

# Anisotropy of Solar EIT waves

P. F. Chen

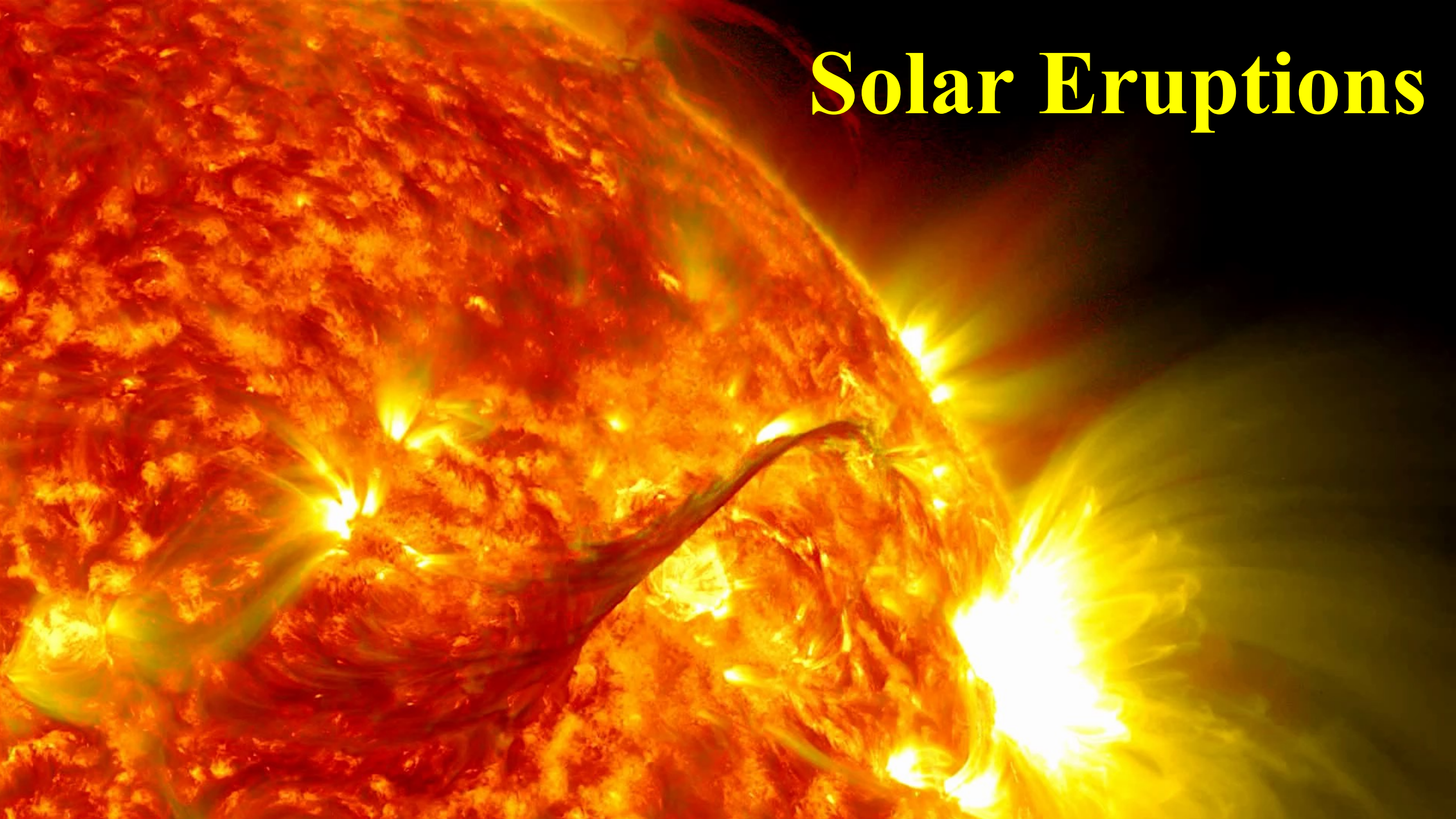


南京大學

NANJING UNIVERSITY



# Solar Eruptions



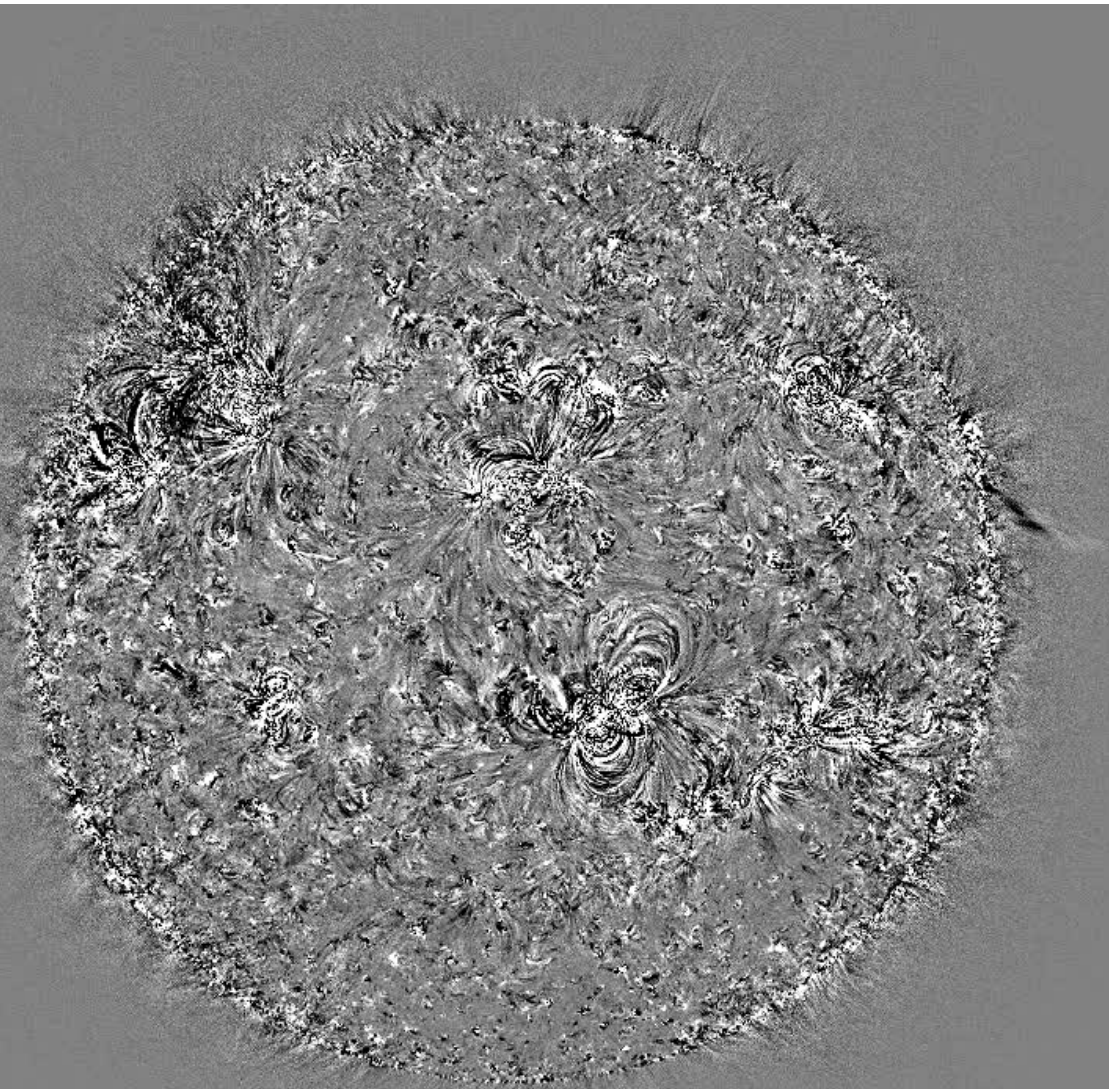
# EIT Waves



**Thompson et al. (1998)**

**$V=250$  km/s**

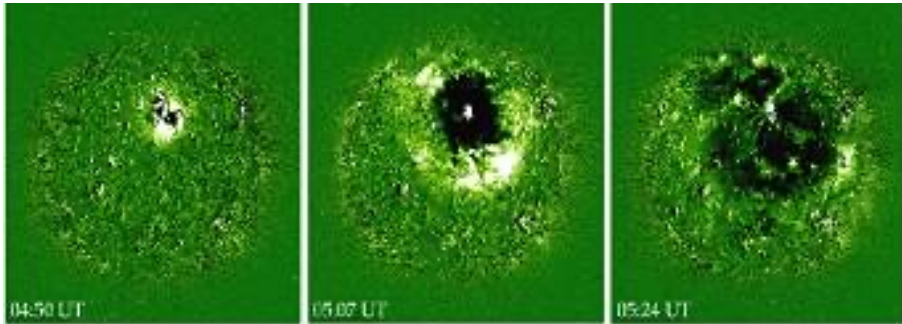
**EIT telescope**



# What Is the Nature?



Fast-mode magnetoacoustic wave



**Thompson et al. (1998)**

**Y.-M. Wang (2000)**

**Wu et al. (2001) Zheng et al. (2002)**

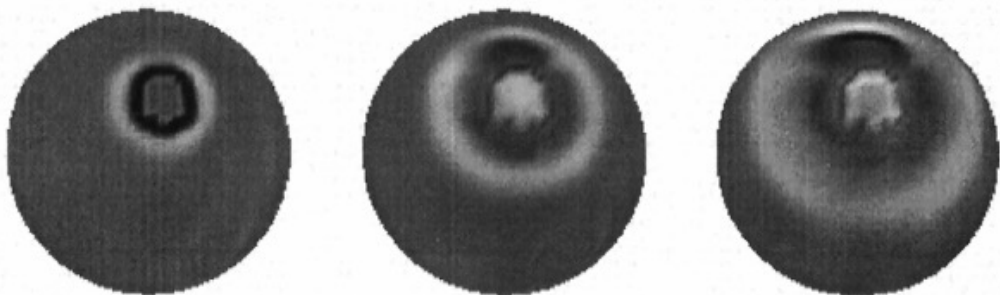
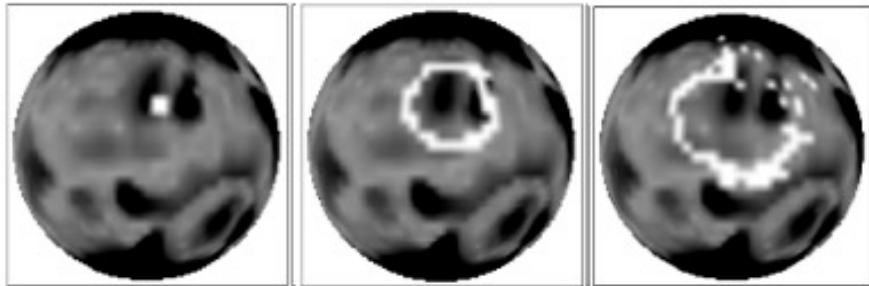
**Ofman (2003) Warmuth & Mann (2005),**

**Grechnev et al. 2008; Pomoell et al. (2008),**

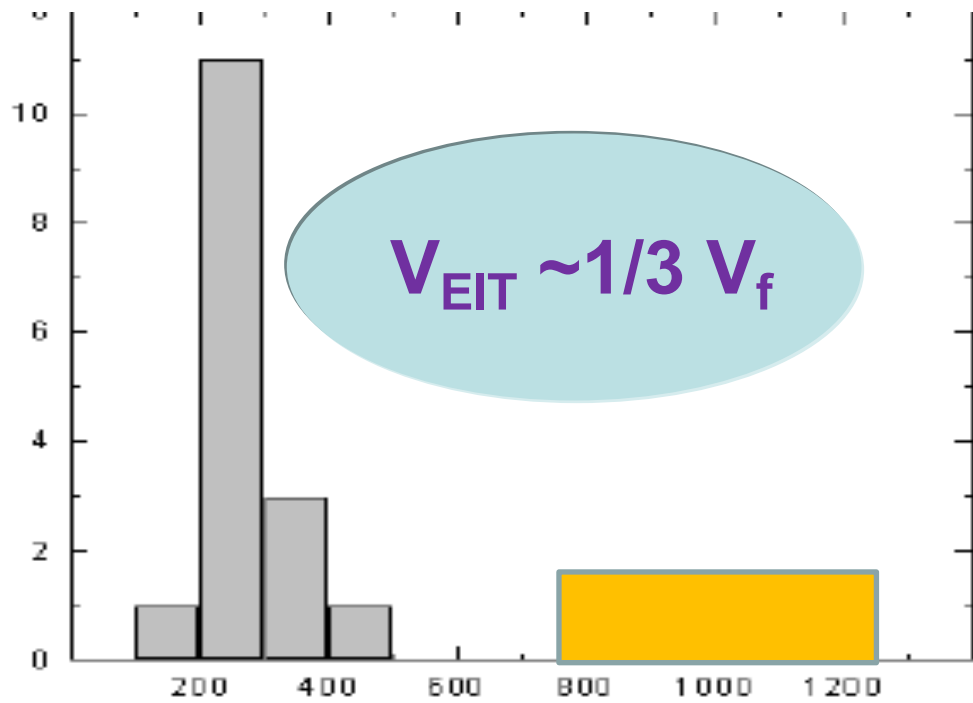
**Veronig et al., (2008), Gopalswamy et al.**

