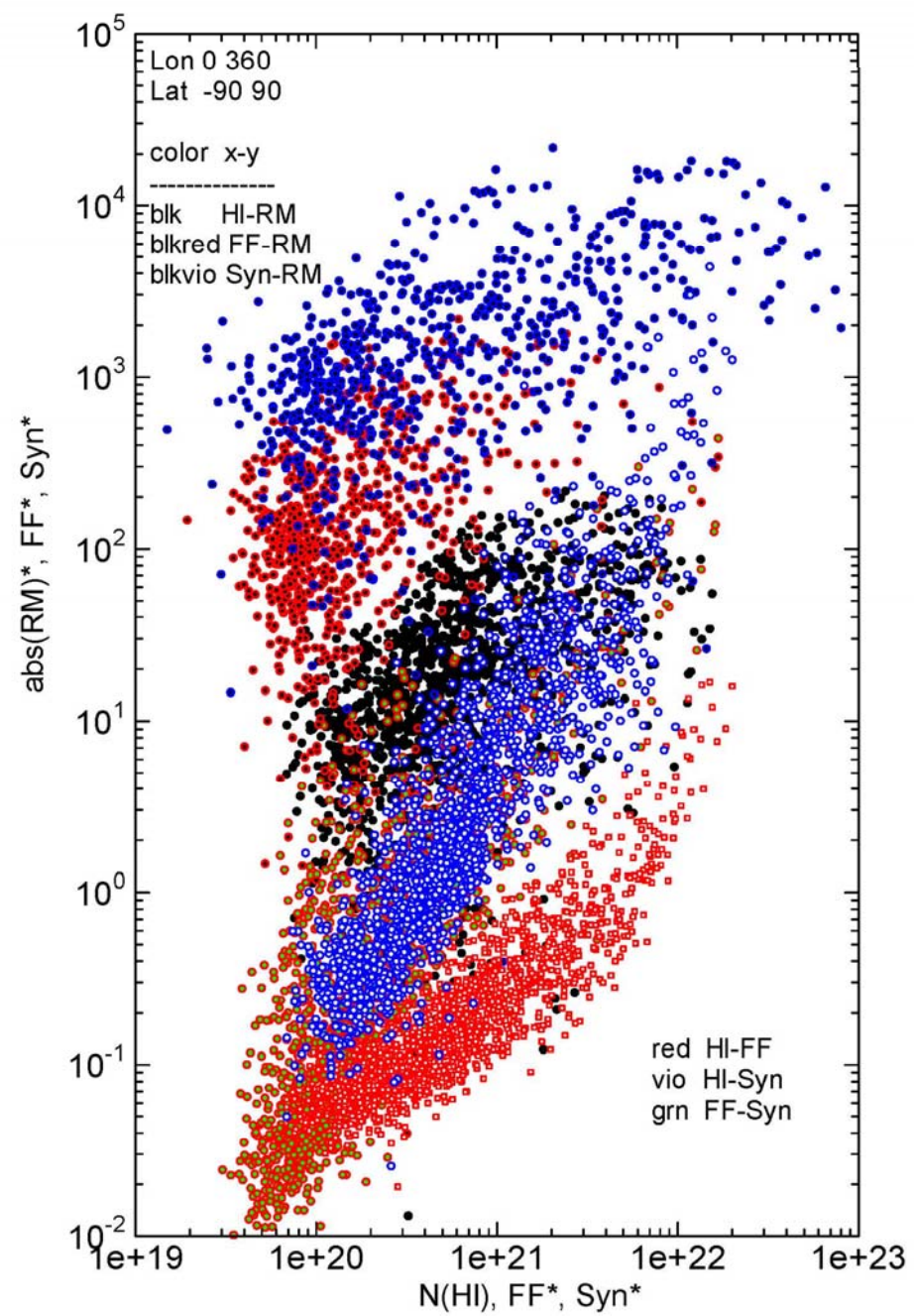


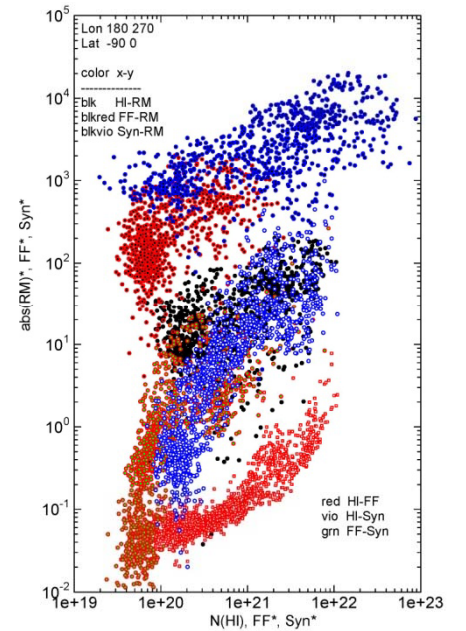
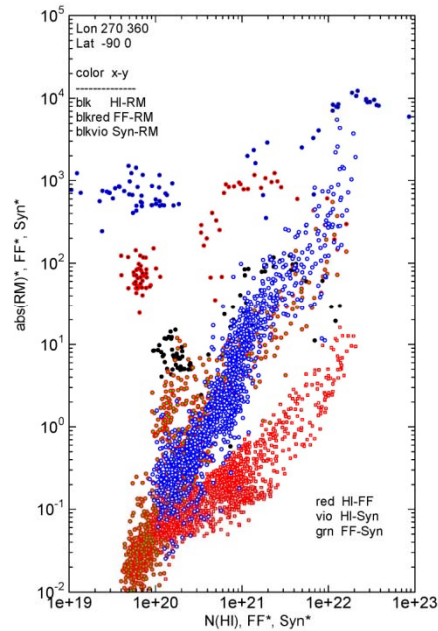
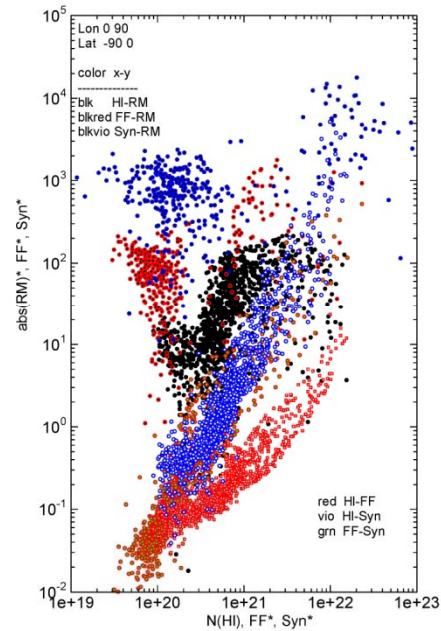
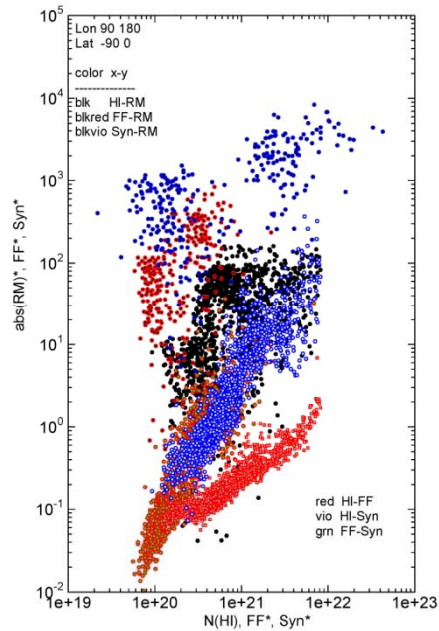
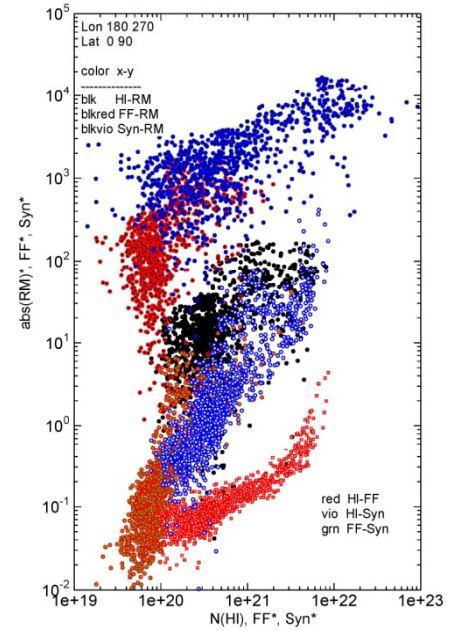
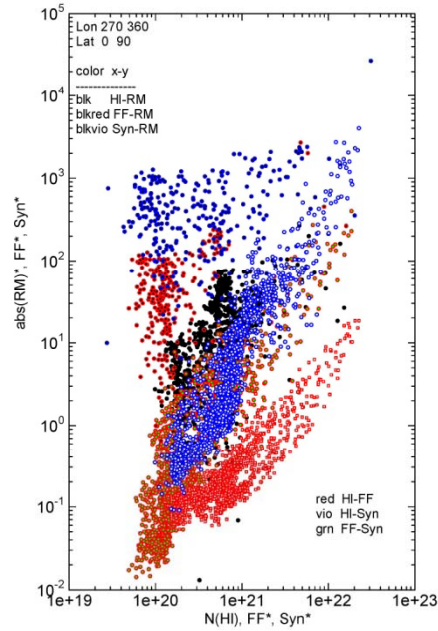
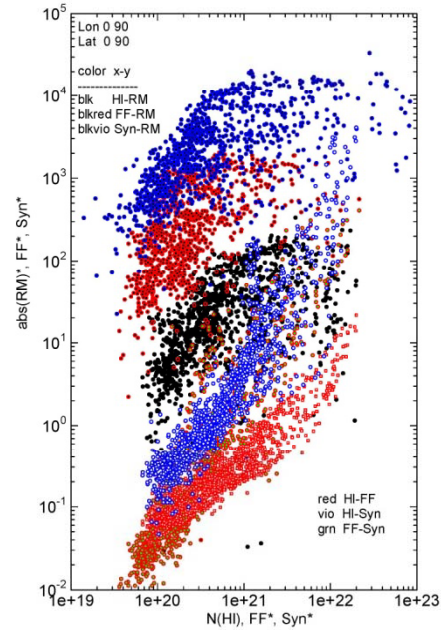
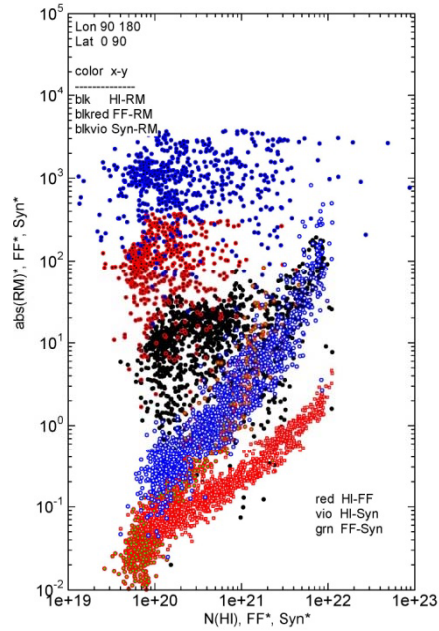


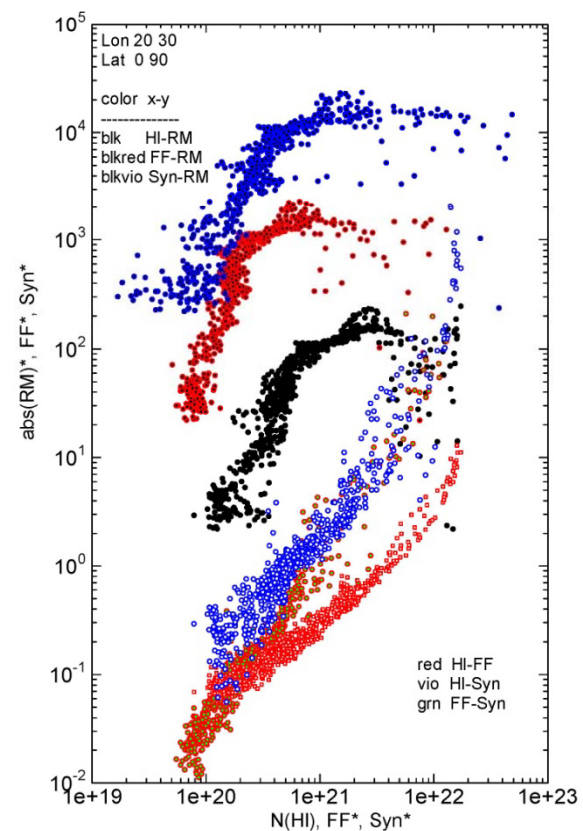
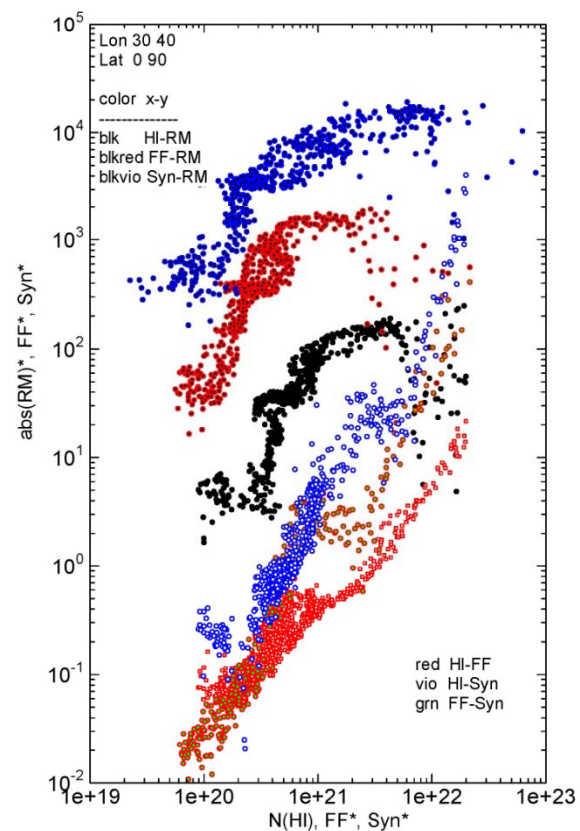
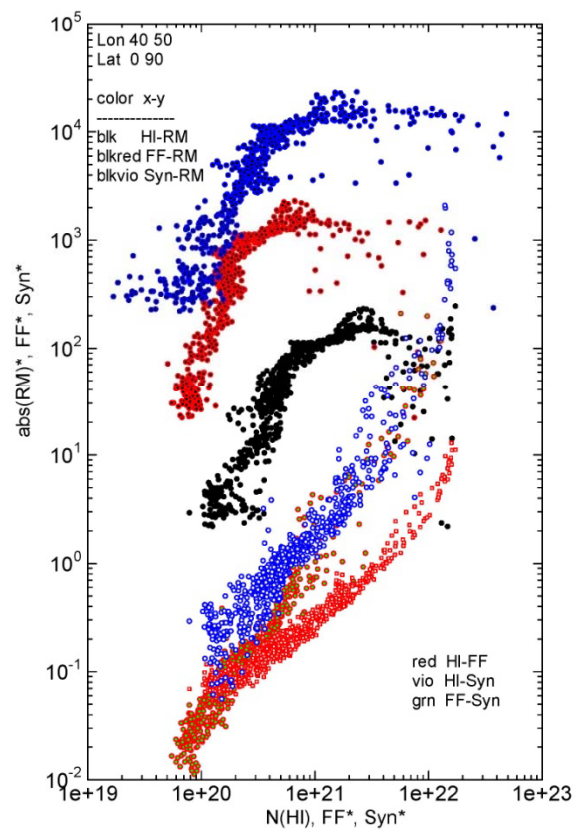