**(2009), Long et al. (2009), Patsourakos et al.,**

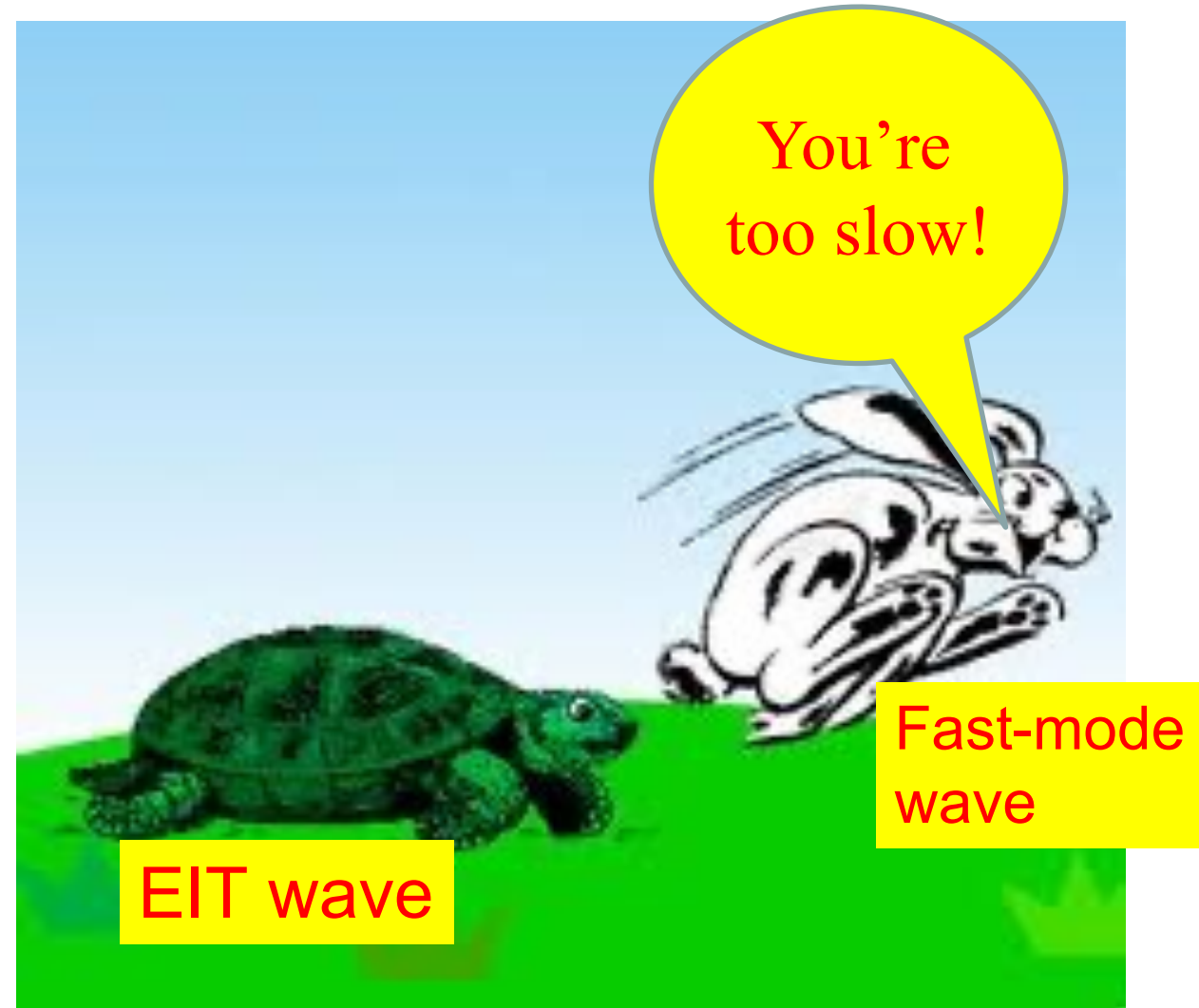
**2009; Kienreich et al. (2009), .....**



# Drawback of Fast-mode Wave Model

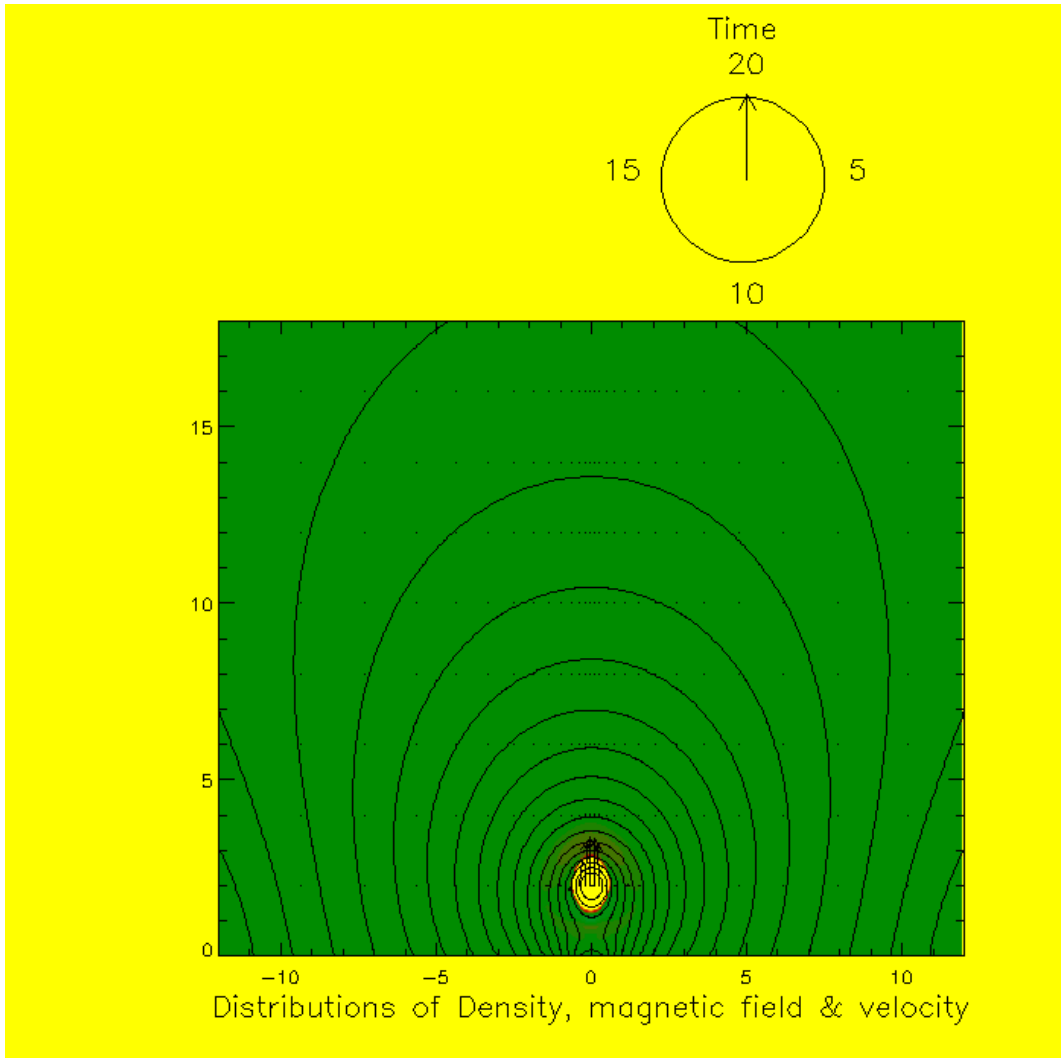


Klassen et al. (2000)  
Zhang, Y. et al. (2011)