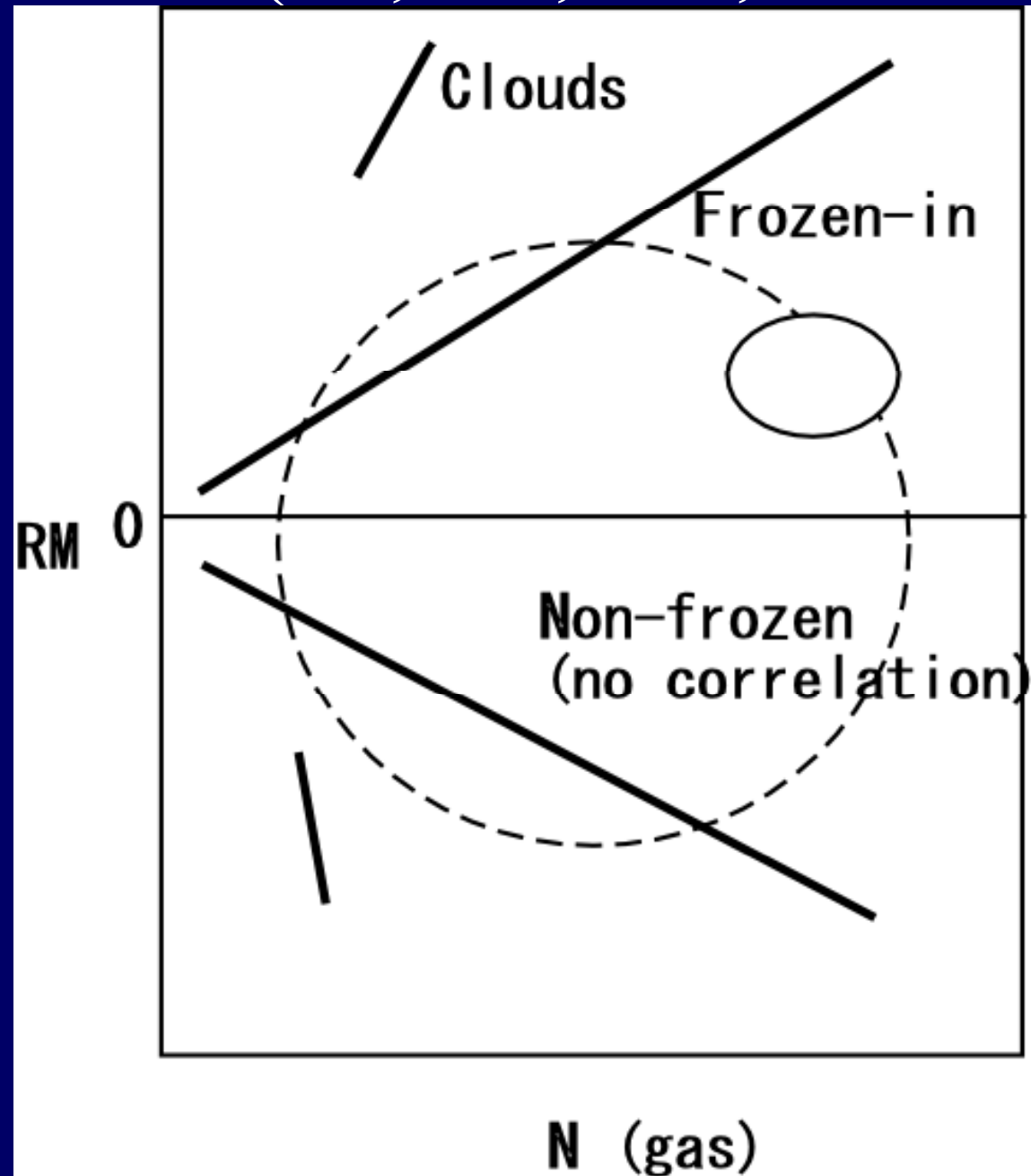


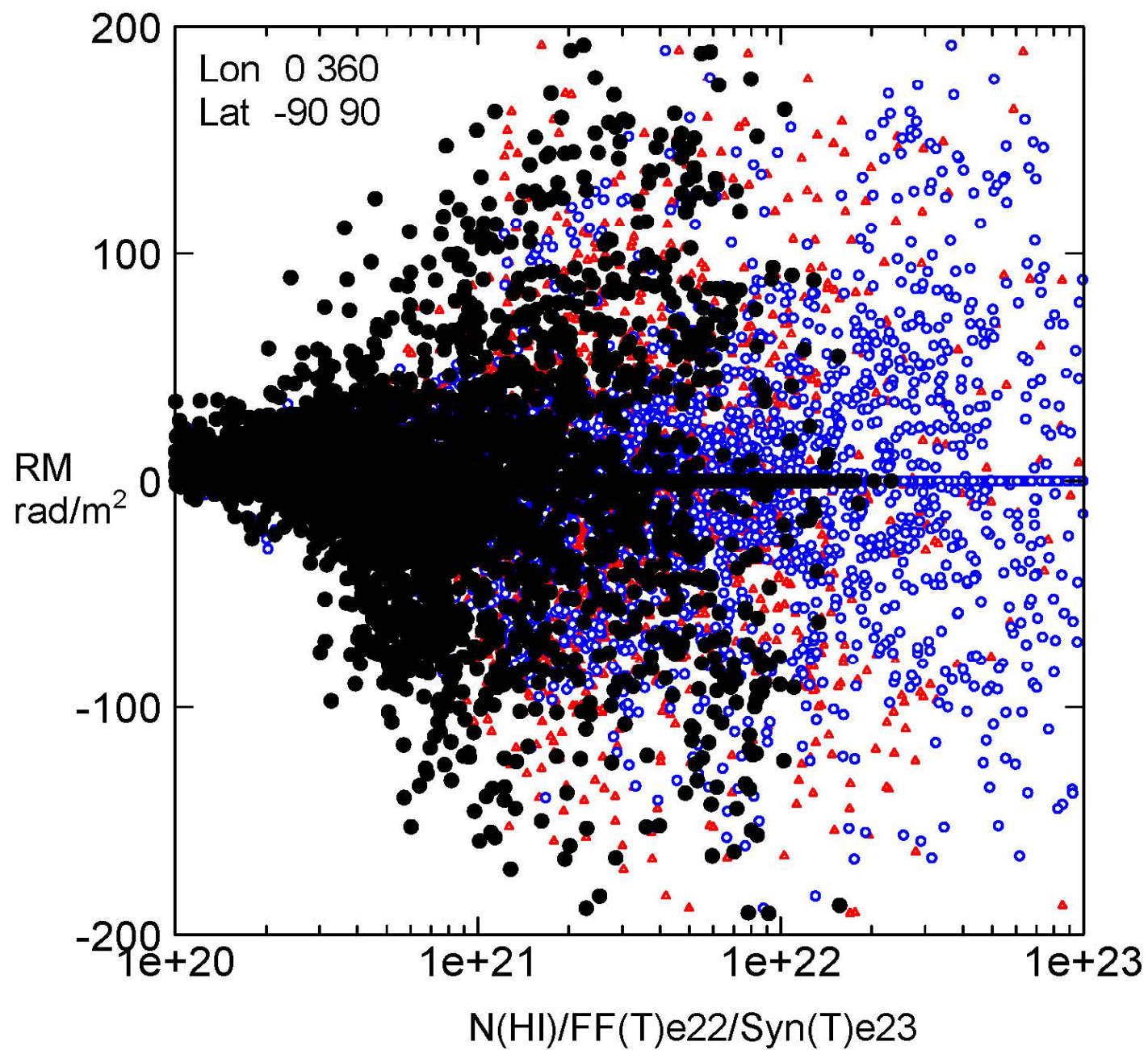


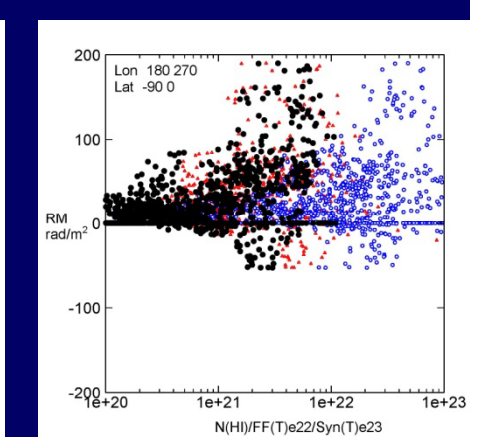
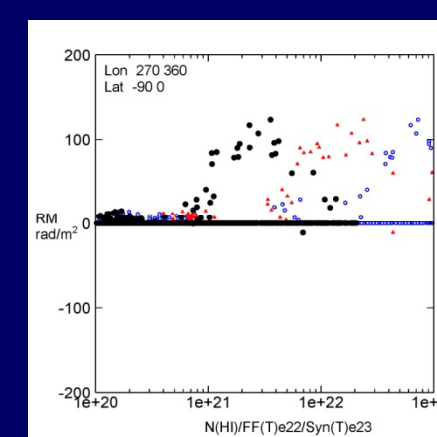
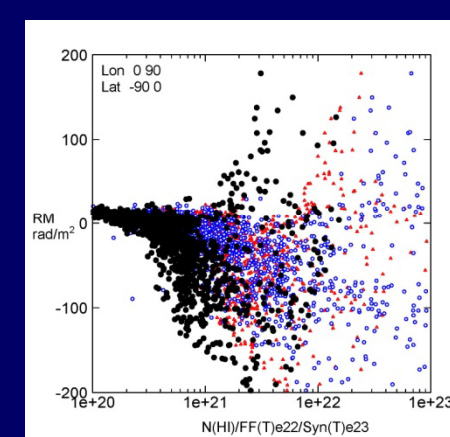
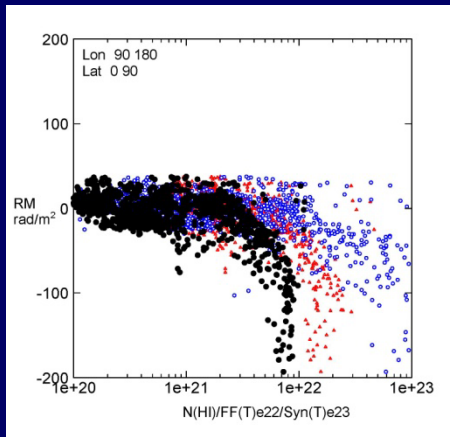
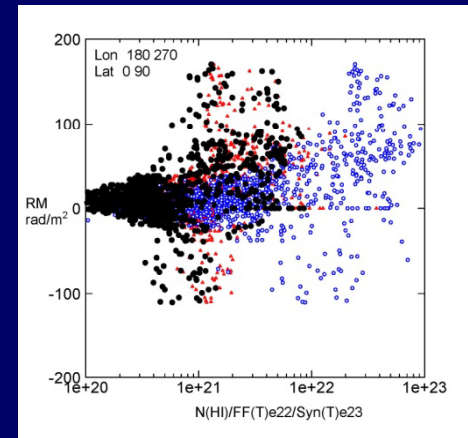
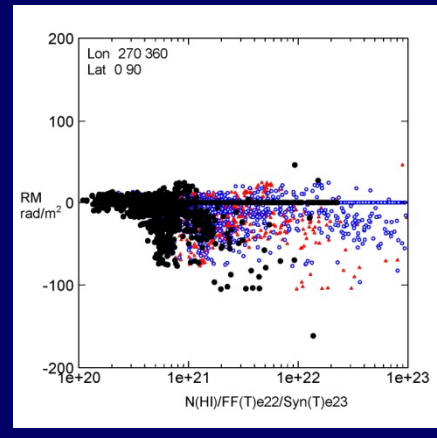
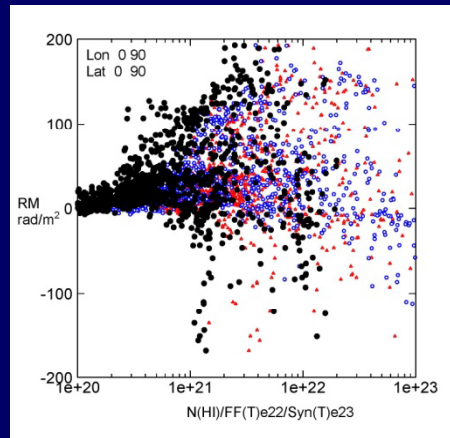
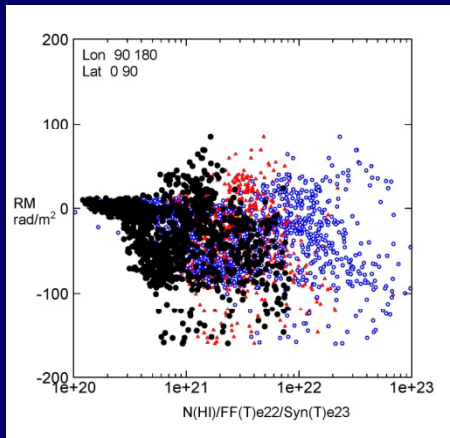
3. RM vs HI

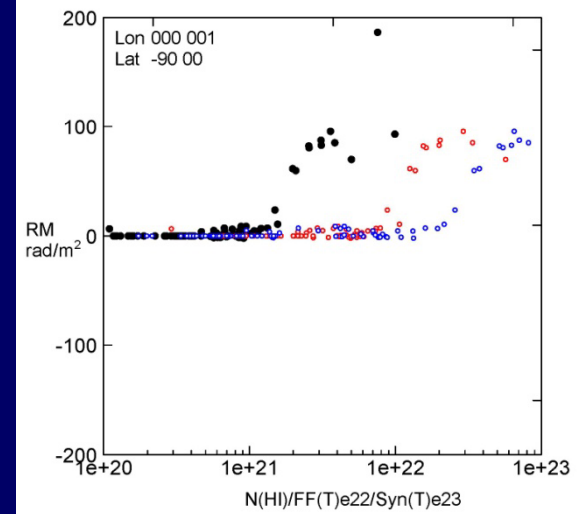
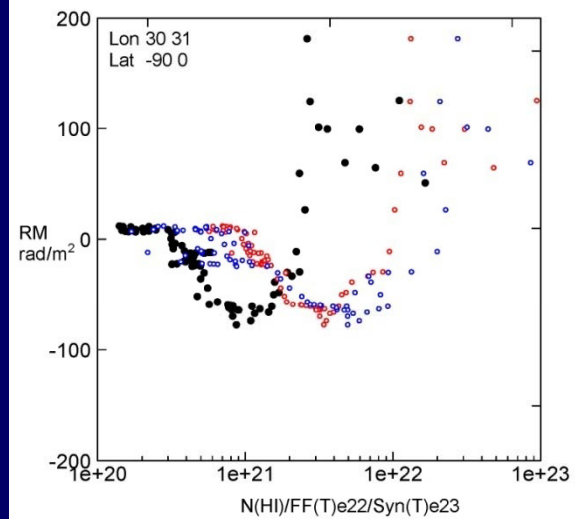
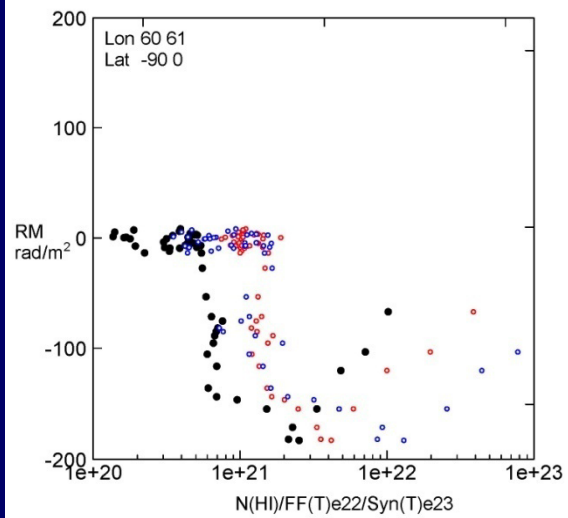
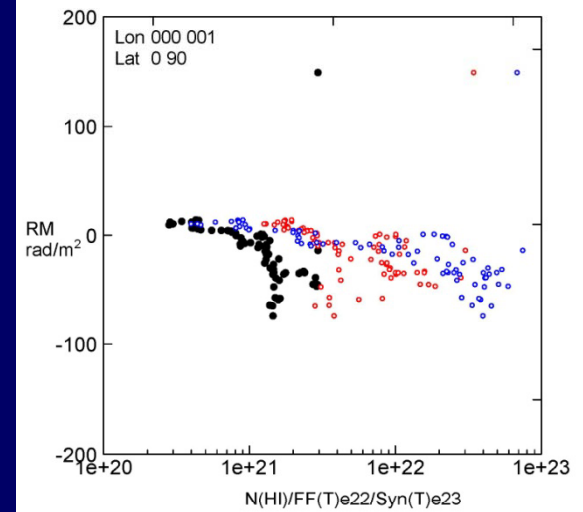
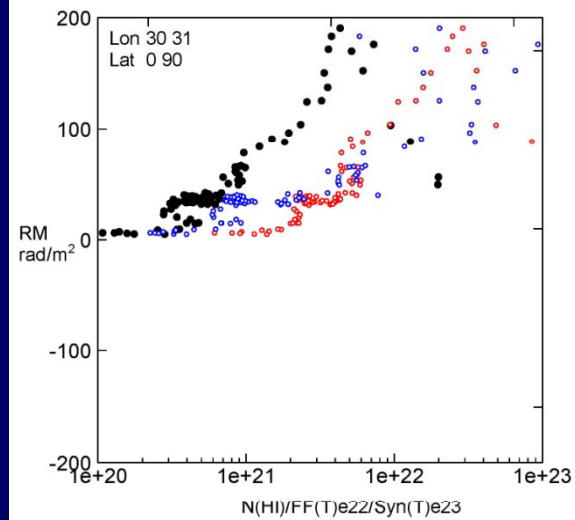
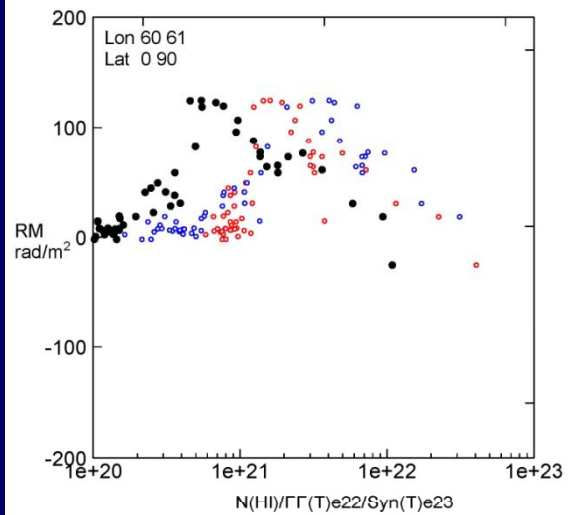
Ordered B / Turbulent B,
Local B reversals