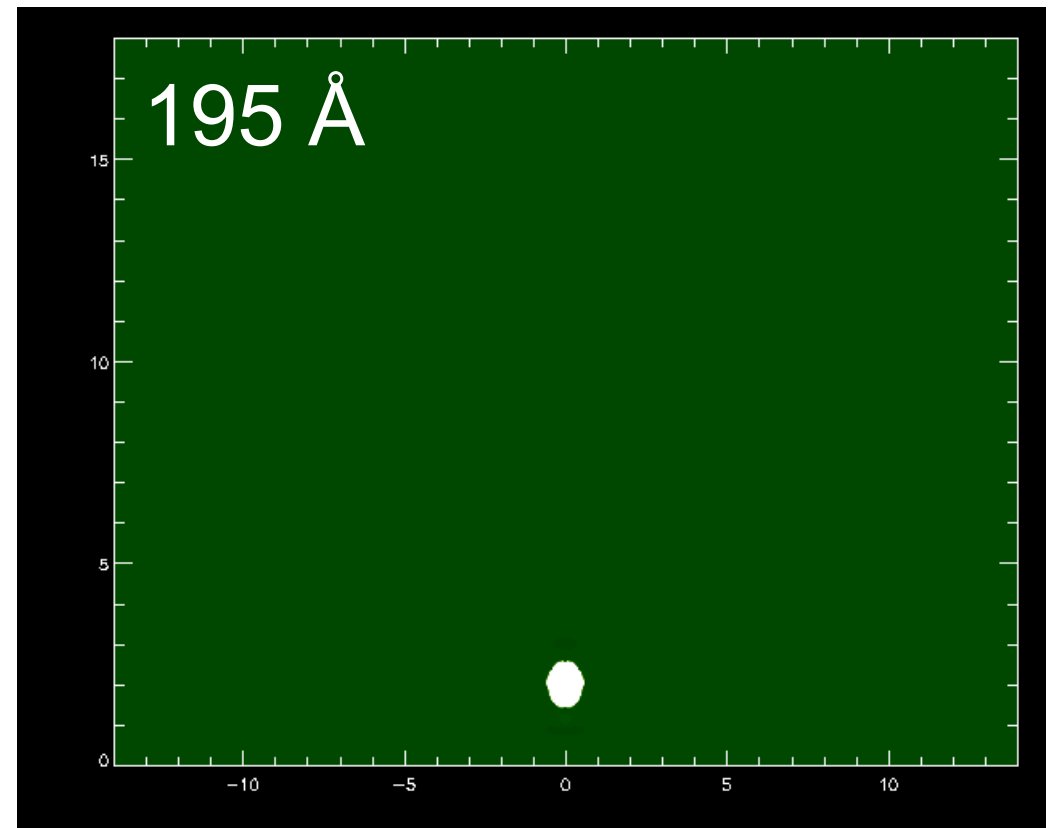


# Our MH Simulation

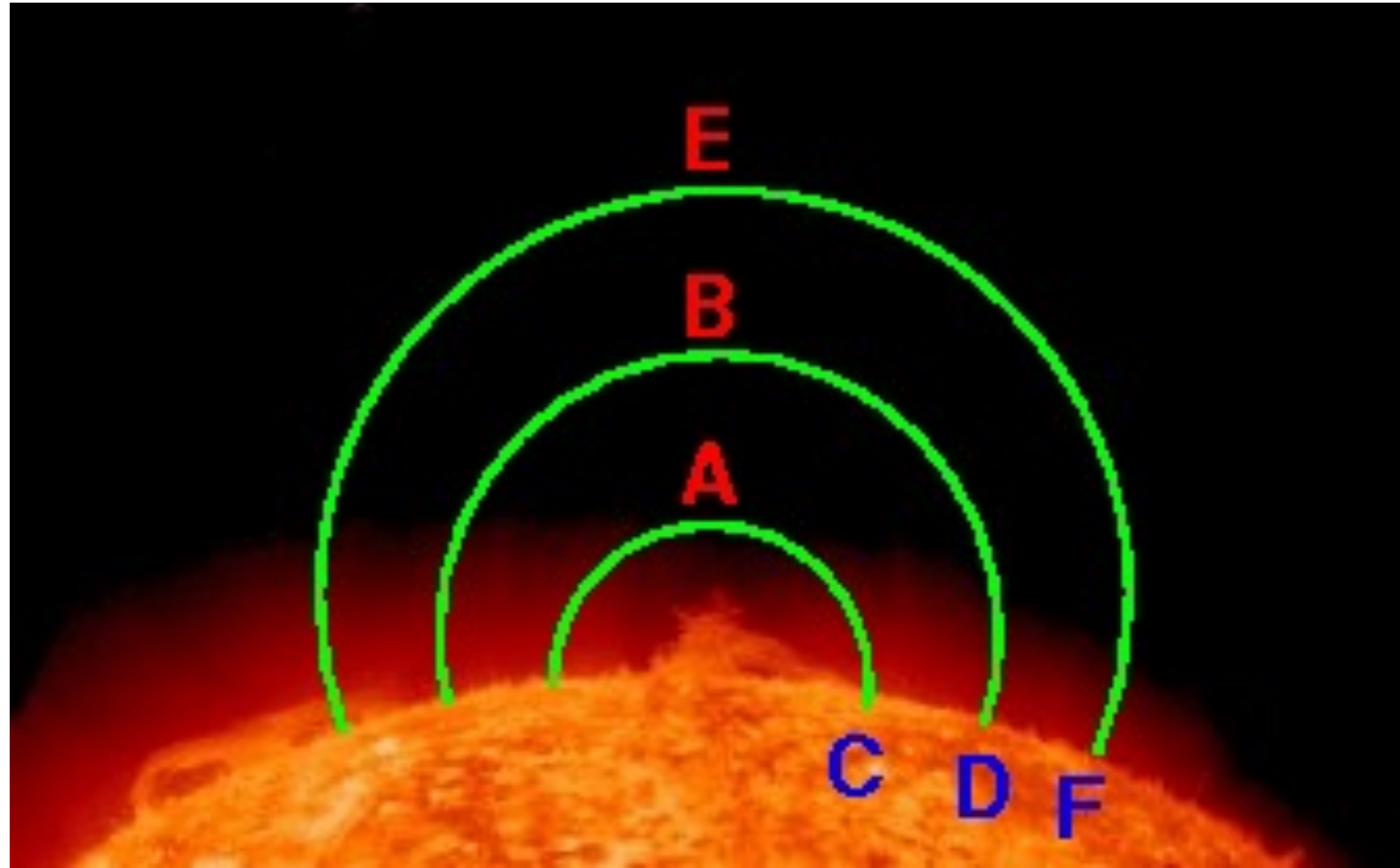
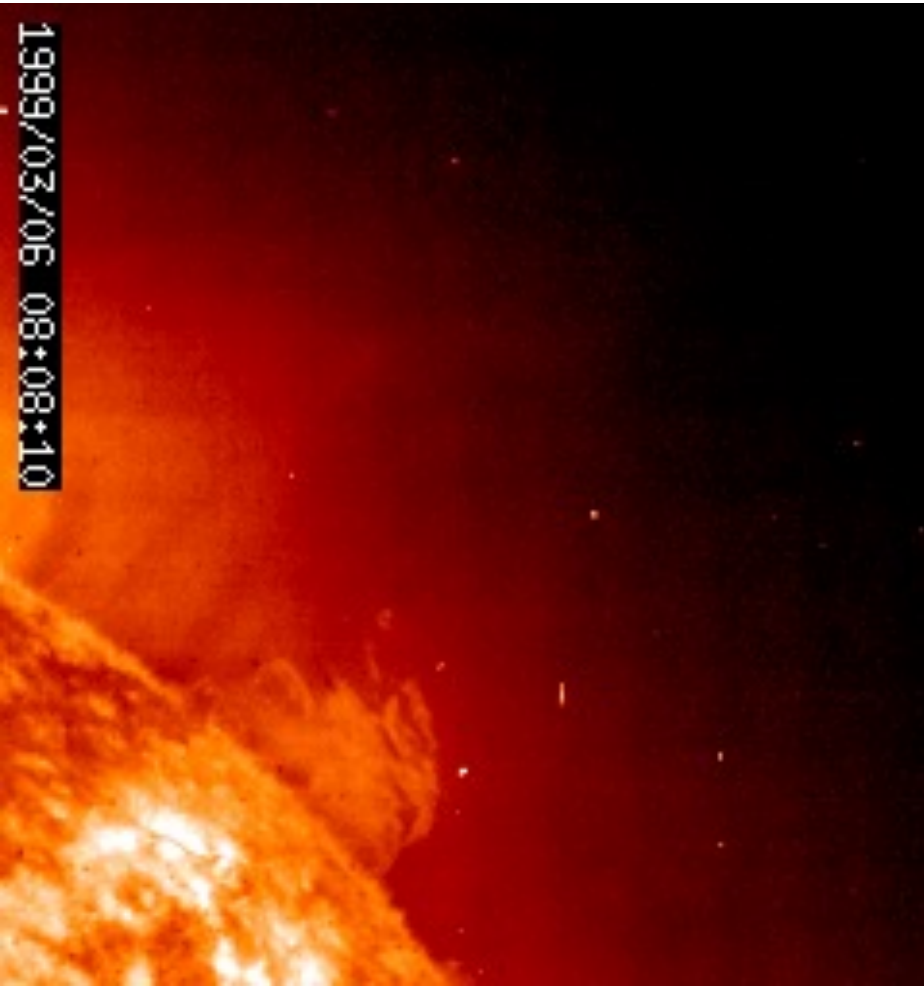
Chen, Wu, Shibata, & Fang (2002); Chen, Fang, & Shibata (2005)



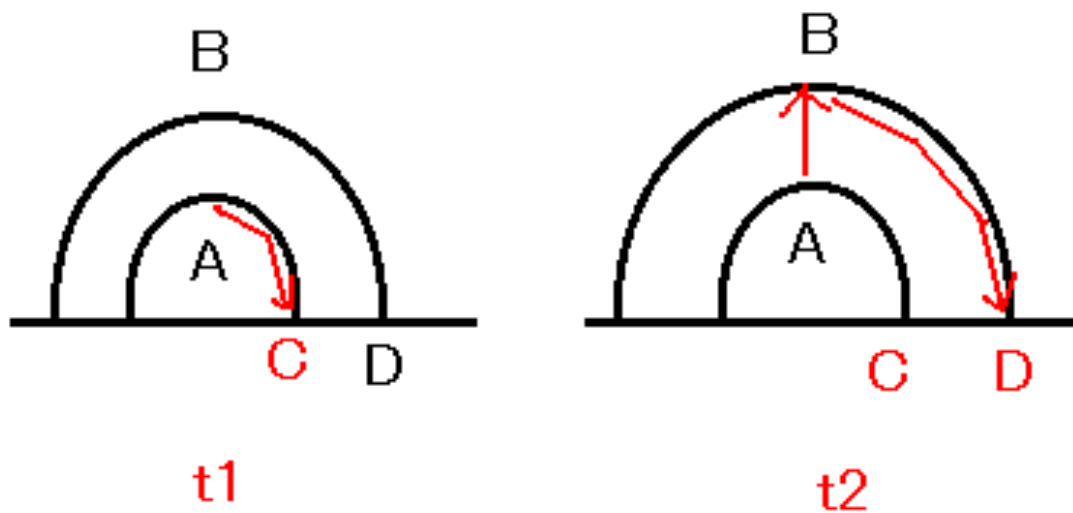
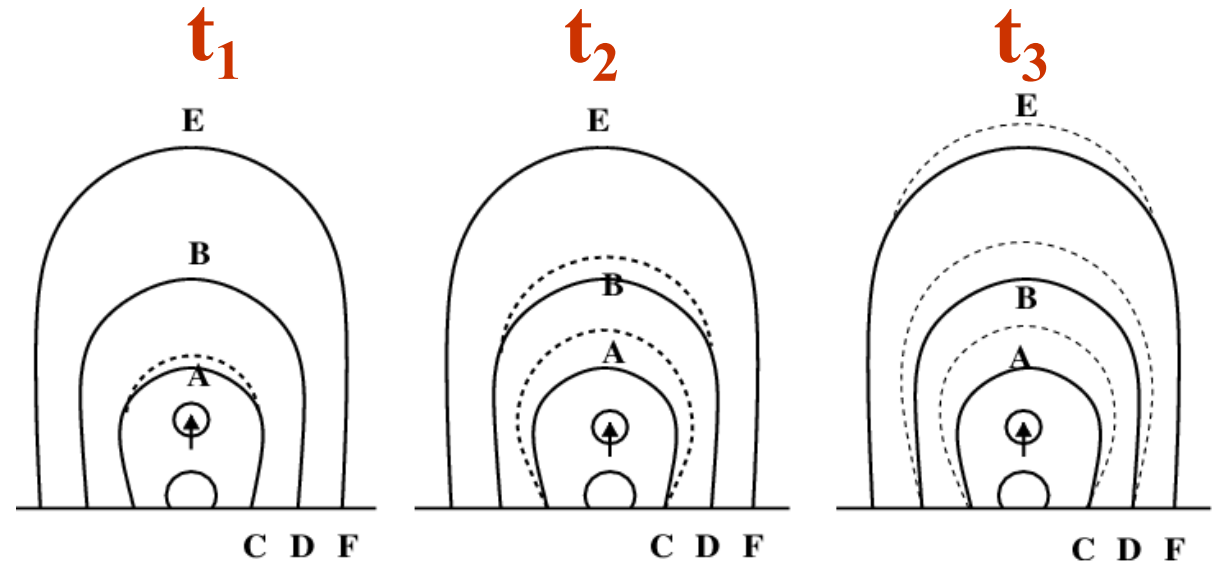
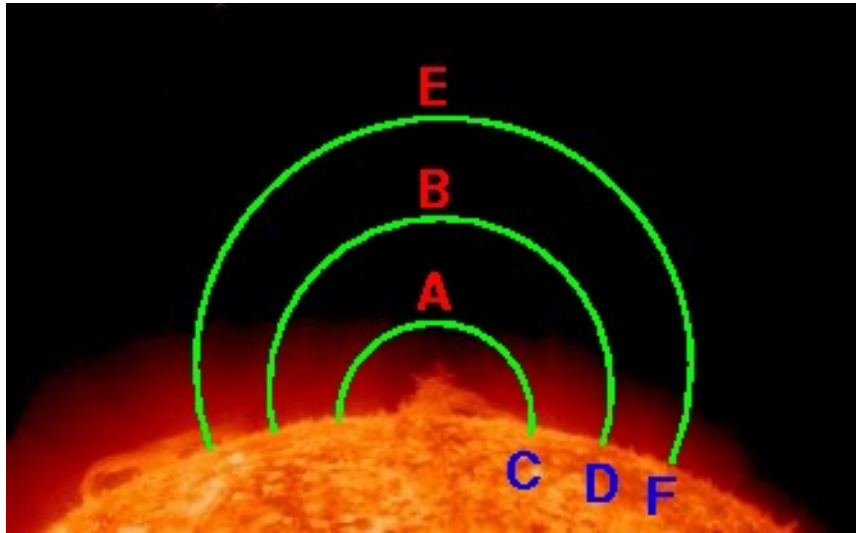
Fast-mode wave 775 km/s  
EIT wave 250 km/s