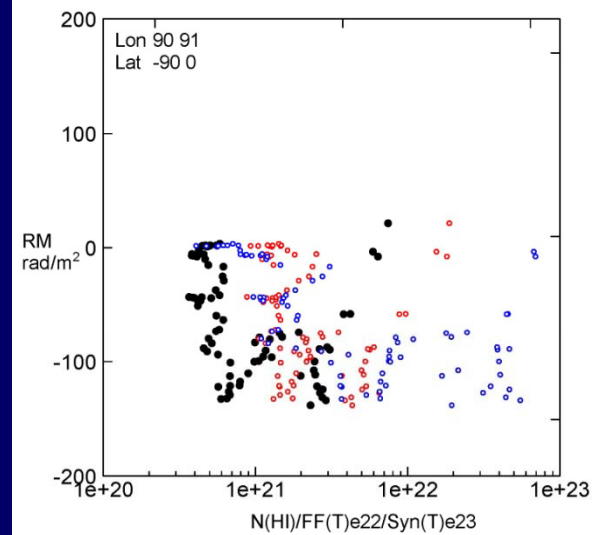
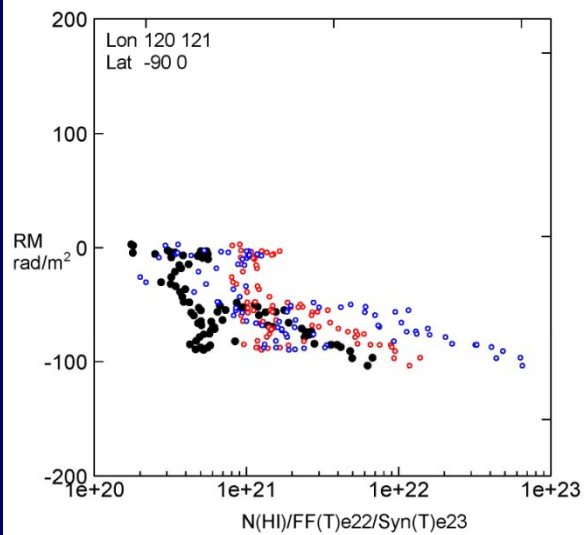
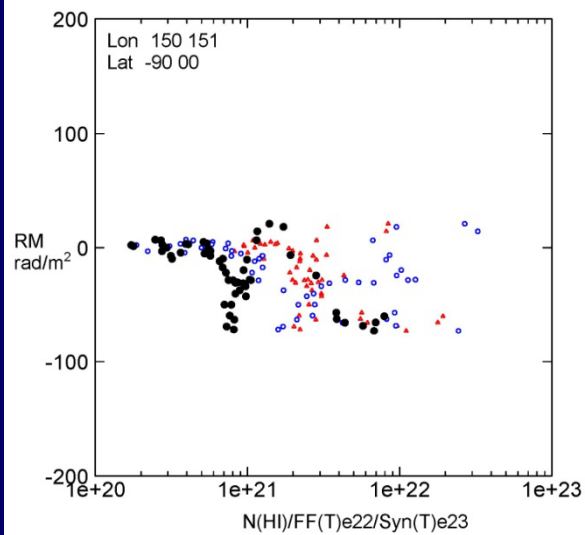
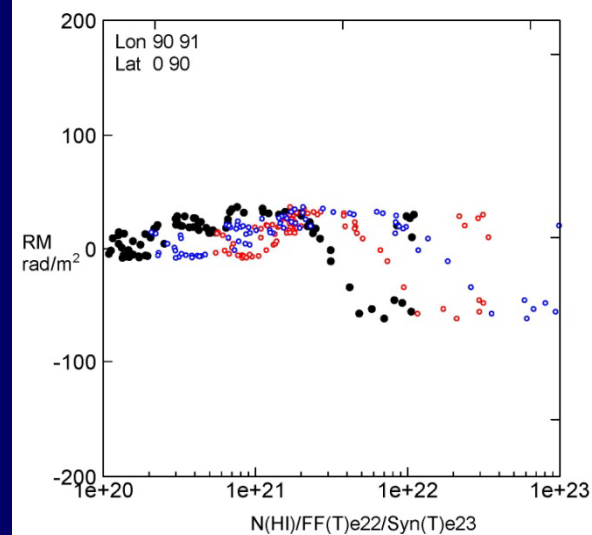
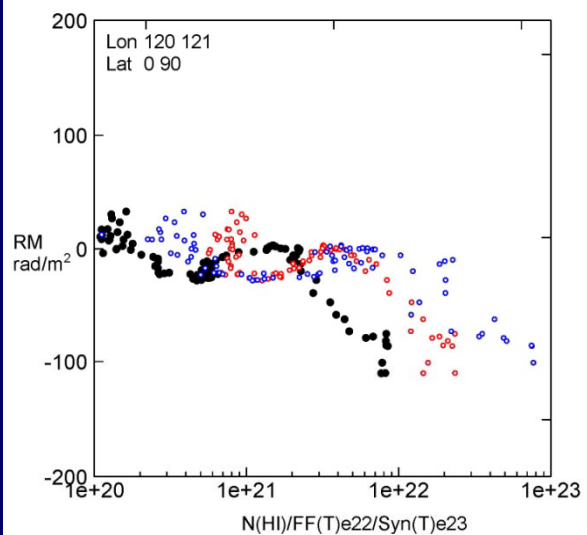
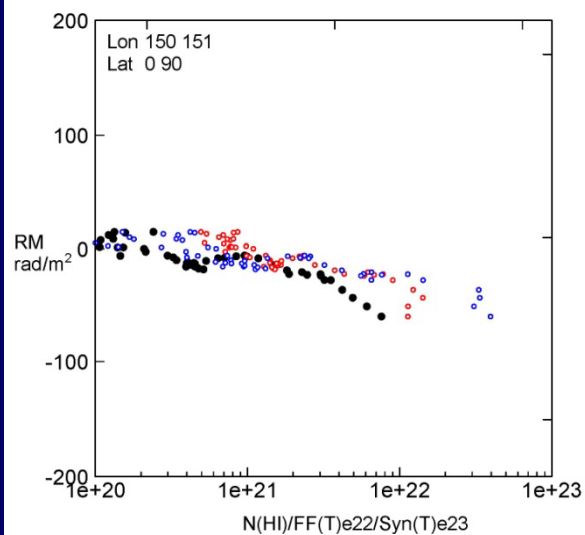
RM vs Gas (HI, H₂, HII, COBE) plot

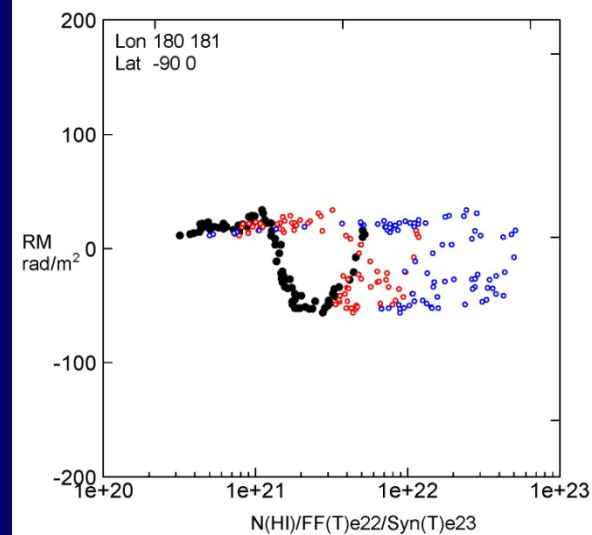
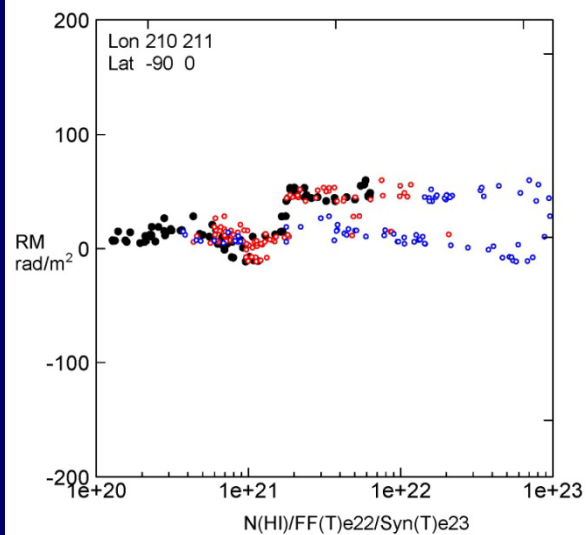
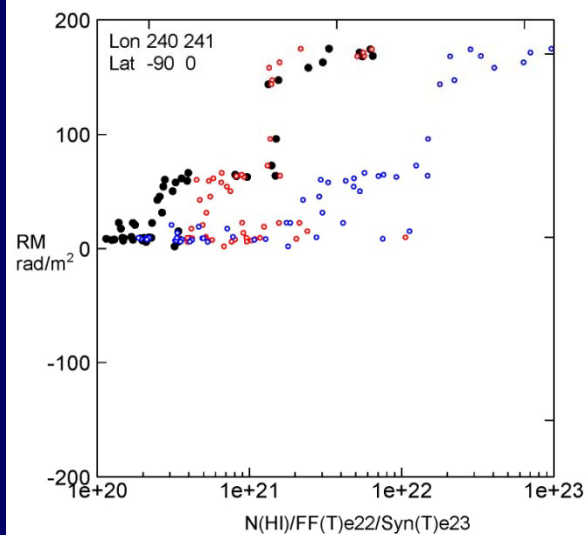
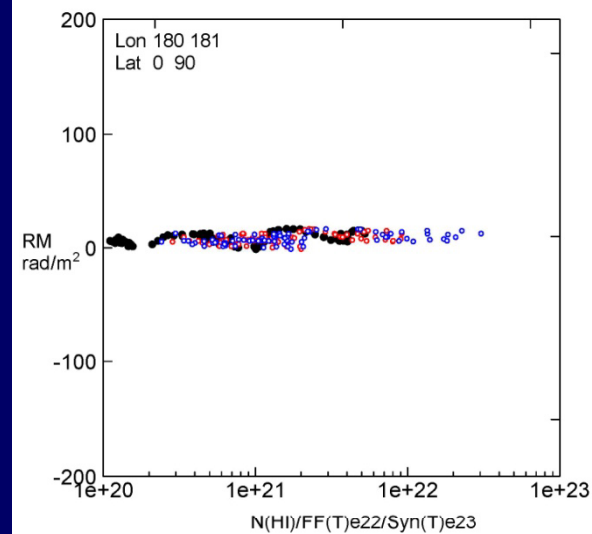
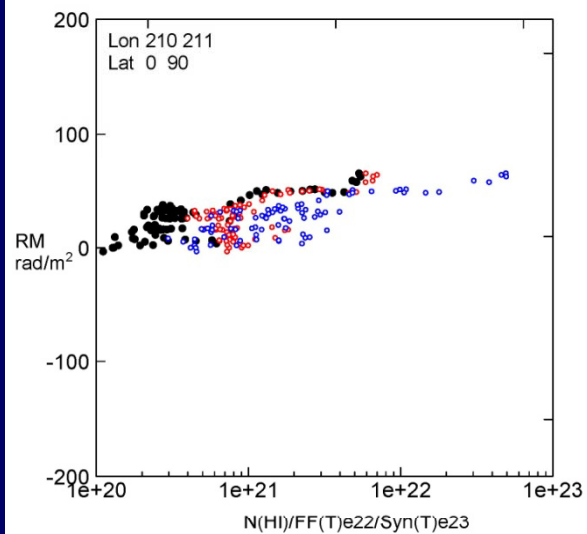
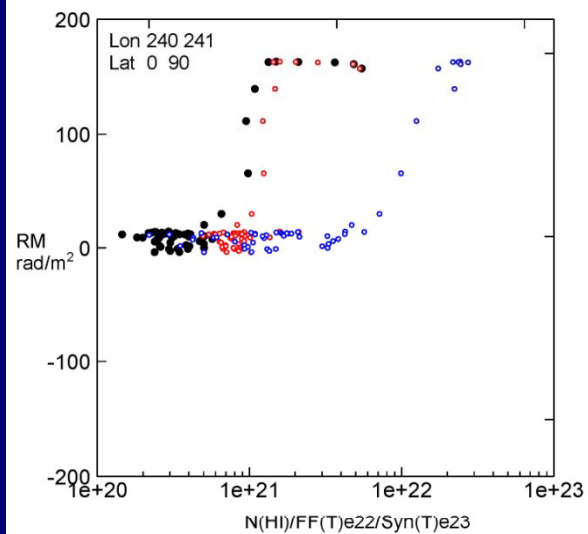