# Our Field-line Stretching Model



# Our Field-line Stretching Model

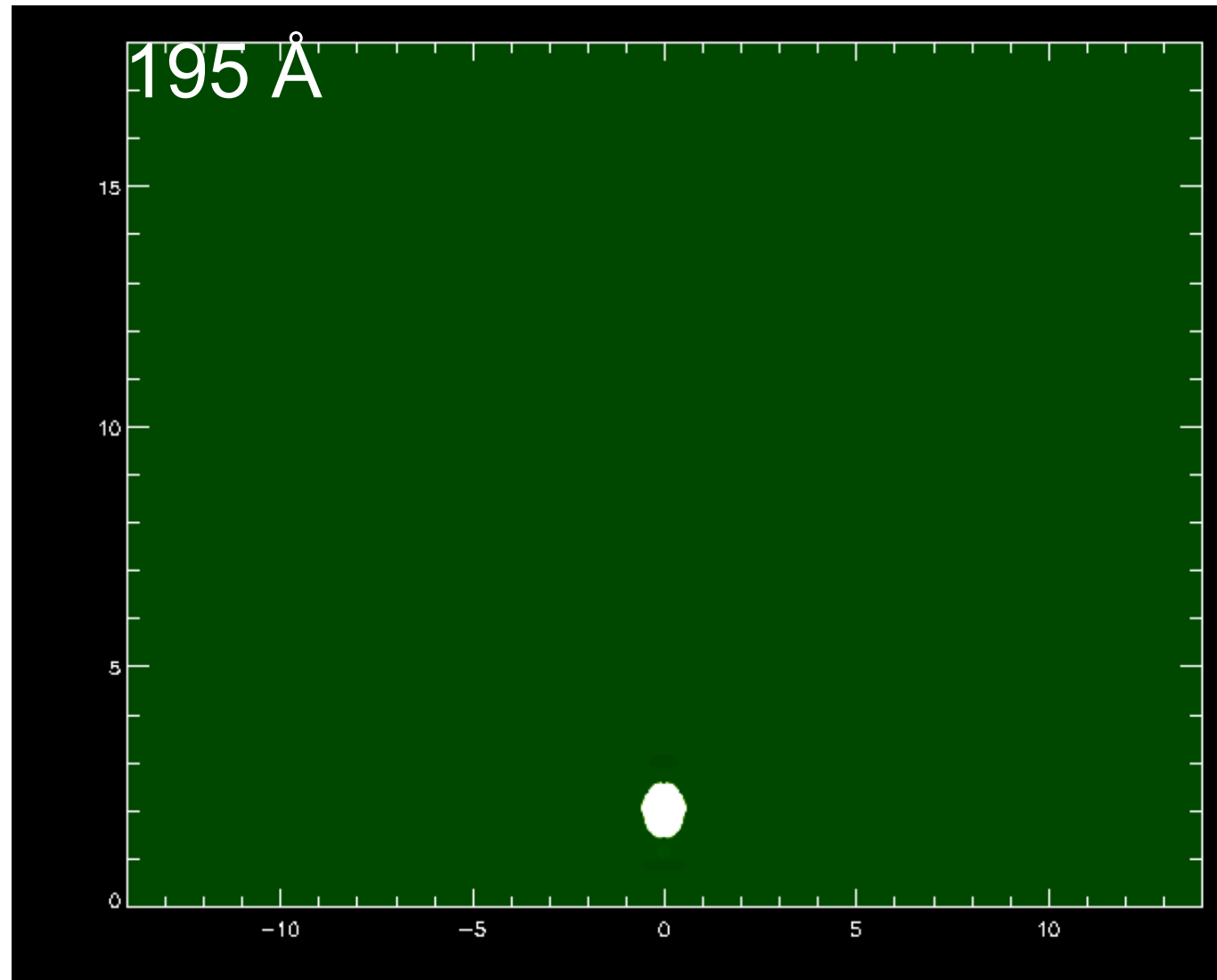


$$\Delta t = \left( \frac{AB}{v_f} + \frac{BD}{v_A} \right) - \frac{AC}{v_A}$$

$$V_{EIT} = \frac{CD}{\Delta t} = \left( \frac{1}{v_f} + \frac{\pi}{2v_A} \right)^{-1} \approx 0.34v_f$$

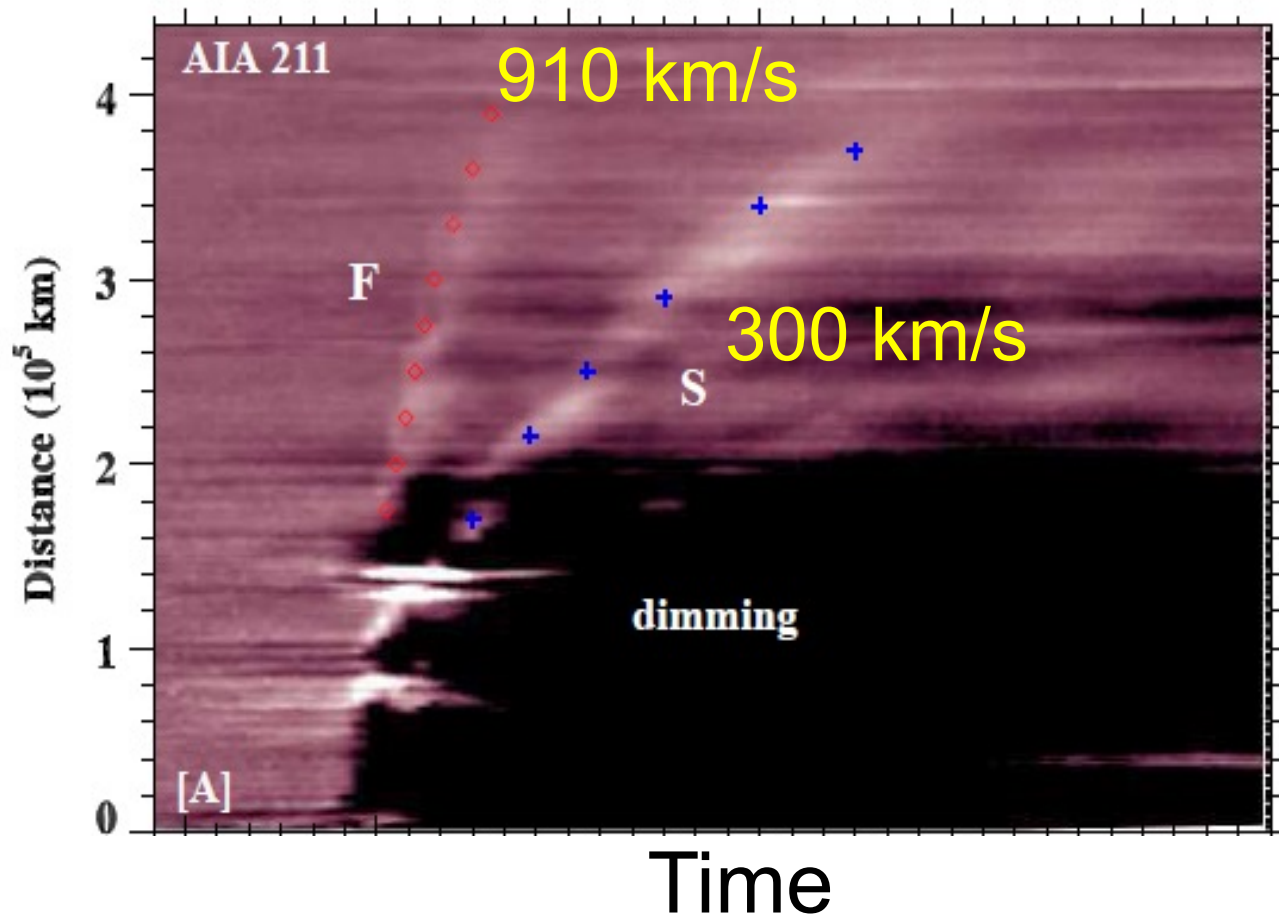
# Our Prediction of Two Waves

Chen, Wu, Shibata, & Fang (2002); Chen, Fang, & Shibata (2005)

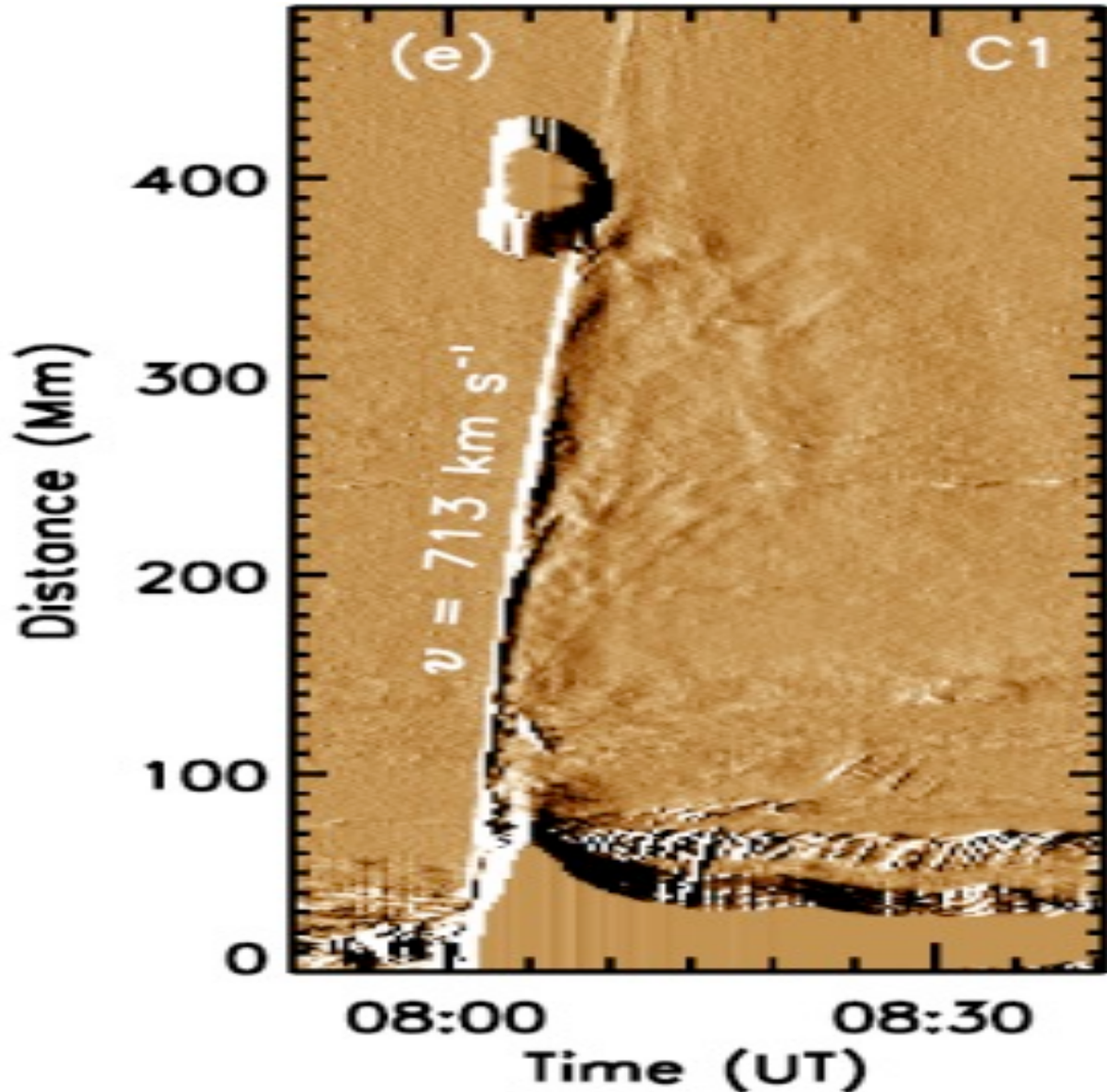
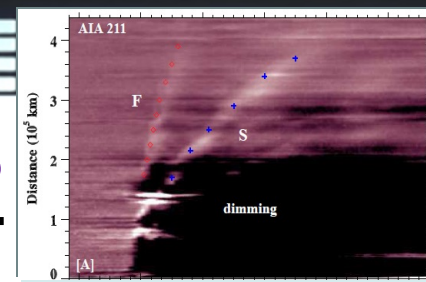


# Confirmation

Harra & Sterling (2003), Chen & Wu (2011), Asai et al. (2012), Cheng et al. (2012), Shen et al. (2012, 2013), Kumar et al. (2013), Chandra et al. (2018) .....