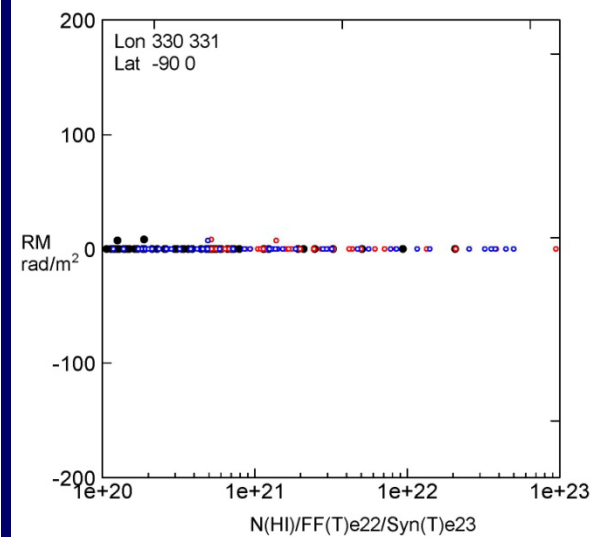
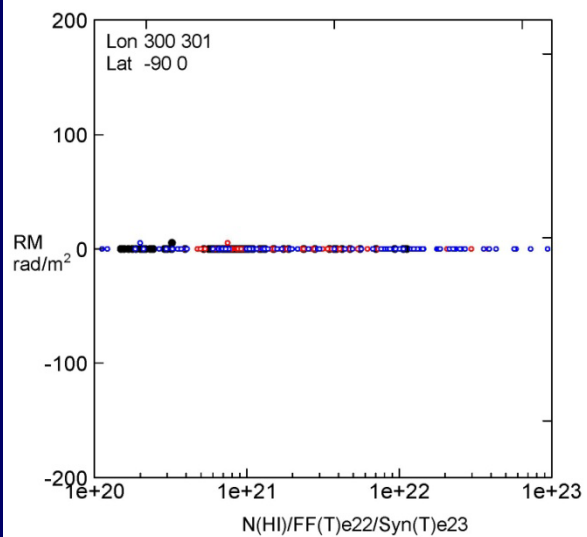
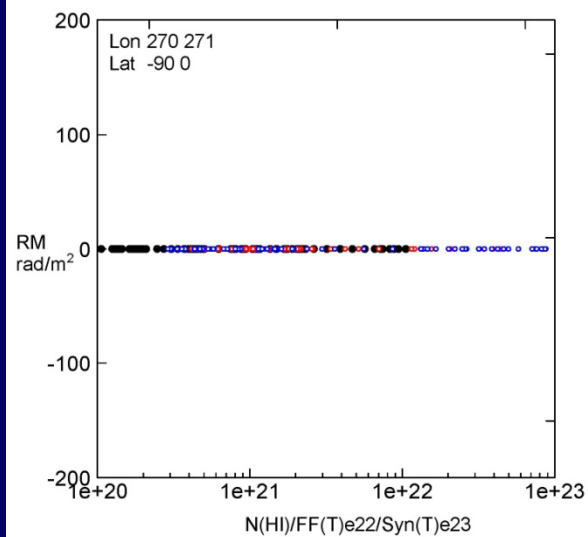
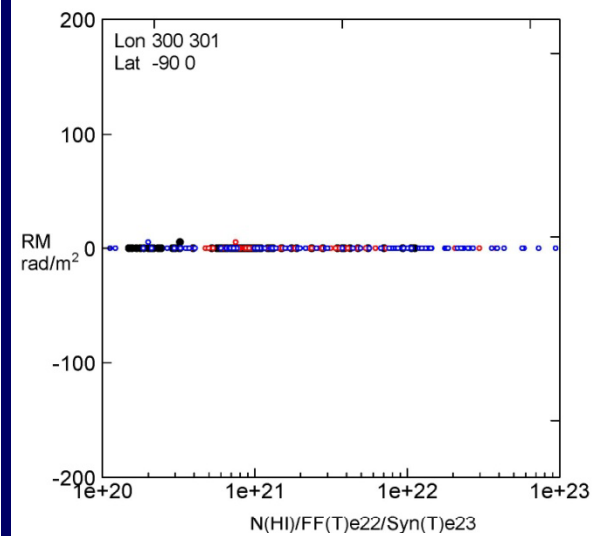
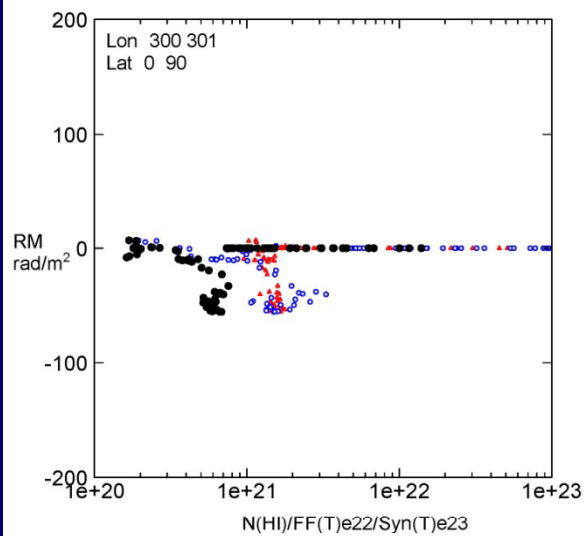
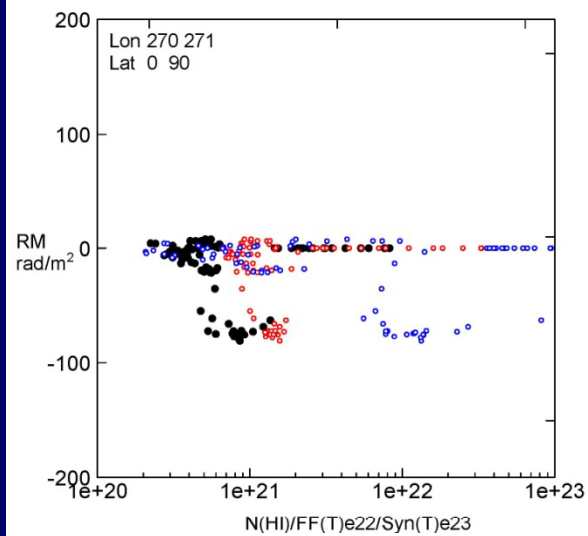


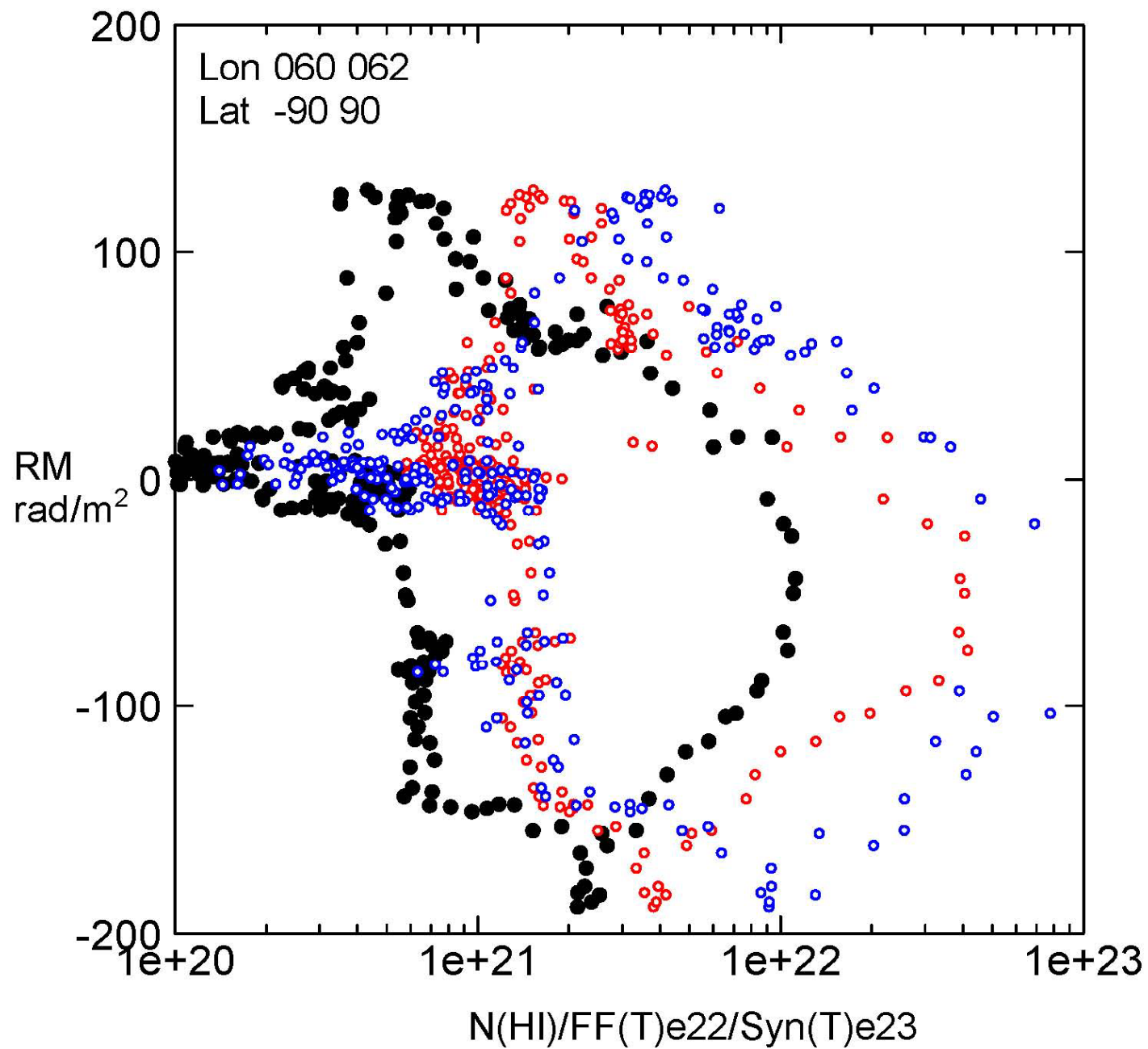




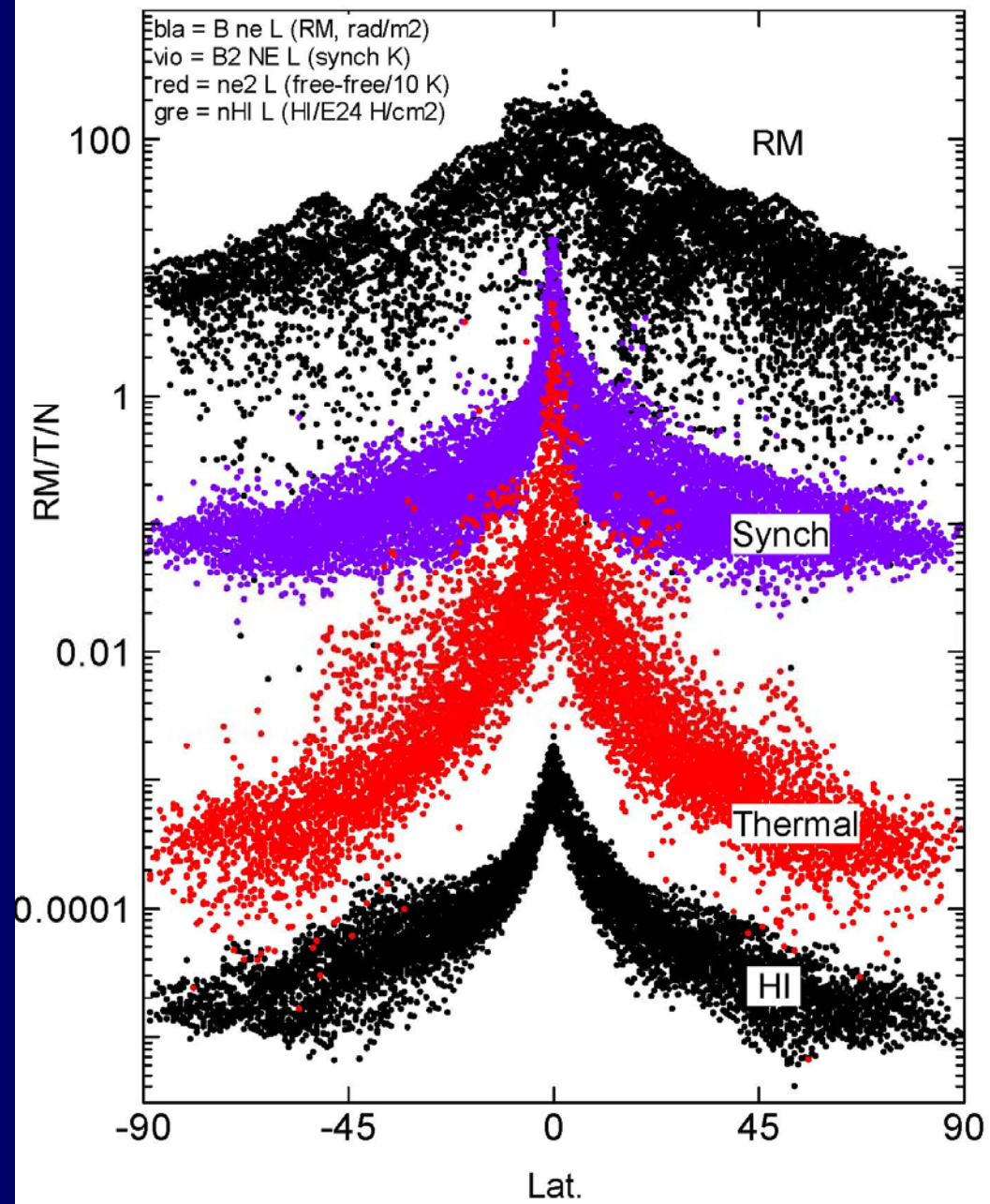


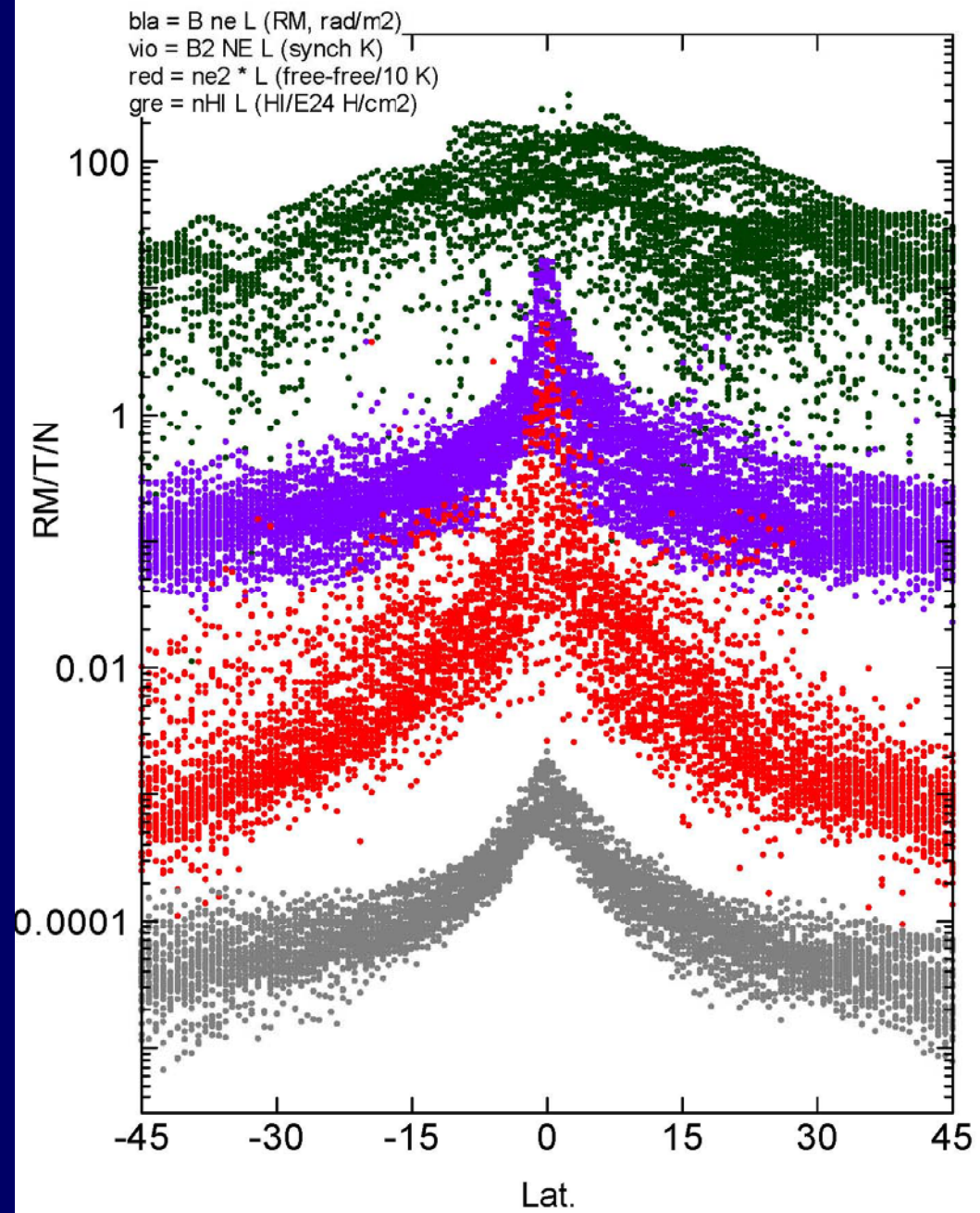




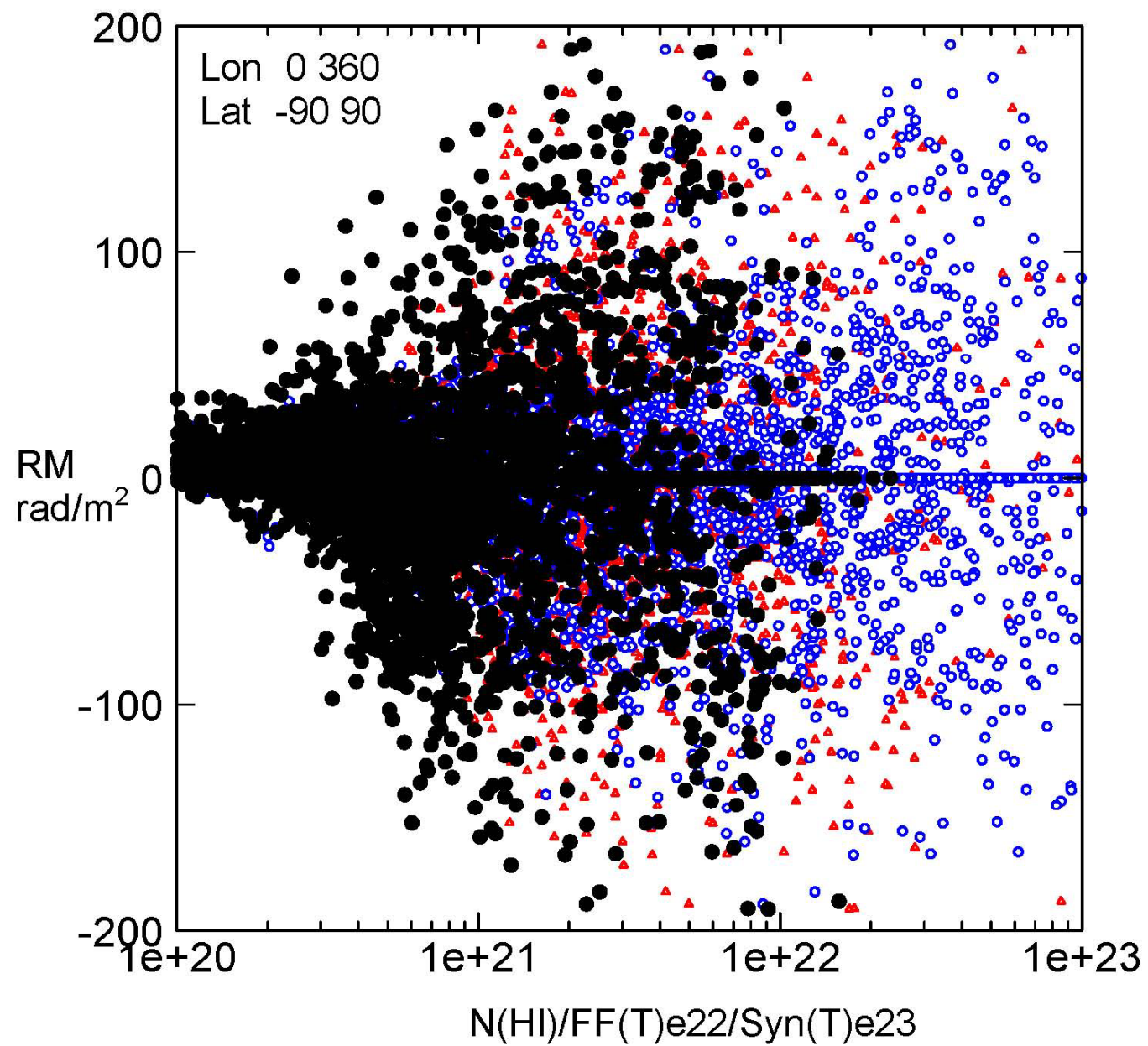


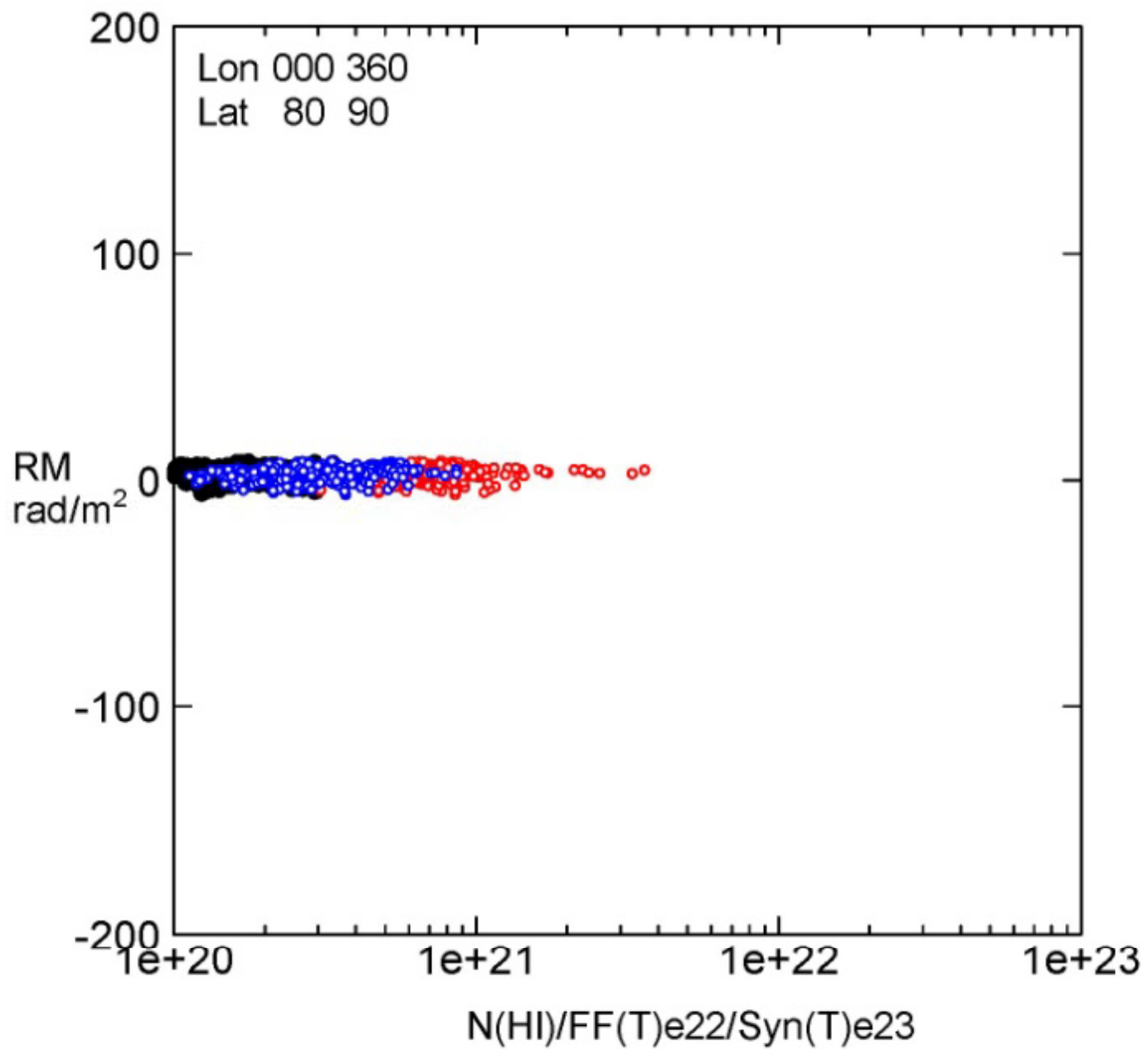
4. RM, HI, FF, Syn vs Latitude

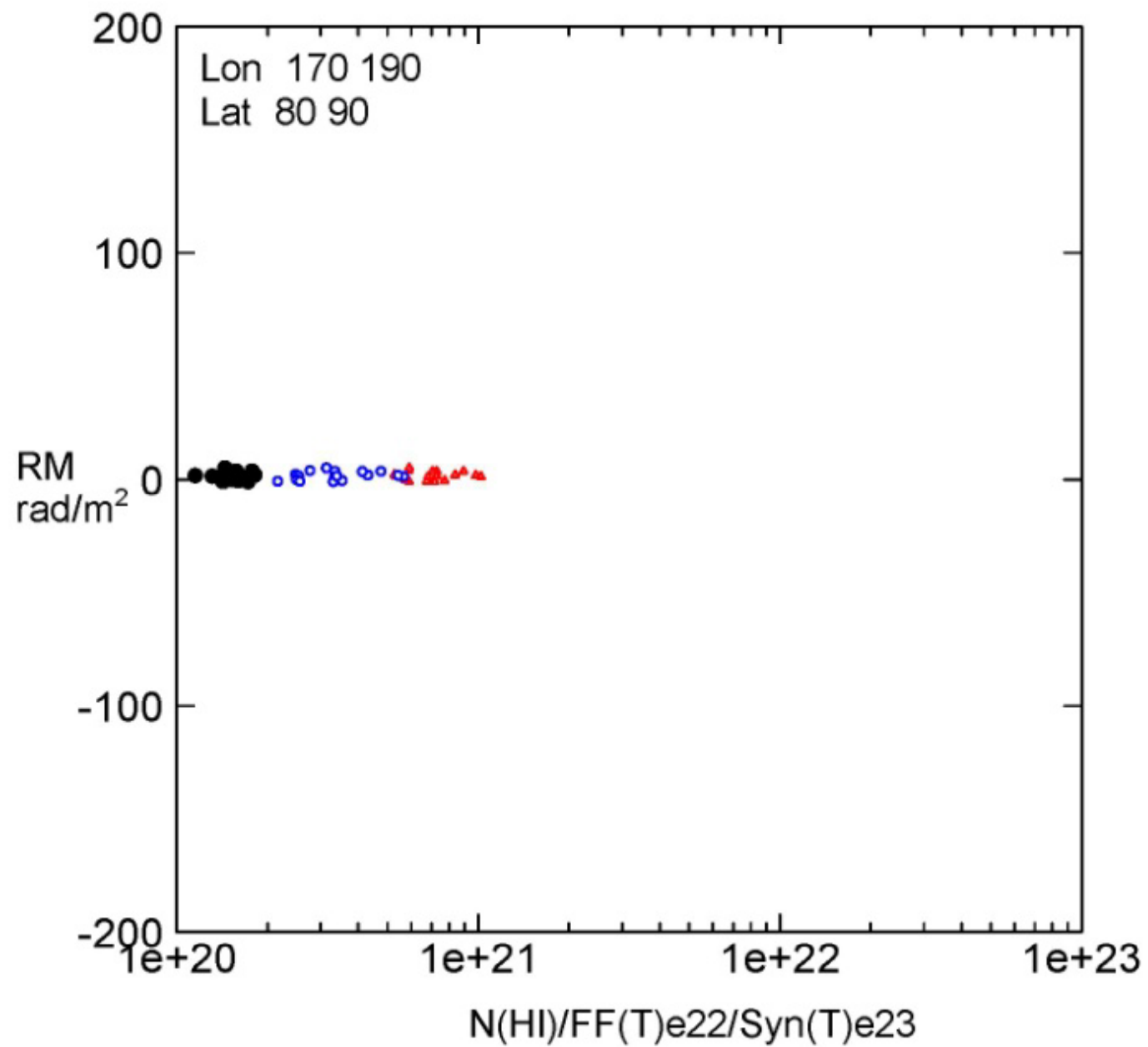




5. Window for Cosmology







II.

Galactic Variation of RM

Data:

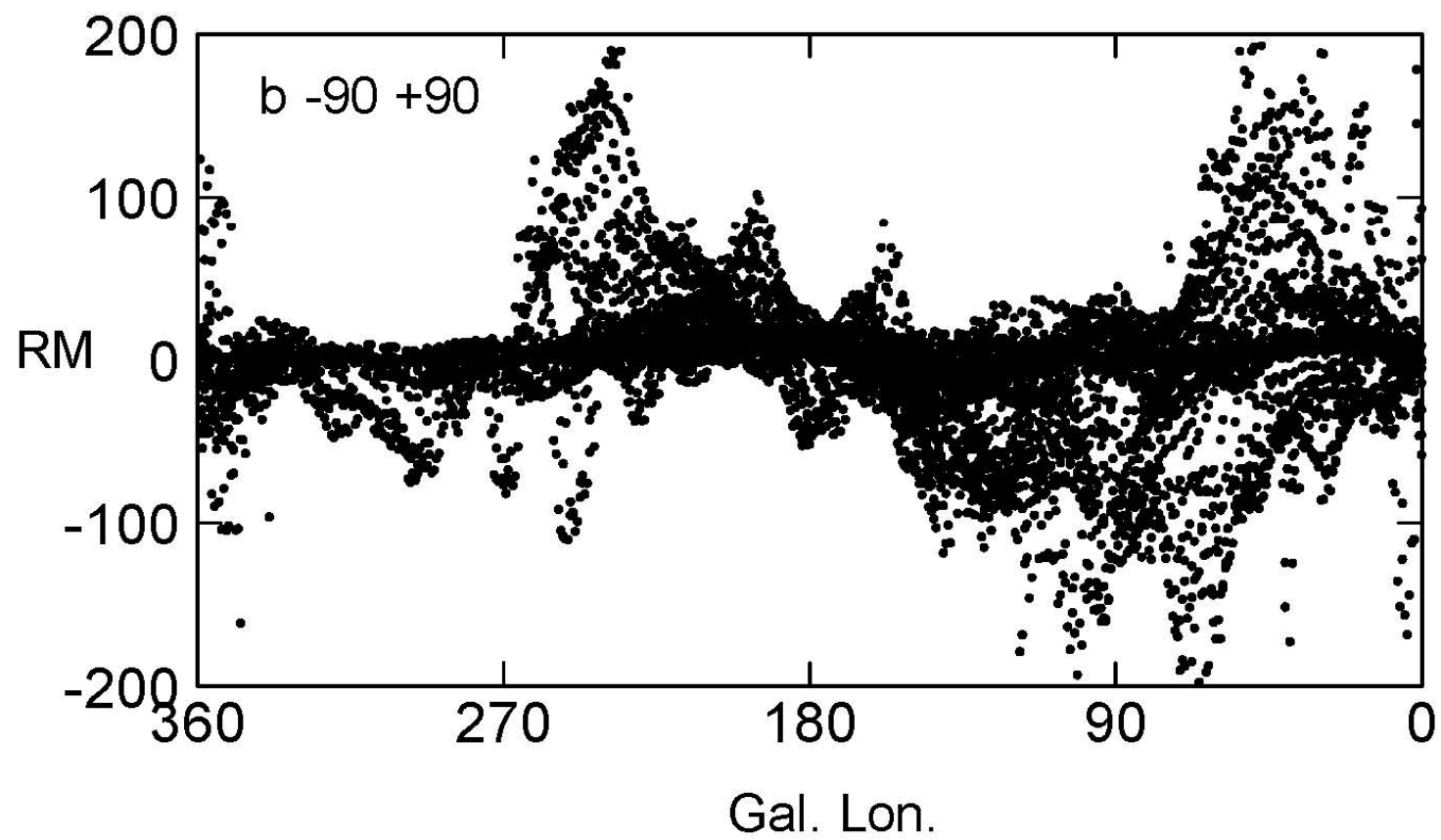
Taylor, et al. 2009

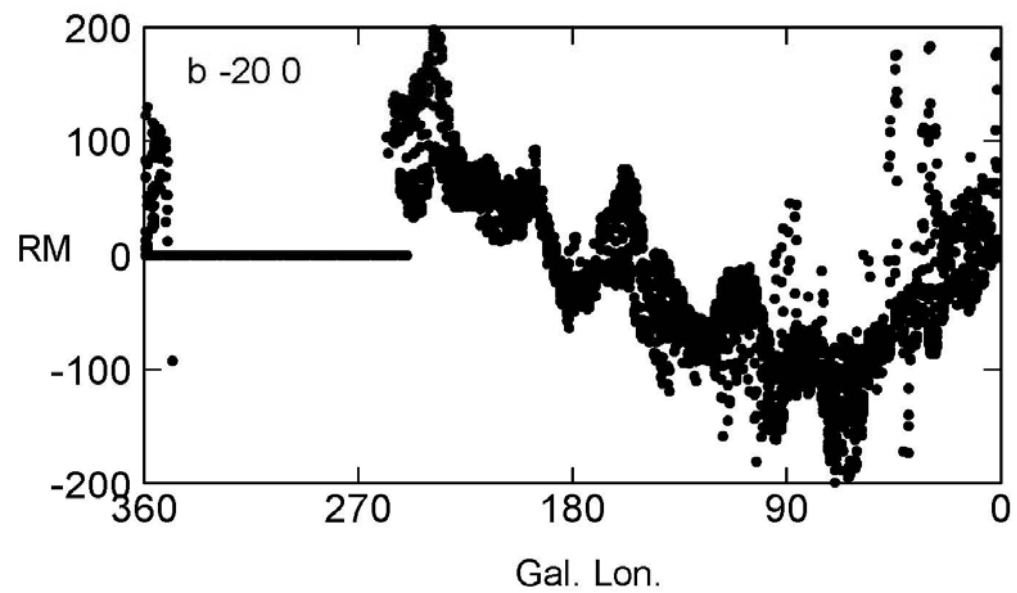
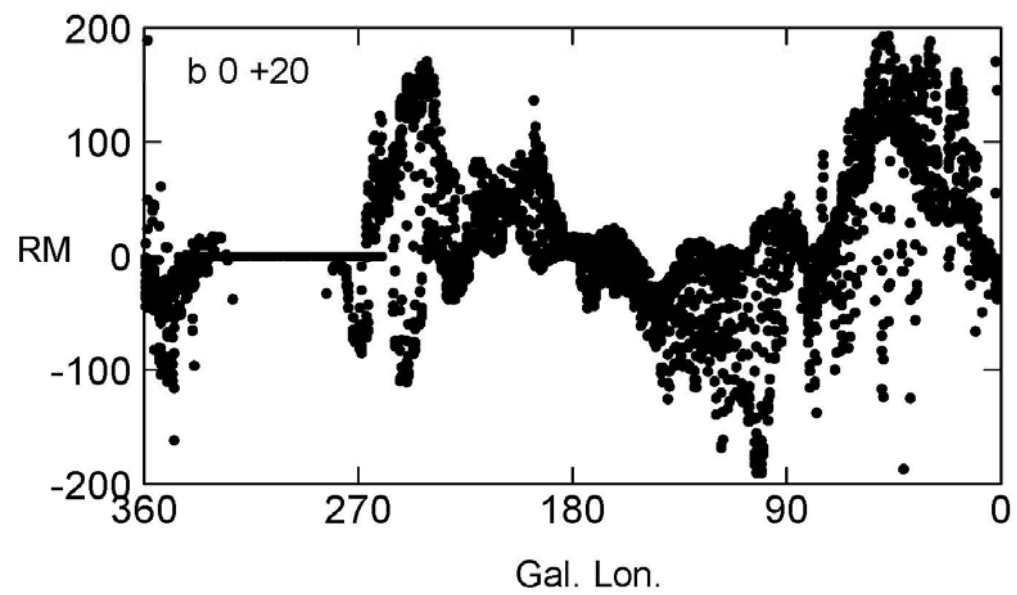
Kalbella et al. 2011