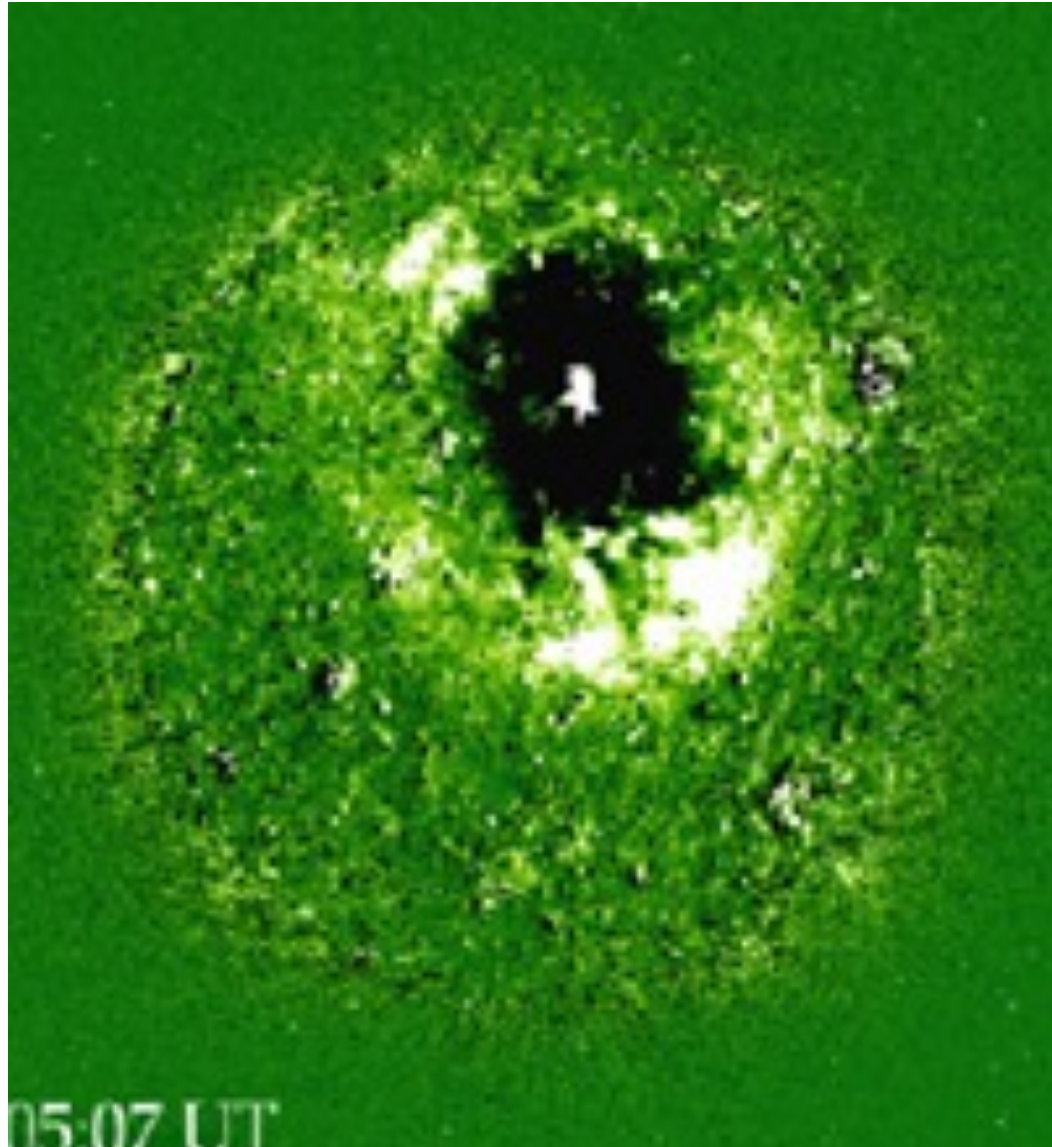


# Why EIT Wave Is Absent in Some Events



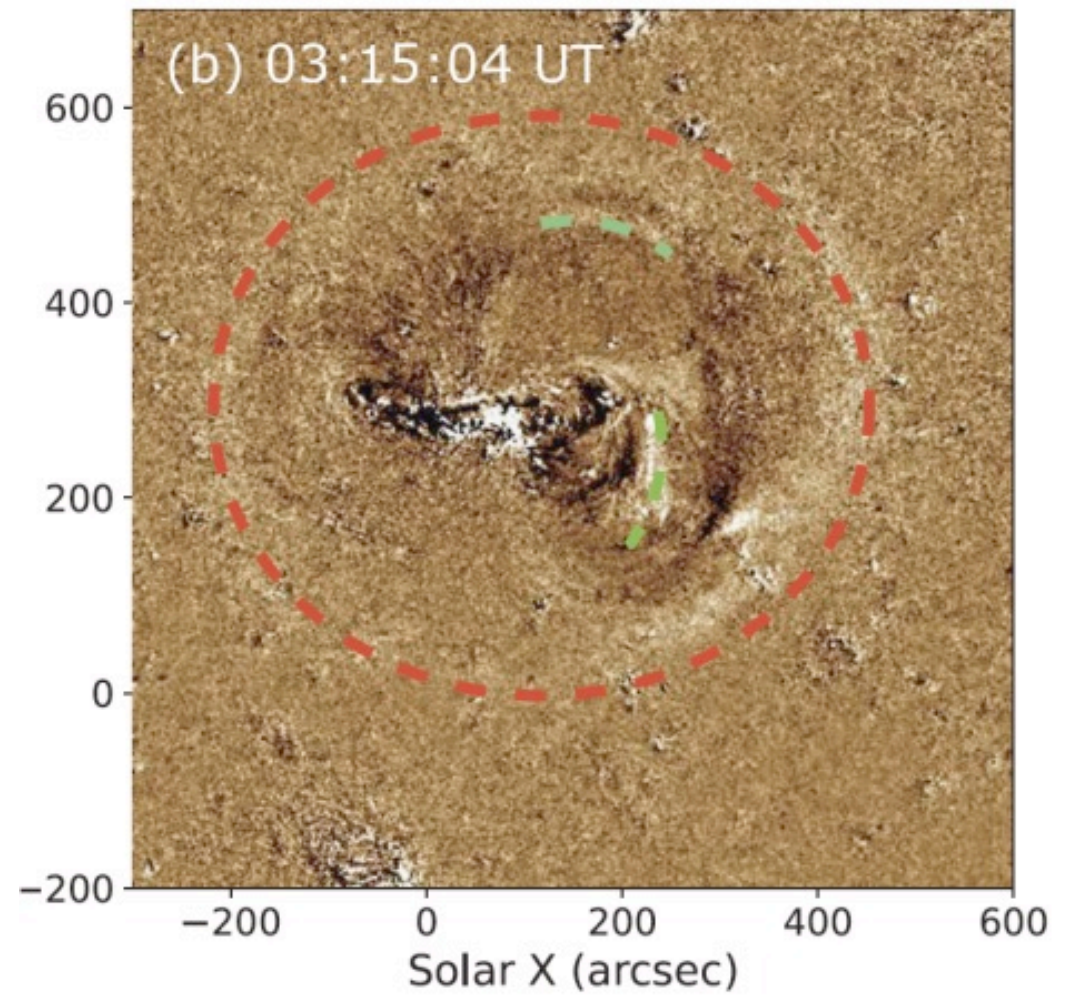
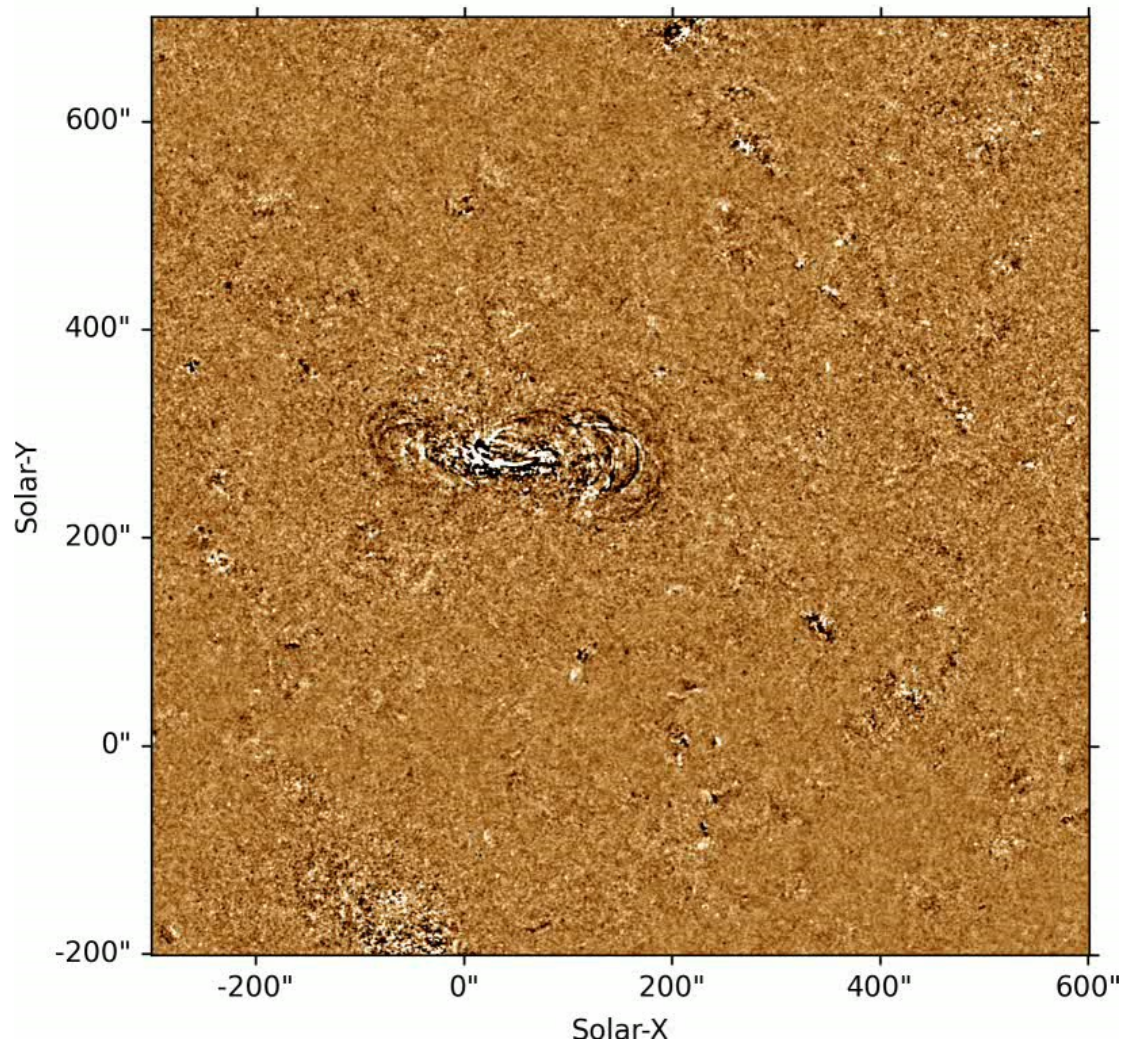
Shen & Liu (2012)  
Hou, Z. Y. + (2022)  
Wang, C. + (2022)