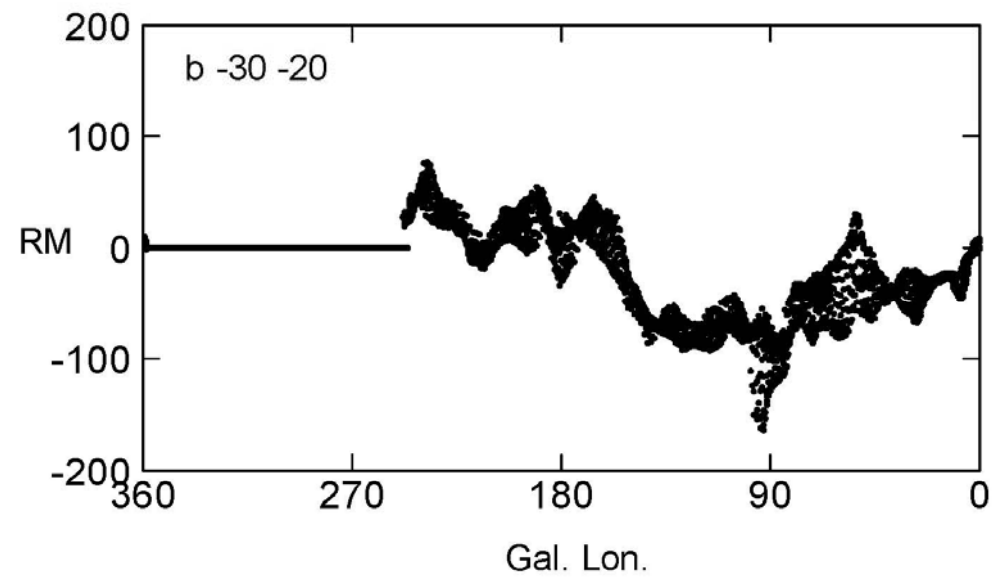
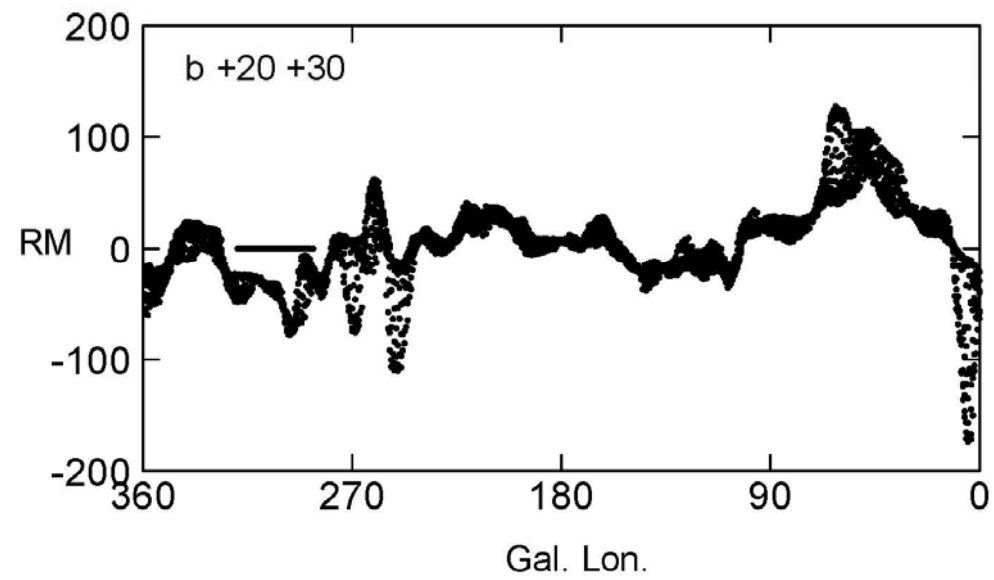
Tables

H. Nakanishi

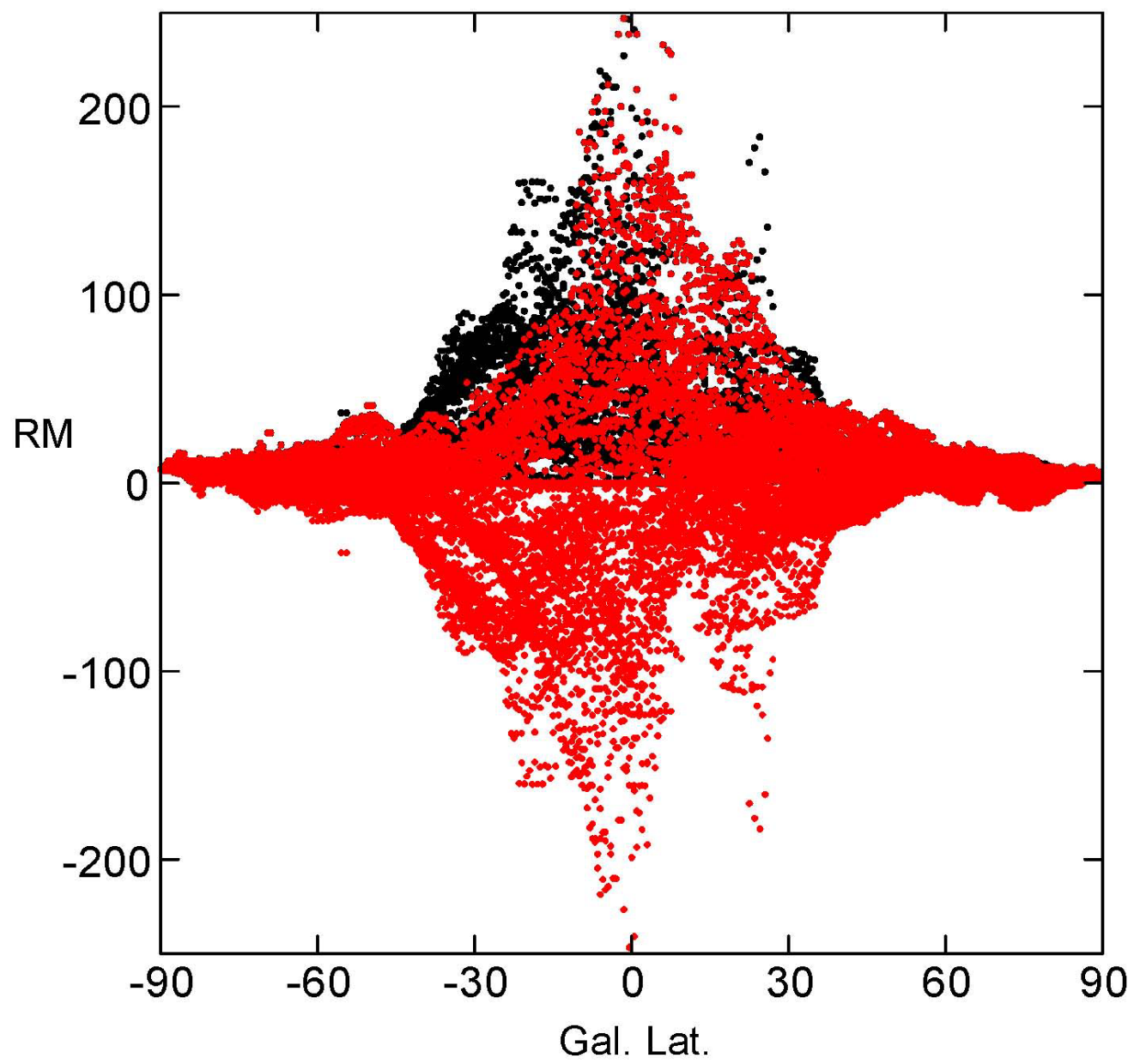
1. RM vs Longitude

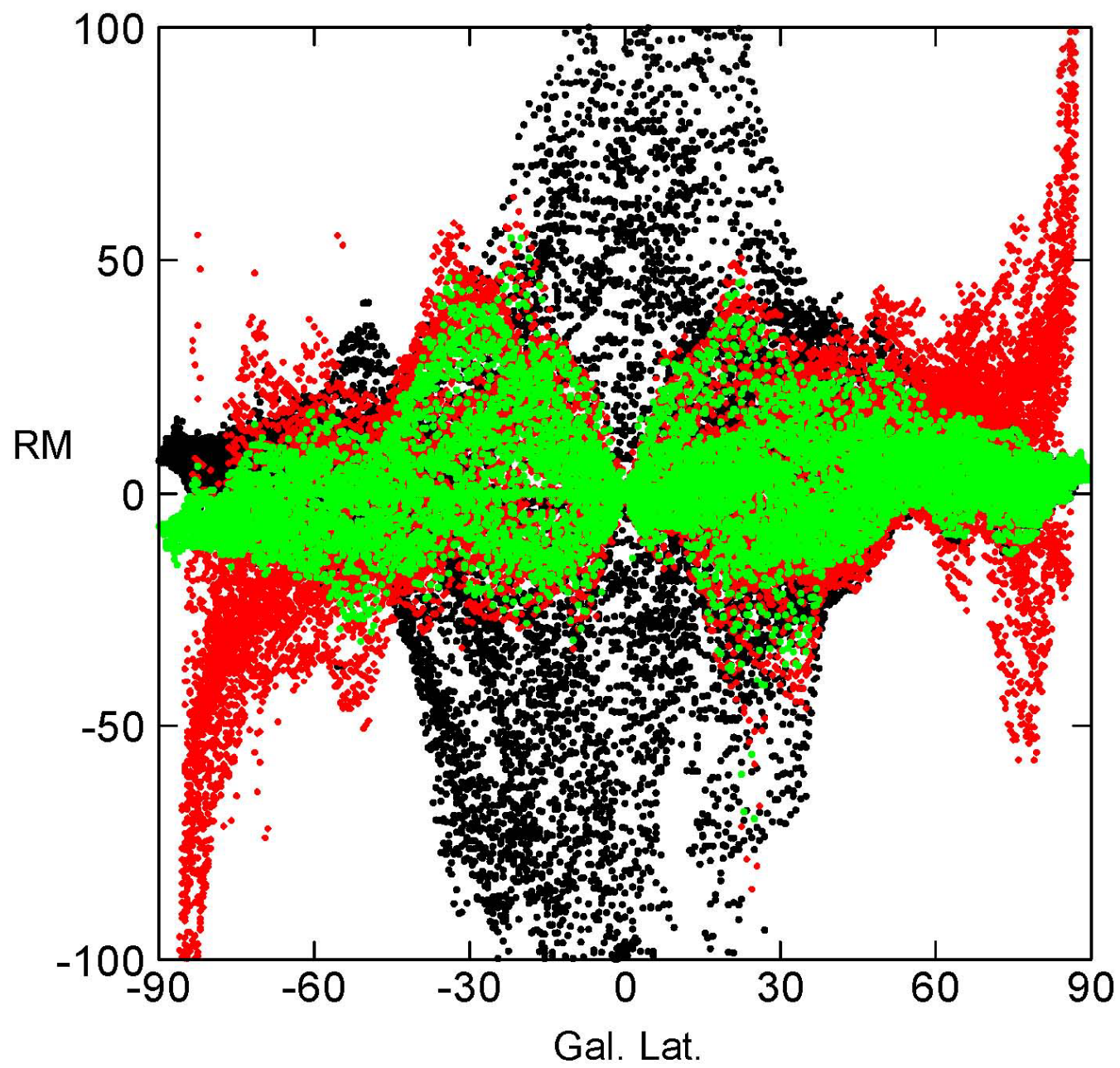


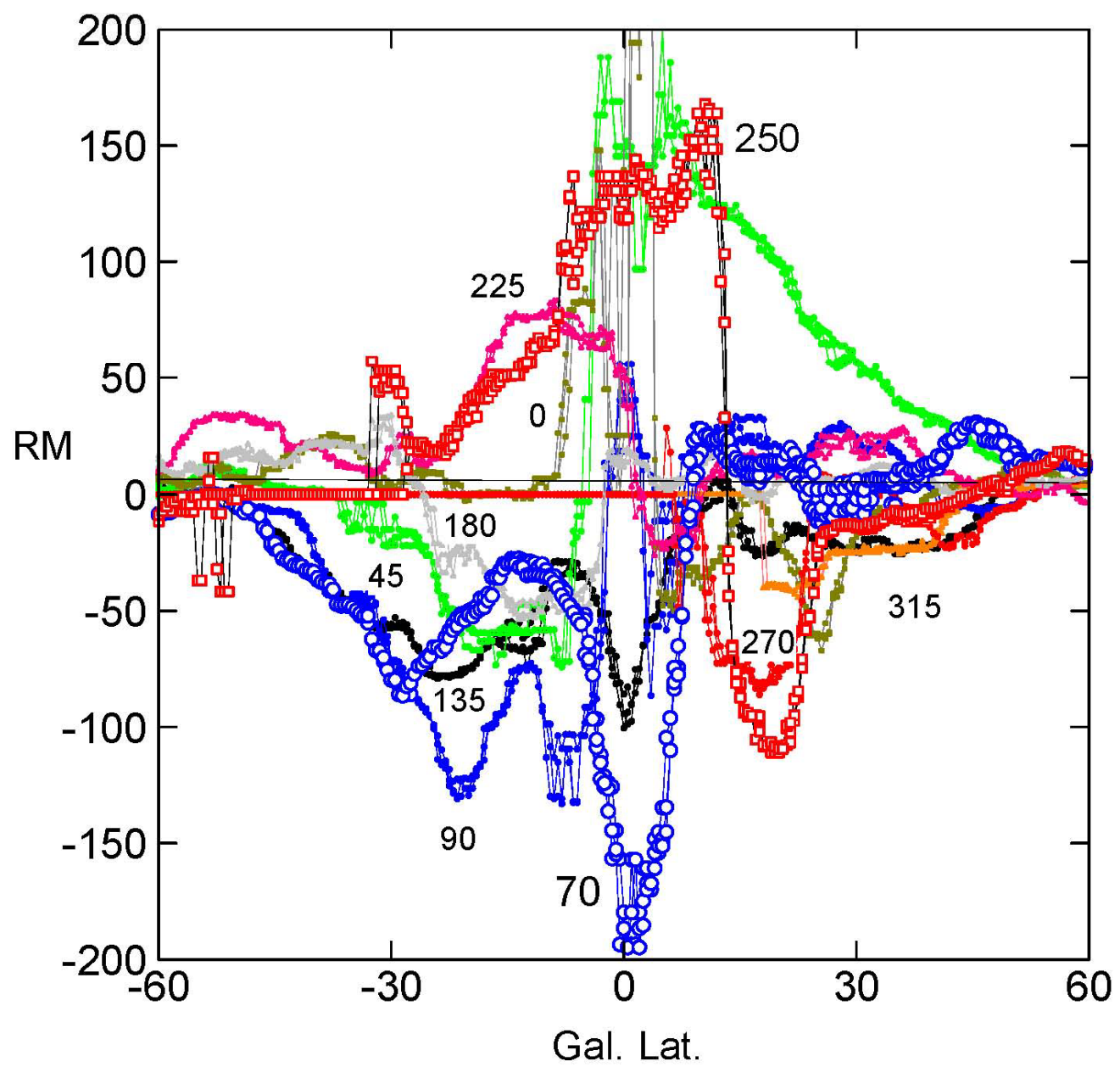


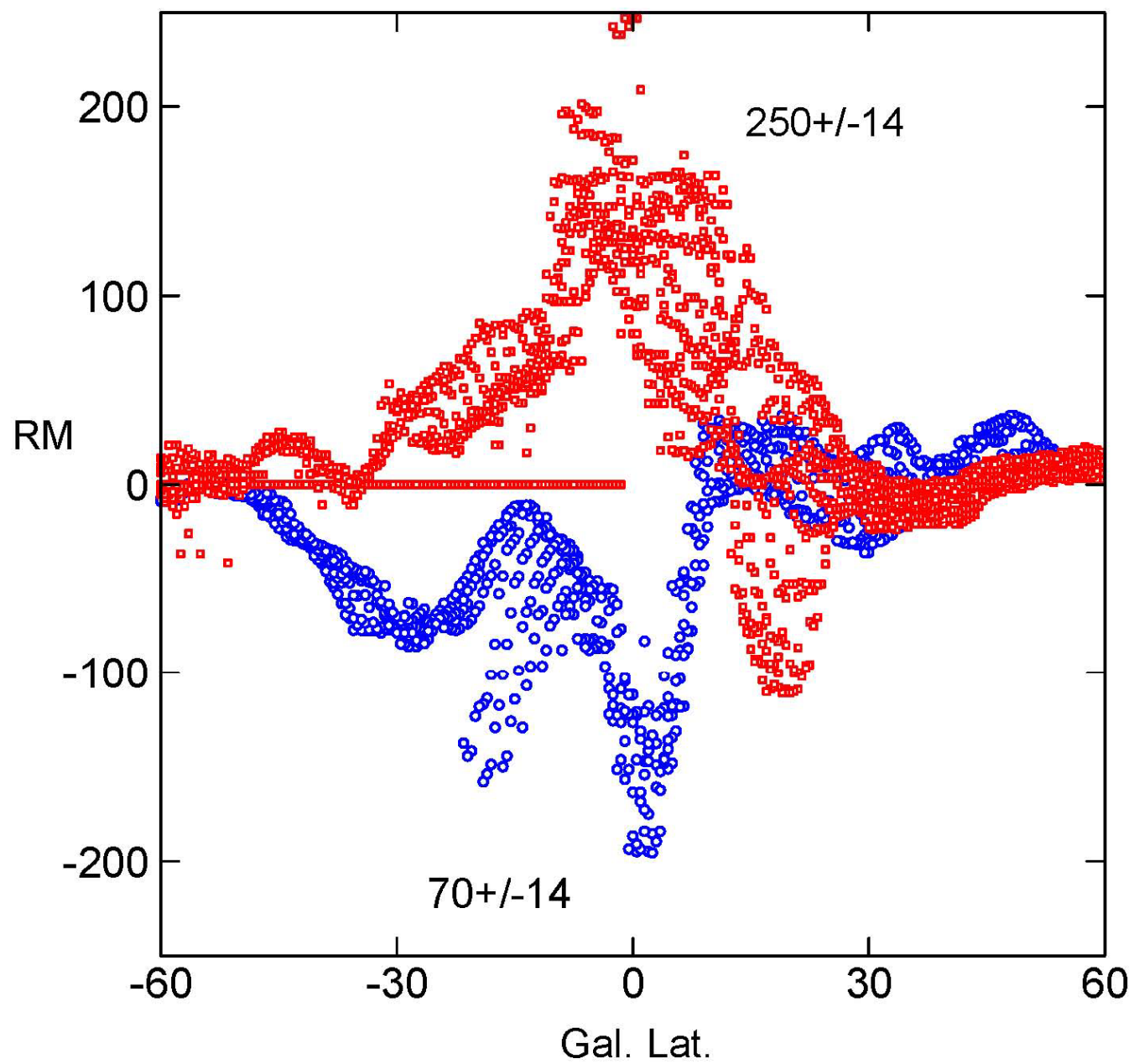


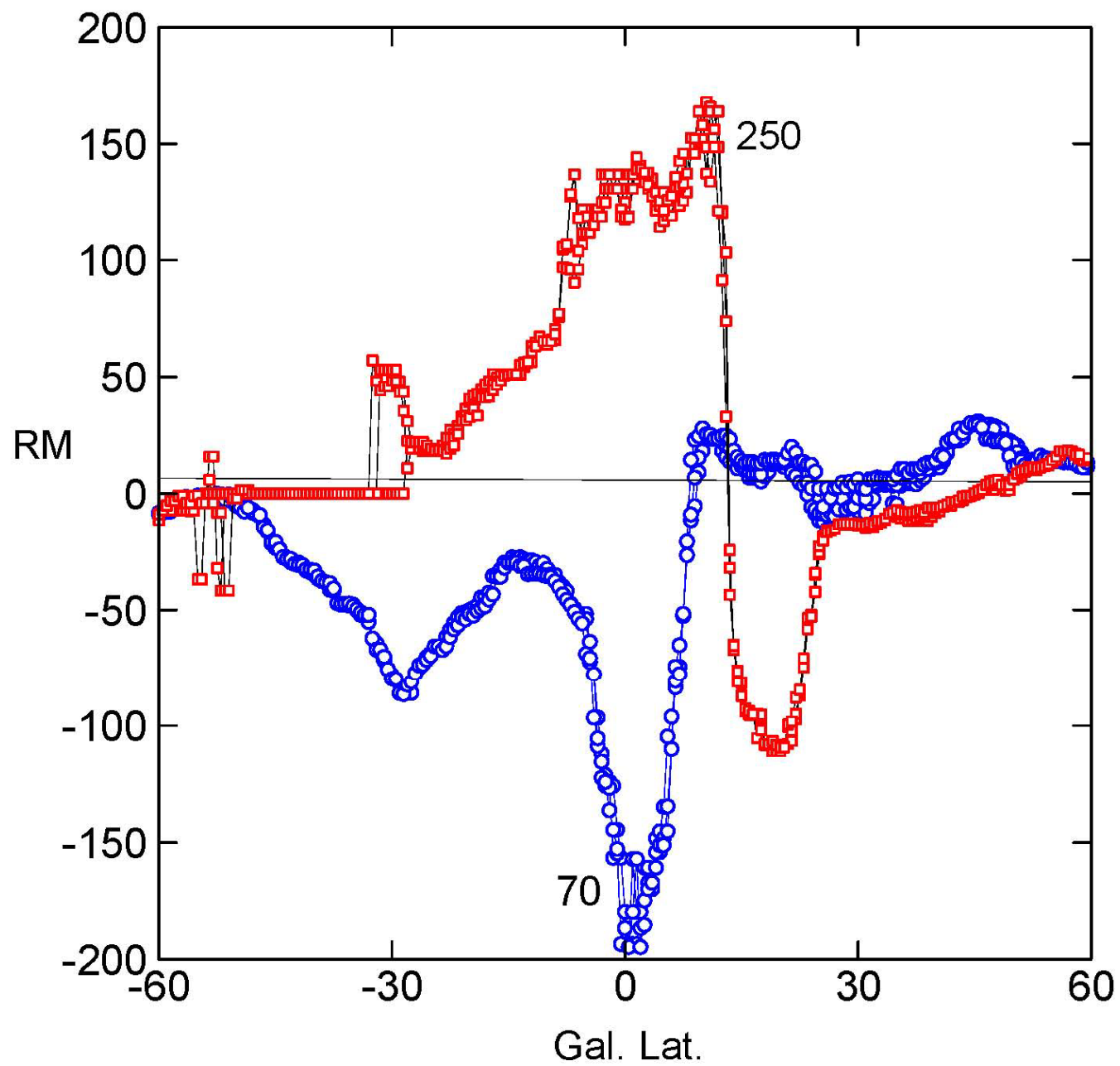
2. RM vs Latitude







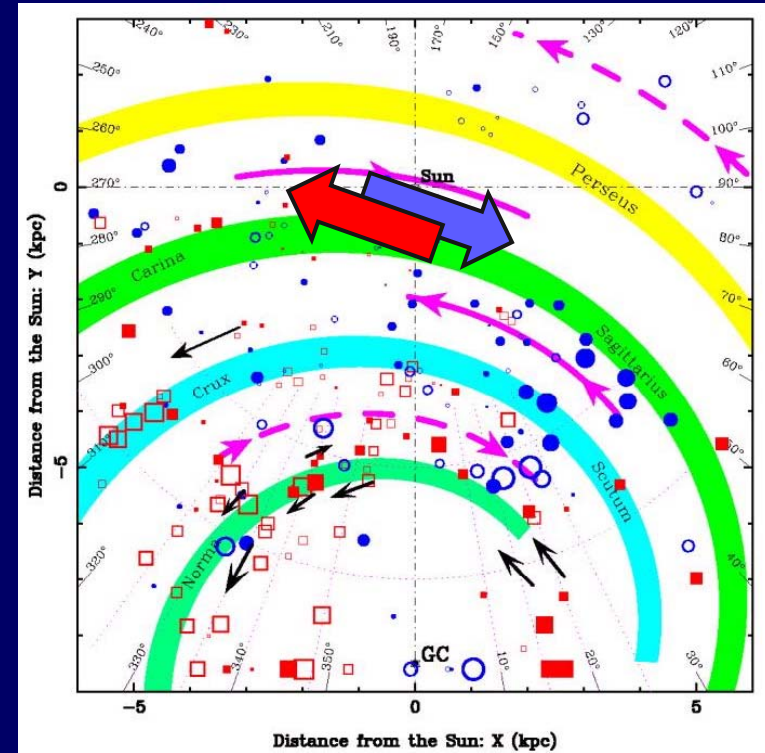
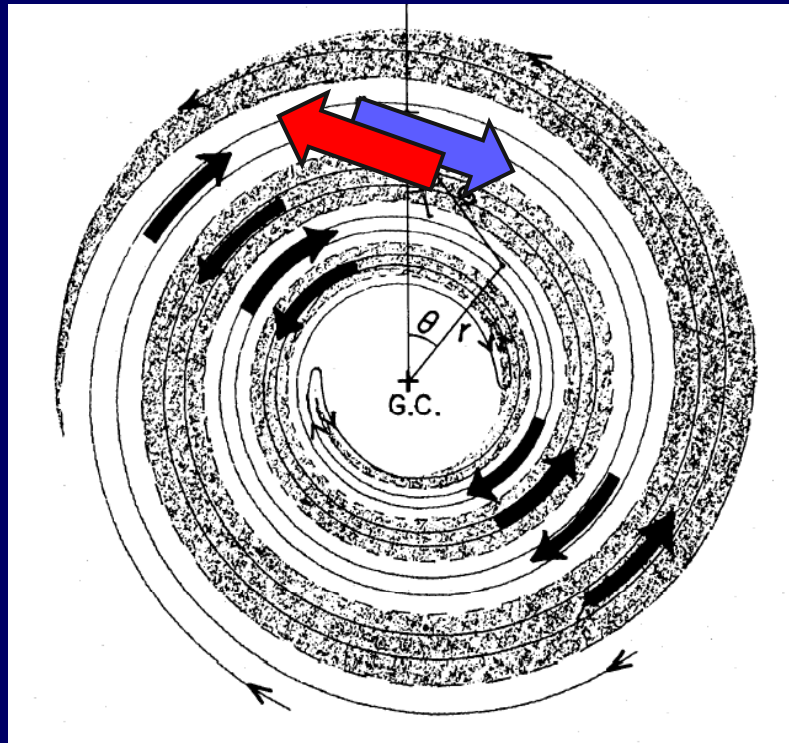




3. Local B G-Plane Reversal

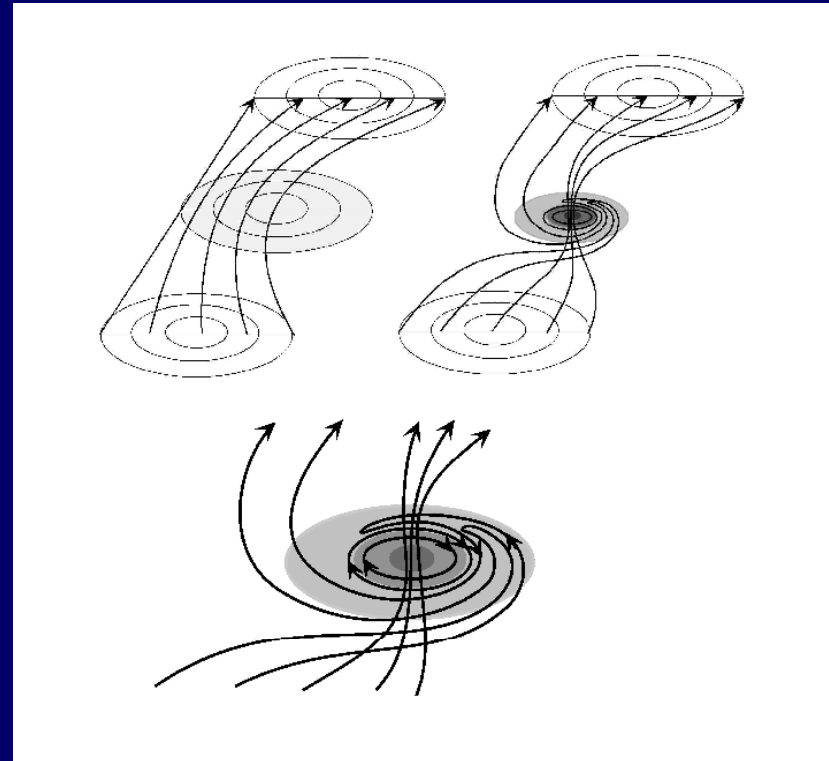
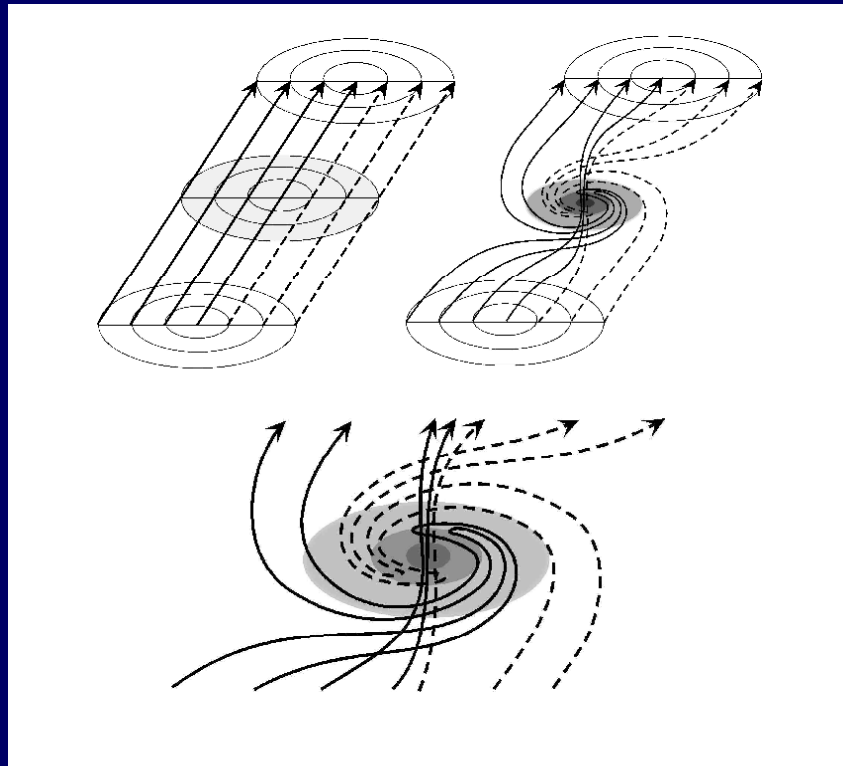
Bisymmetric B field

(Sofue Fujimoto 1980', Han 2000)