# Why Always Anisotropic?



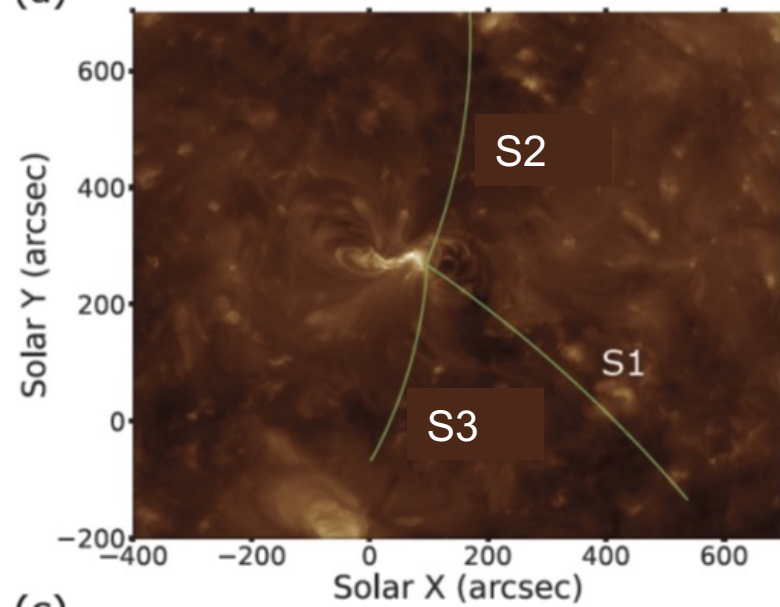
# Observations

Time: 2019-03-08T03:05:16.843

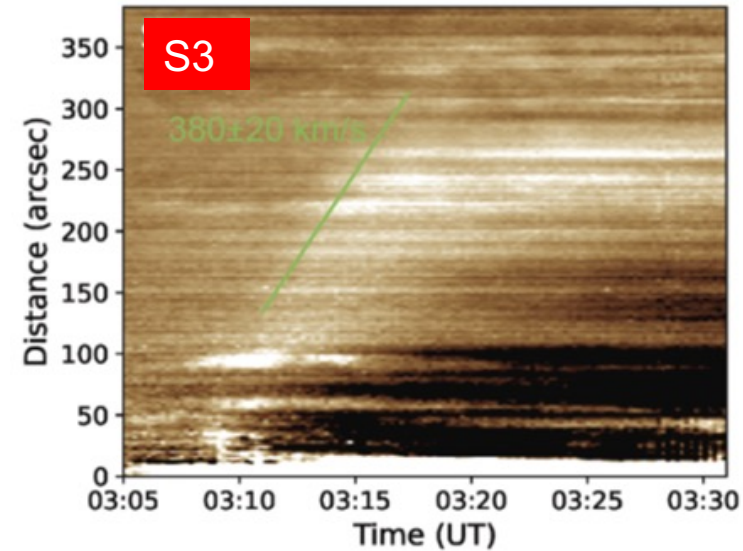
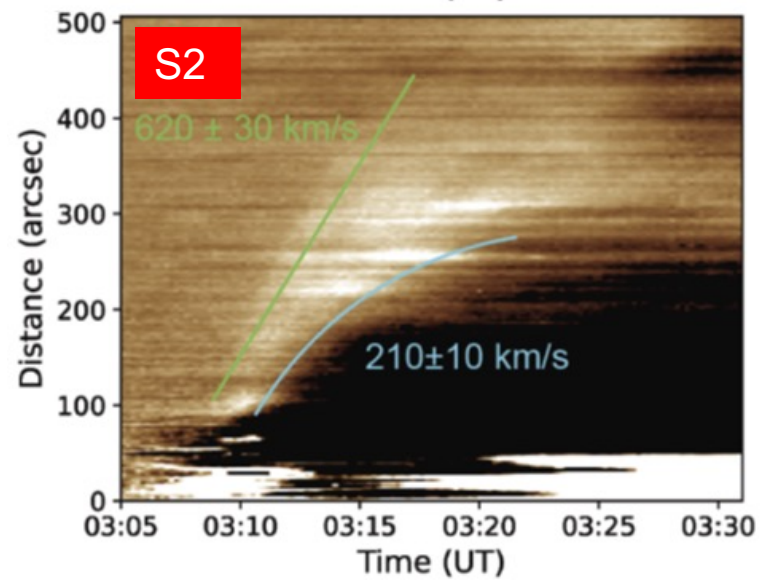
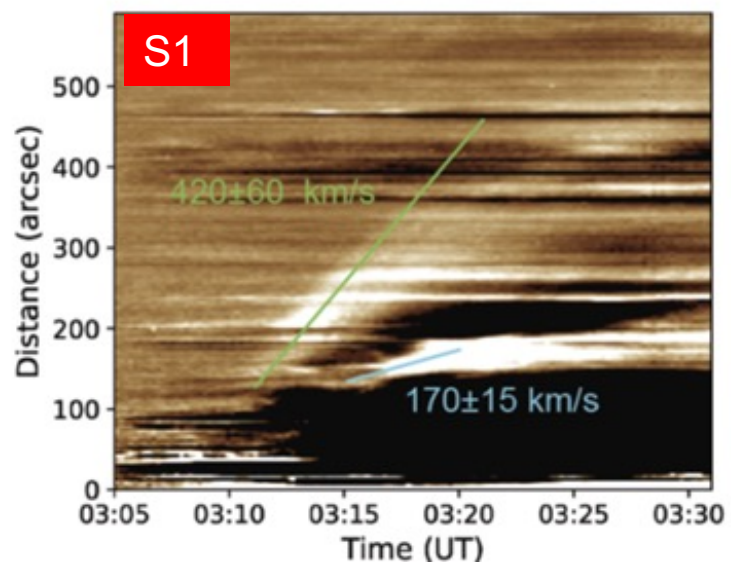




(a)

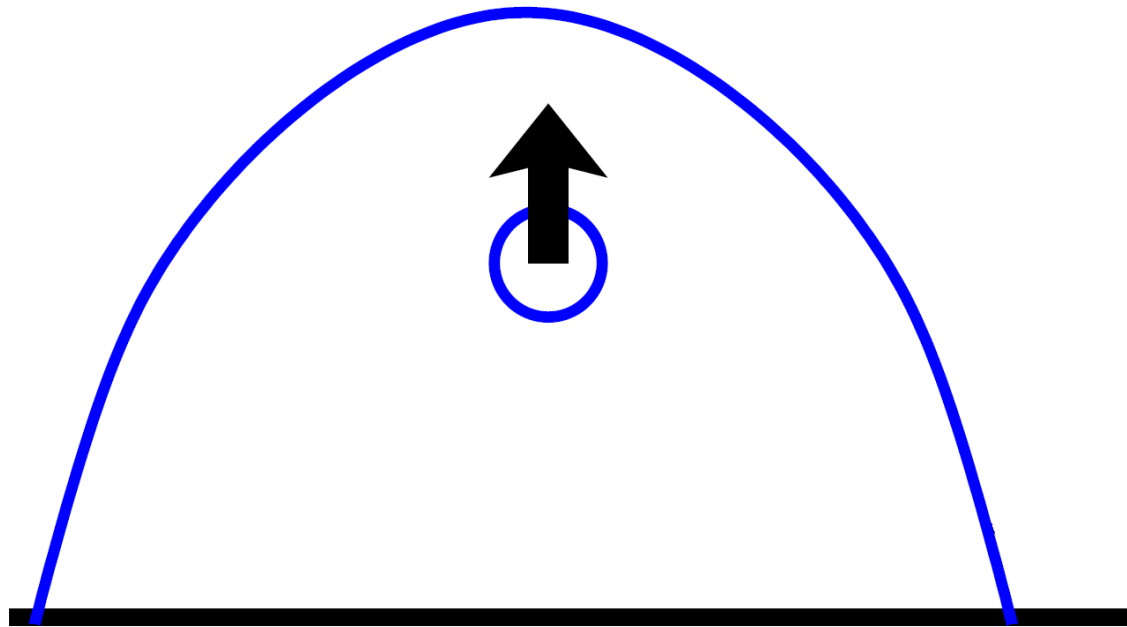


(b)