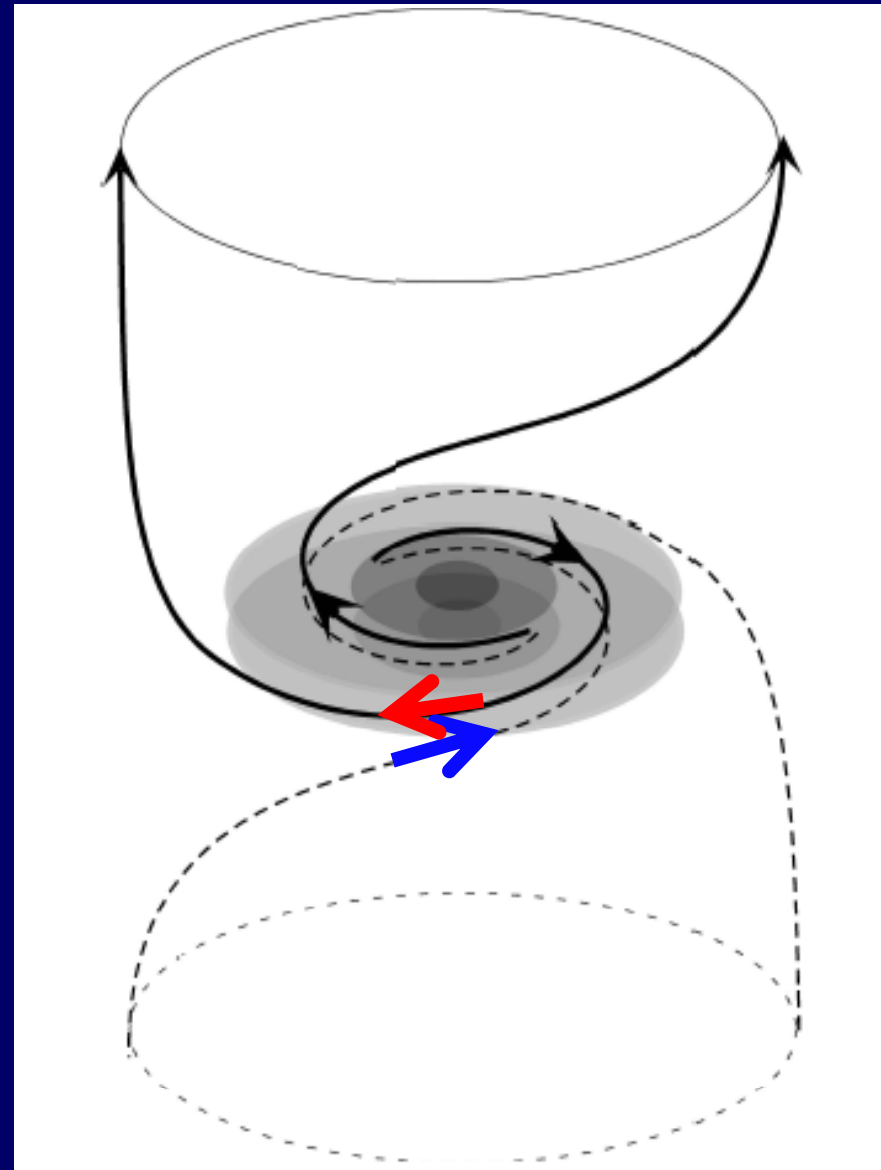
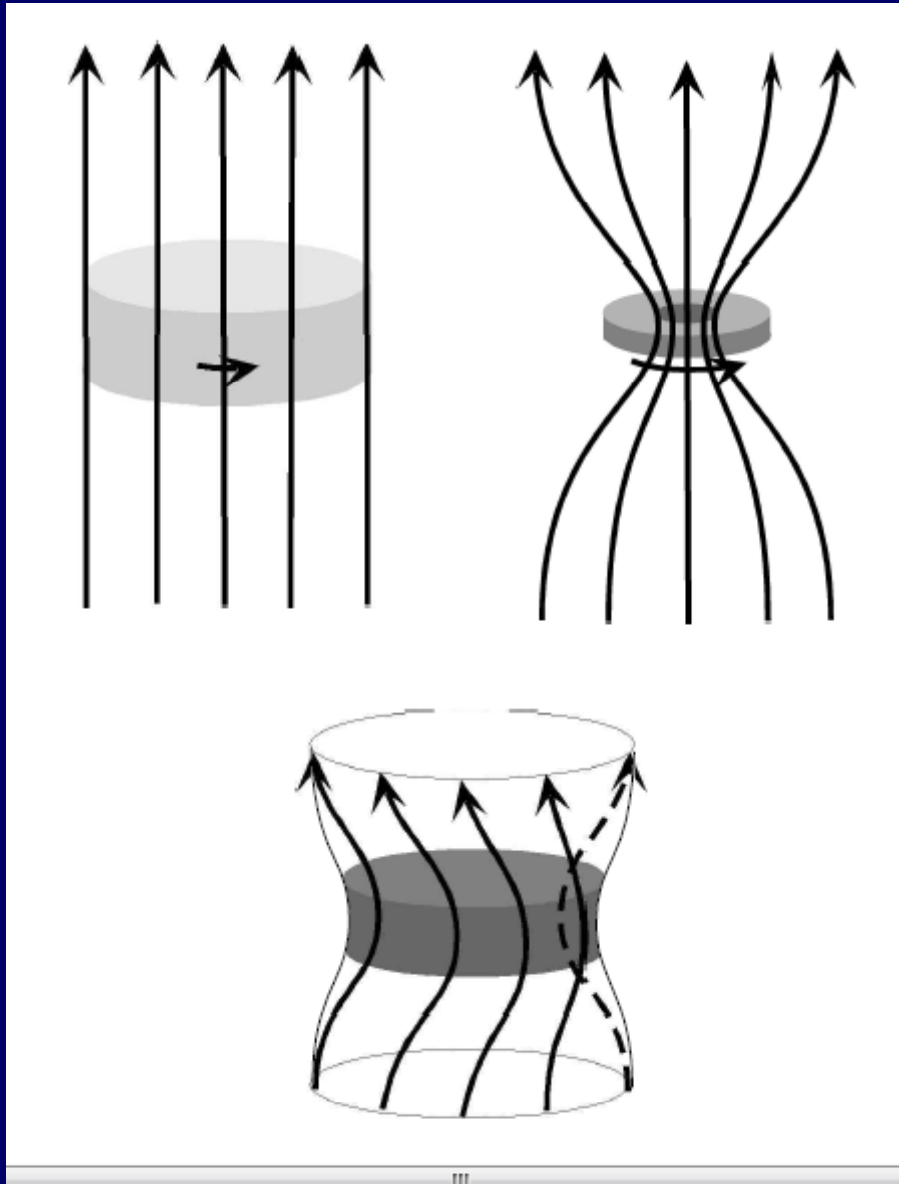


Cosmic B $\Rightarrow$ Galactic B

$\Rightarrow$ BSS + ASS/Ring + Vert B

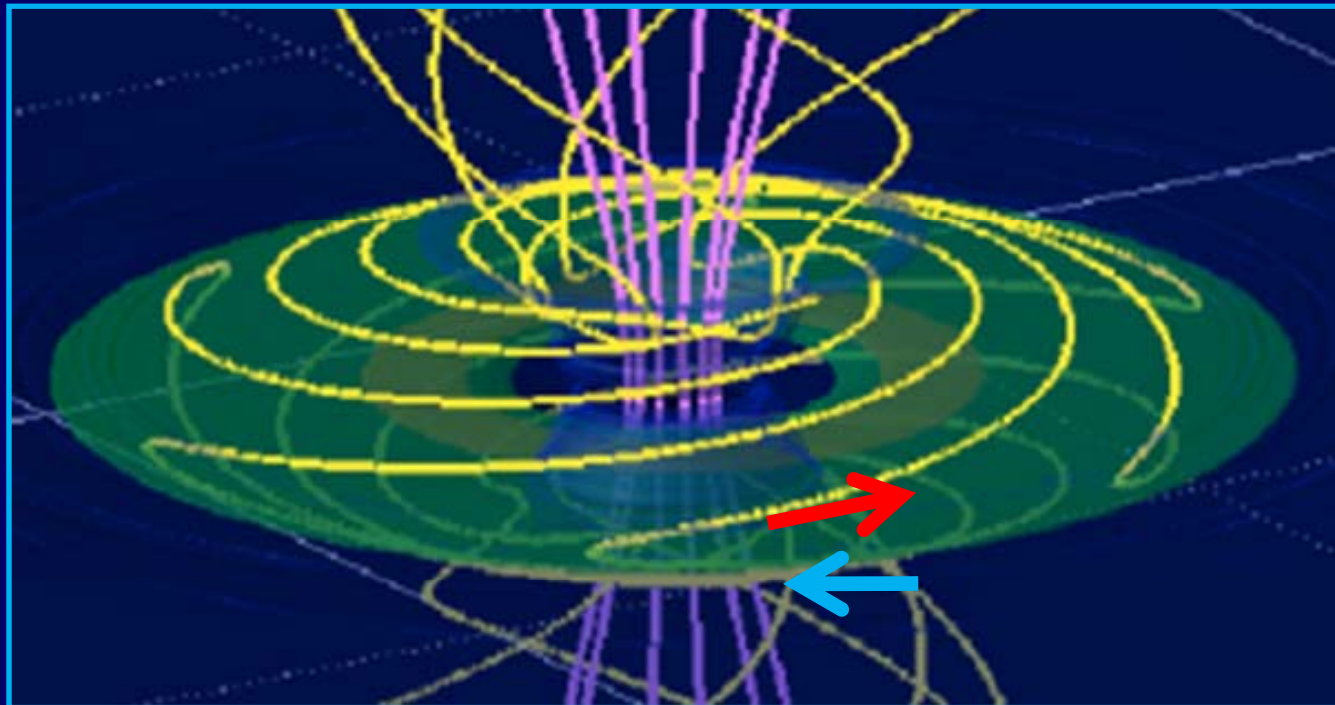


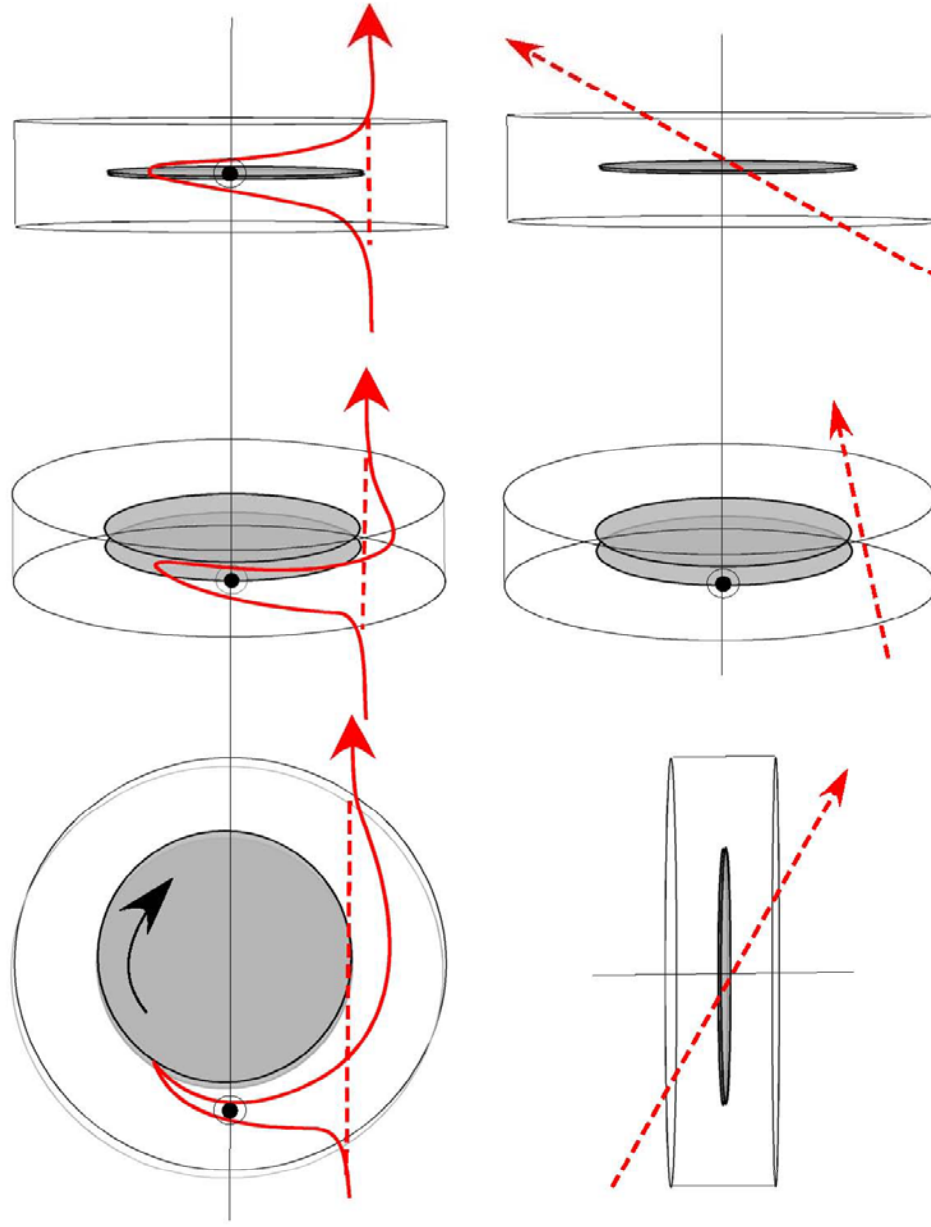
V, ASS

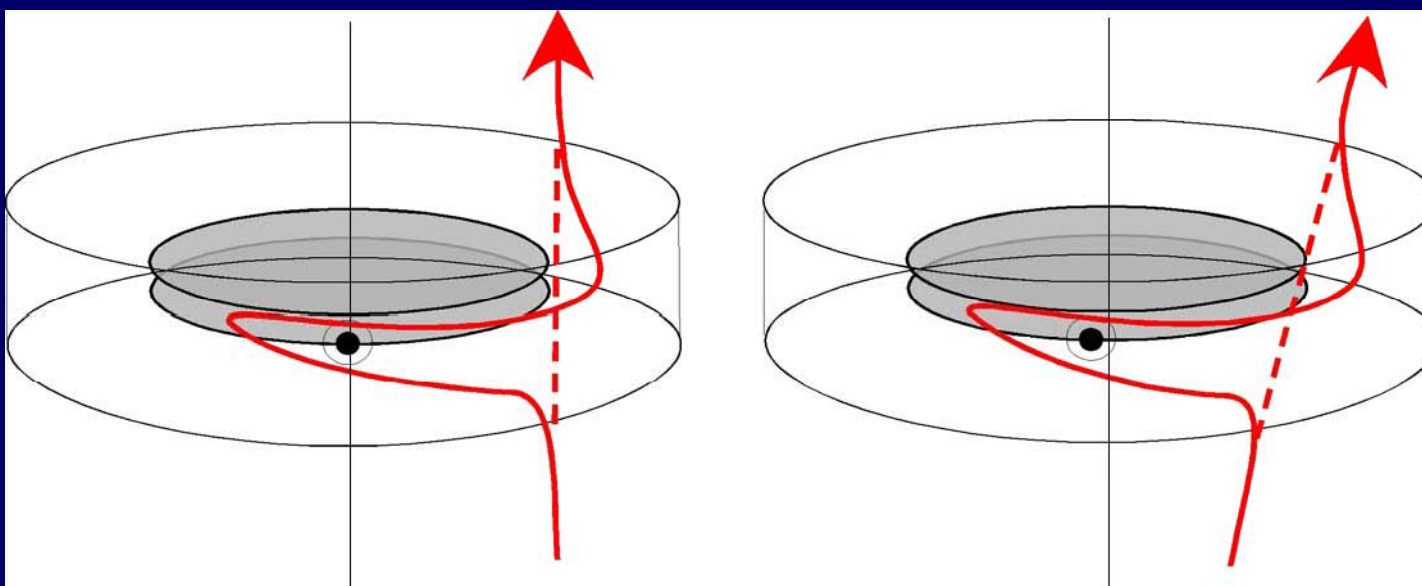


MHD Simulation (Sofue, Machida, Kudoh 2010)

ASS Axy-symmetric Spiral
=> G-Plane Reversal







cf: Jansson et al. 2008,
2012, 2012 :

BSS + Vert. X B