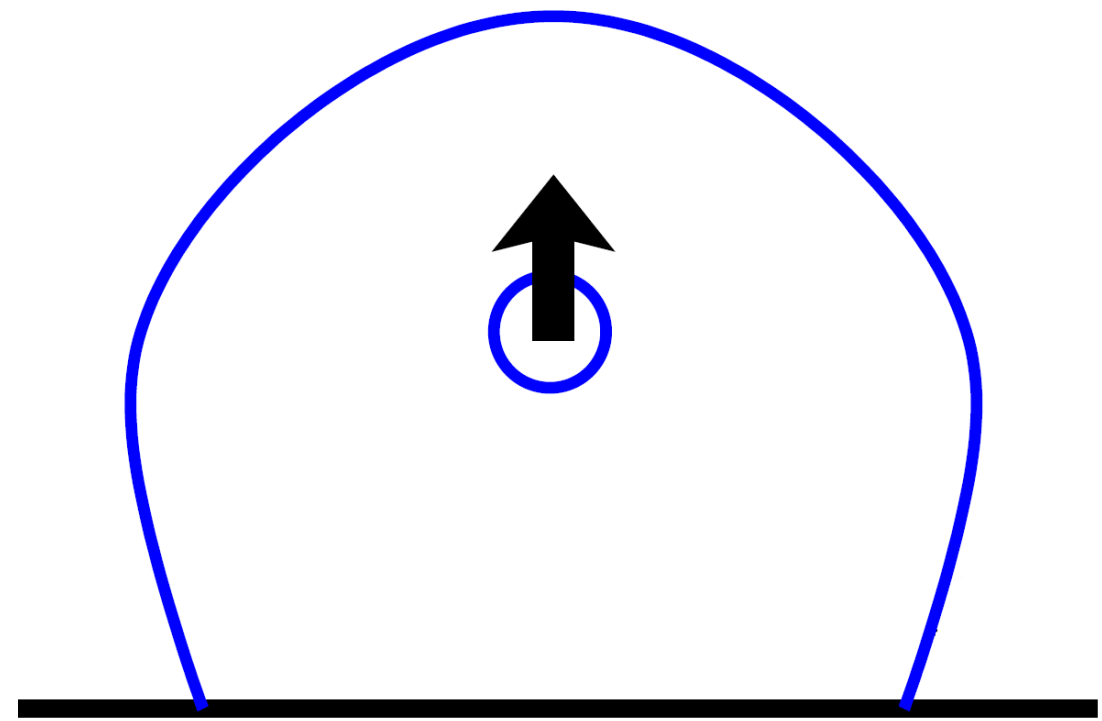


**Backward-inclined**



Solar surface

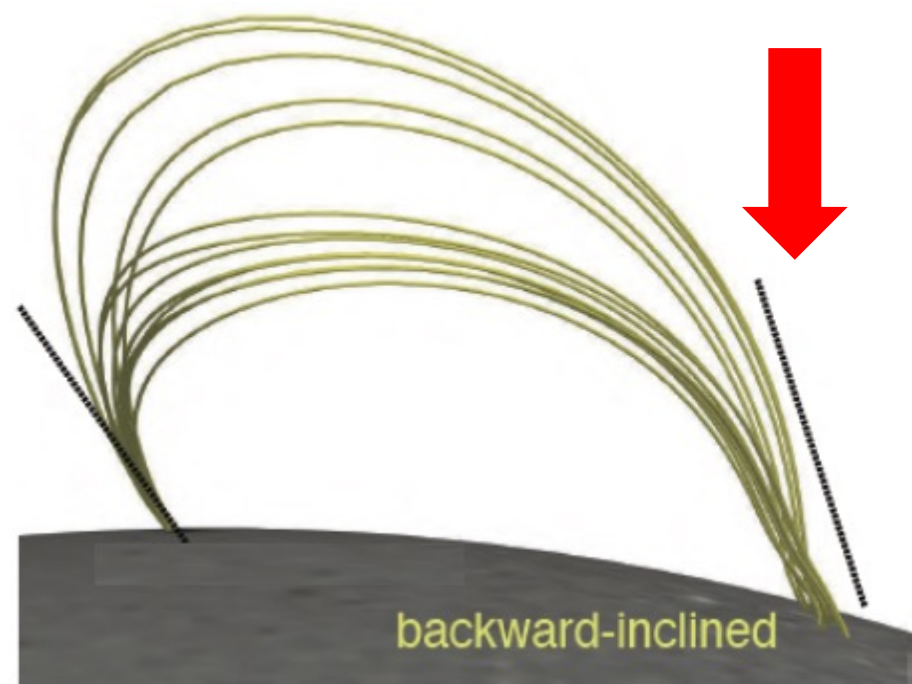
**Forward-inclined**



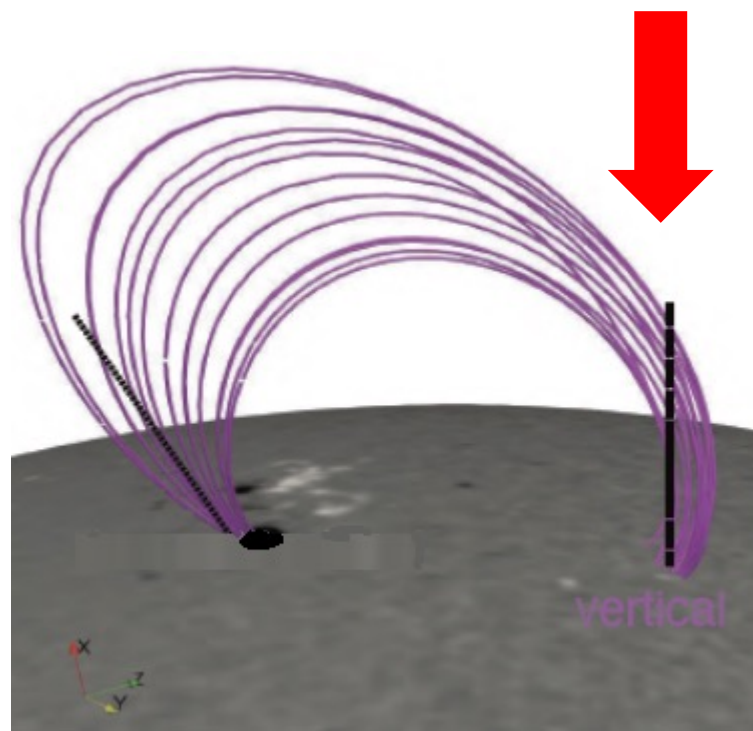
Solar surface

# Brightness of EIT Waves

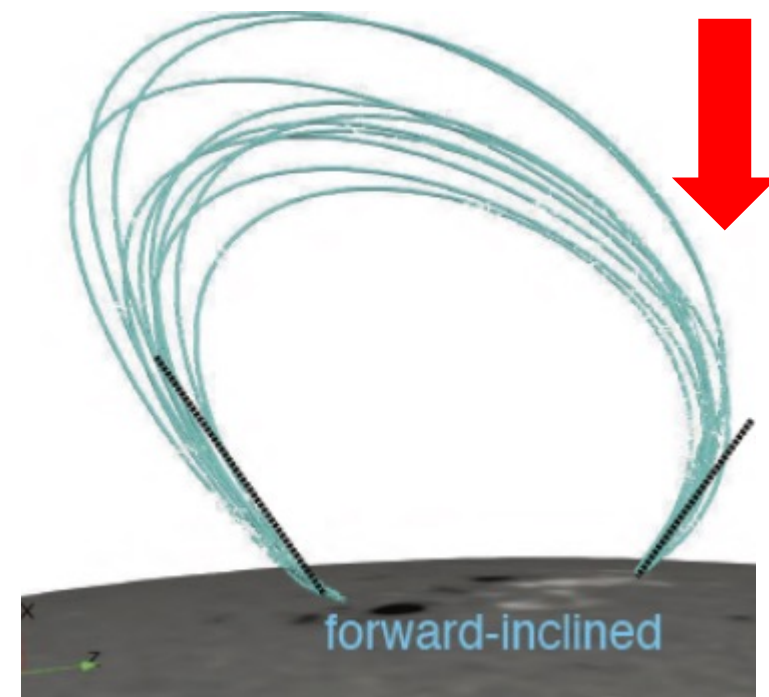
Strong



Medium

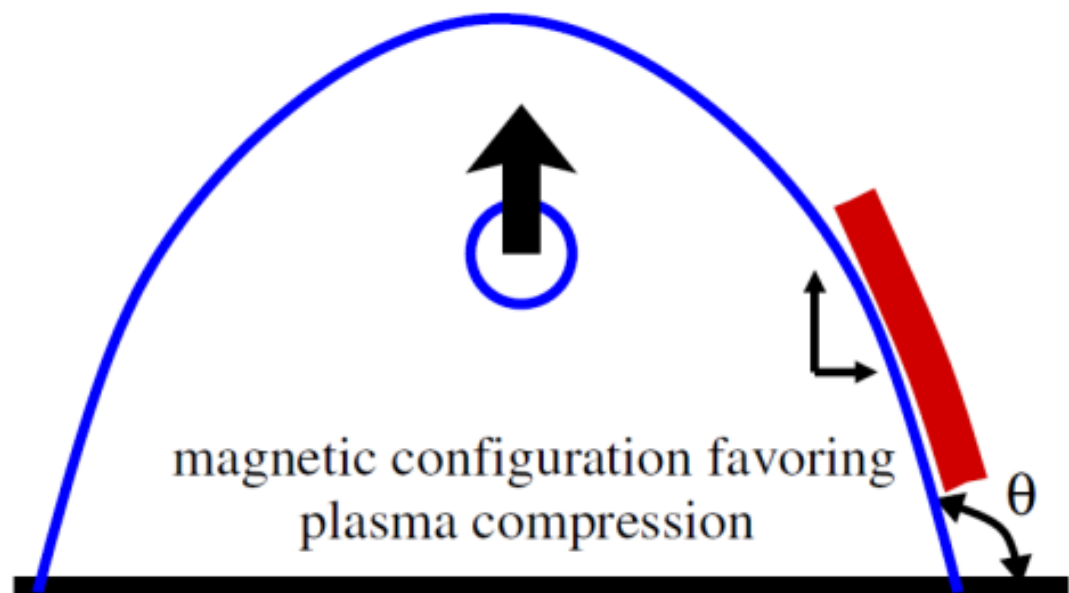


Weak

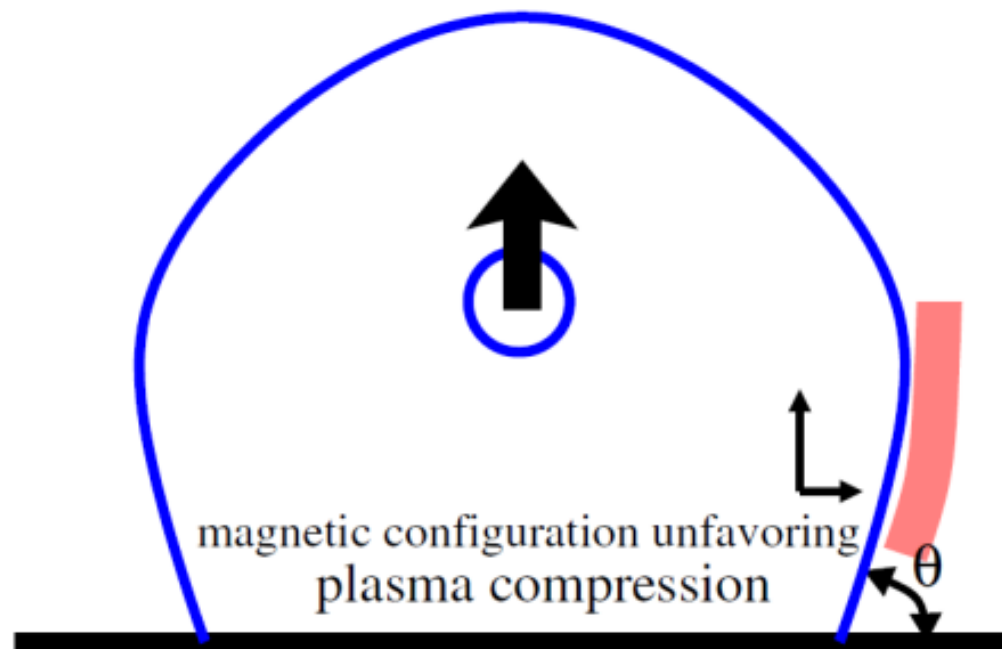




## Backward-inclined

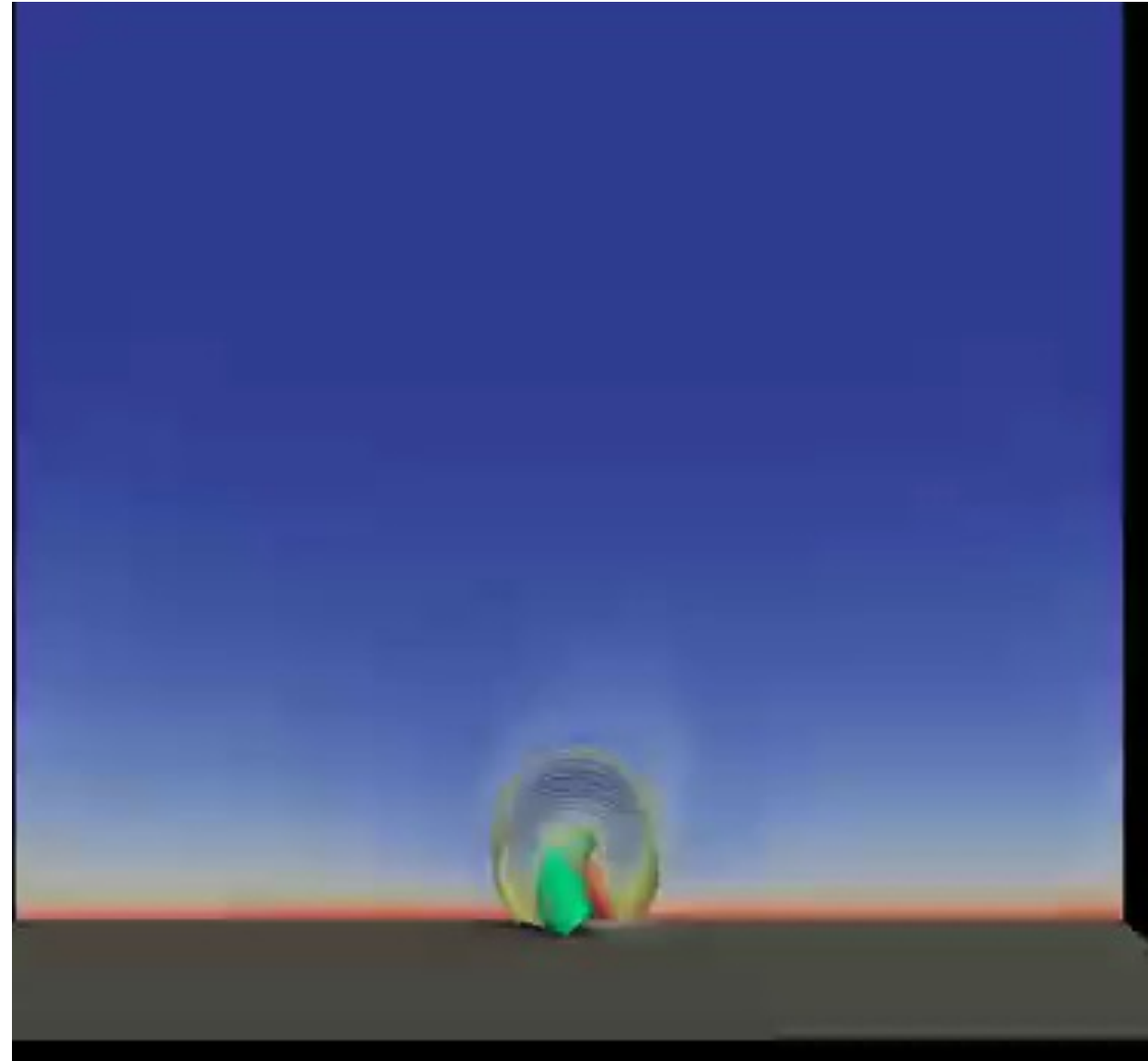
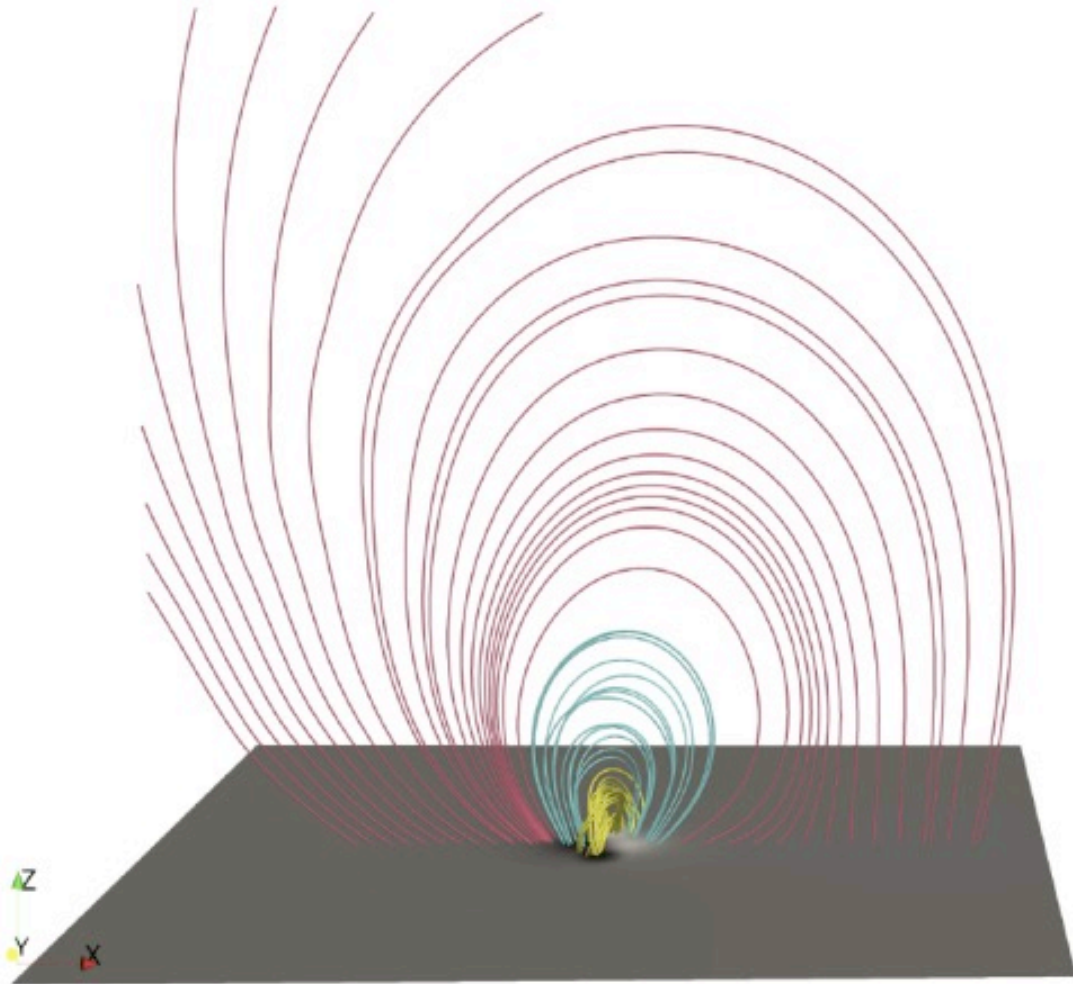


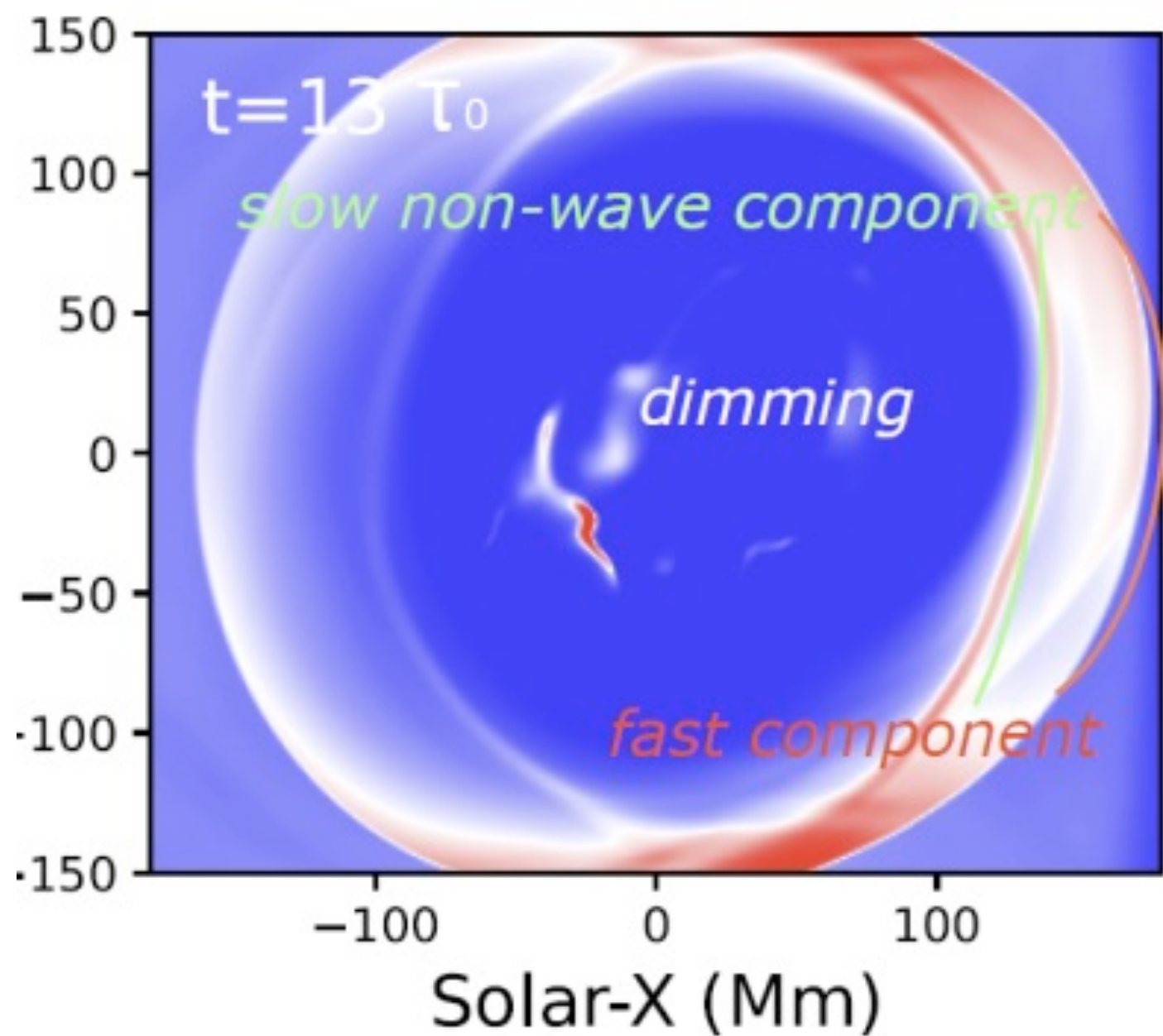
## Forward-inclined



# MHD Simulation

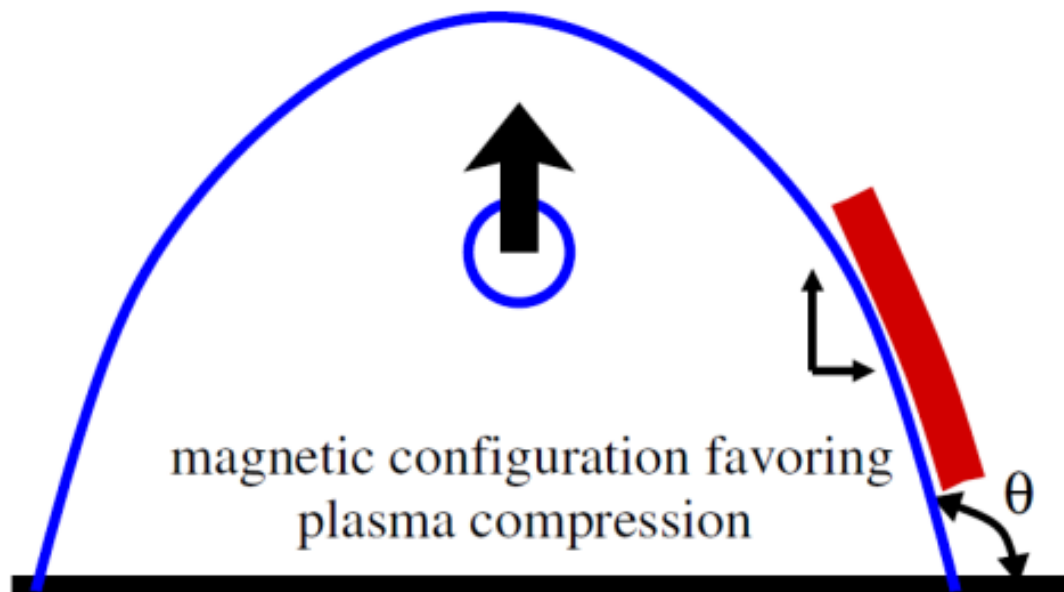
MPI-AMRVAC code (Keppens et al. 2023)



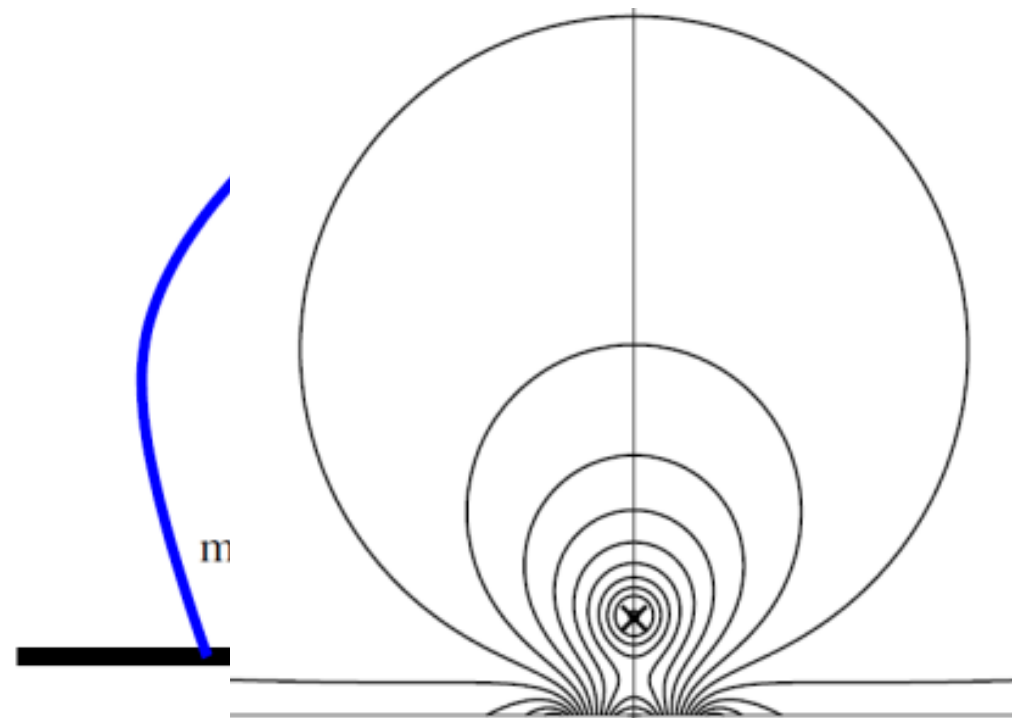




## Backward-inclined



## Forward-inclined



Y. W. Li et al. (2025, A&A, 698, A316)



Thanks!

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## References

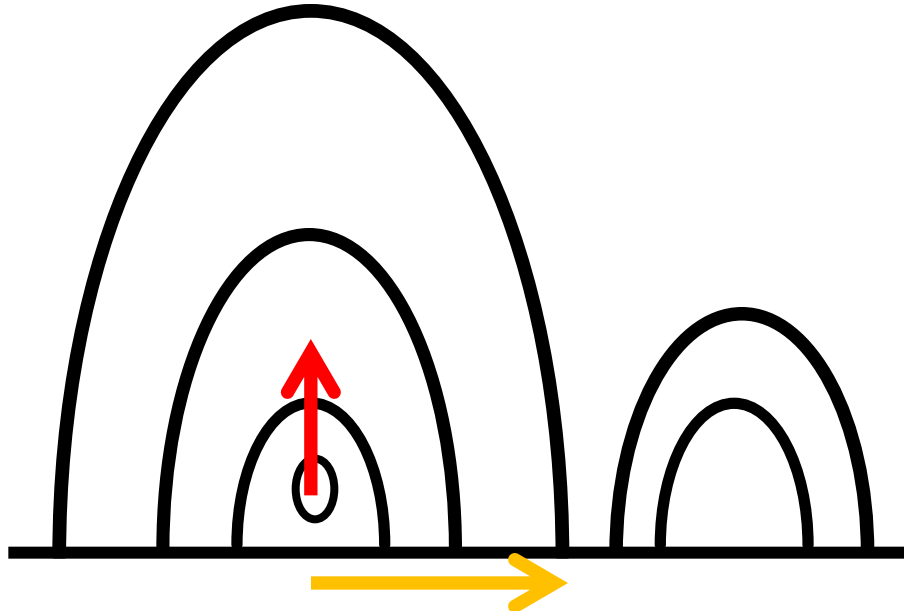
陈鹏飞, 2023, 地球与行星物理论评, 54, 355

Chen, P. F. 2016, GMS, 216, 381

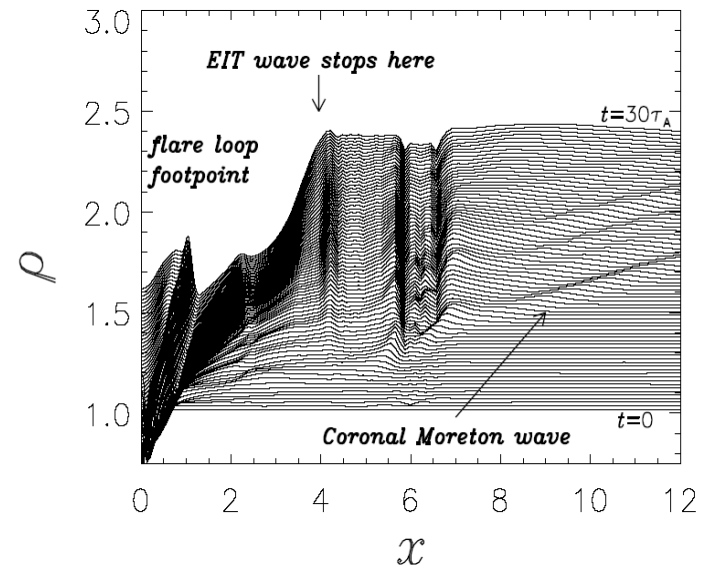
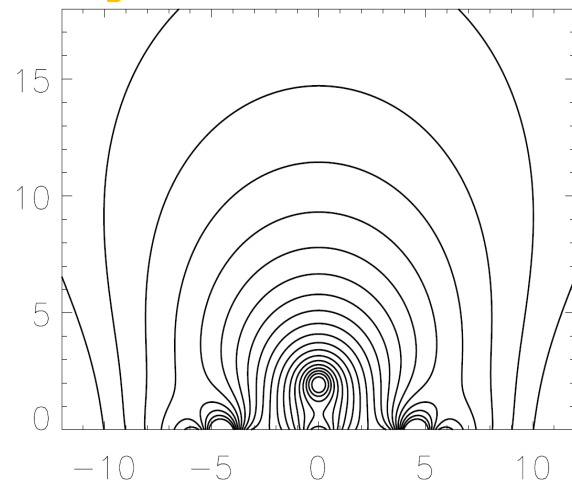
Warmuth et al. 2015, LRSP, 12, 3



# Why EIT Wave Stops near Magnetic Separatrix



**Chen, Fang, & Shibata (2005)**



**If the B Field is elongated,**

