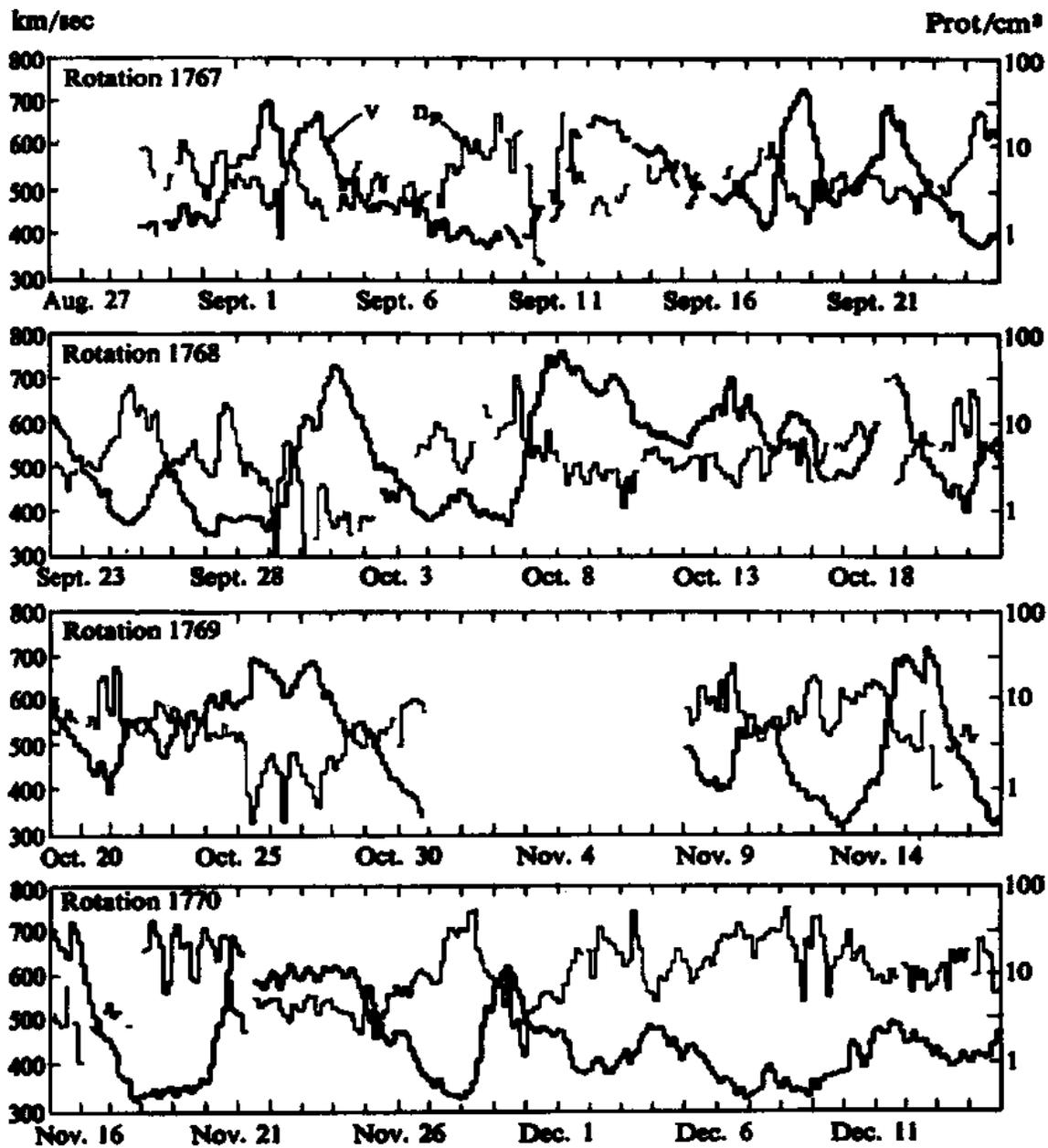


The Slow Solar Wind

M. Neugebauer
University of Arizona



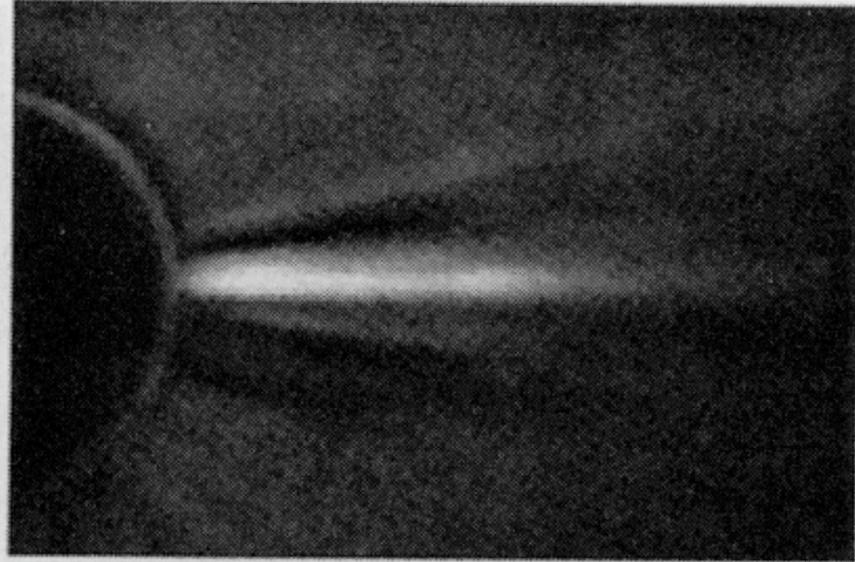
Lasco image

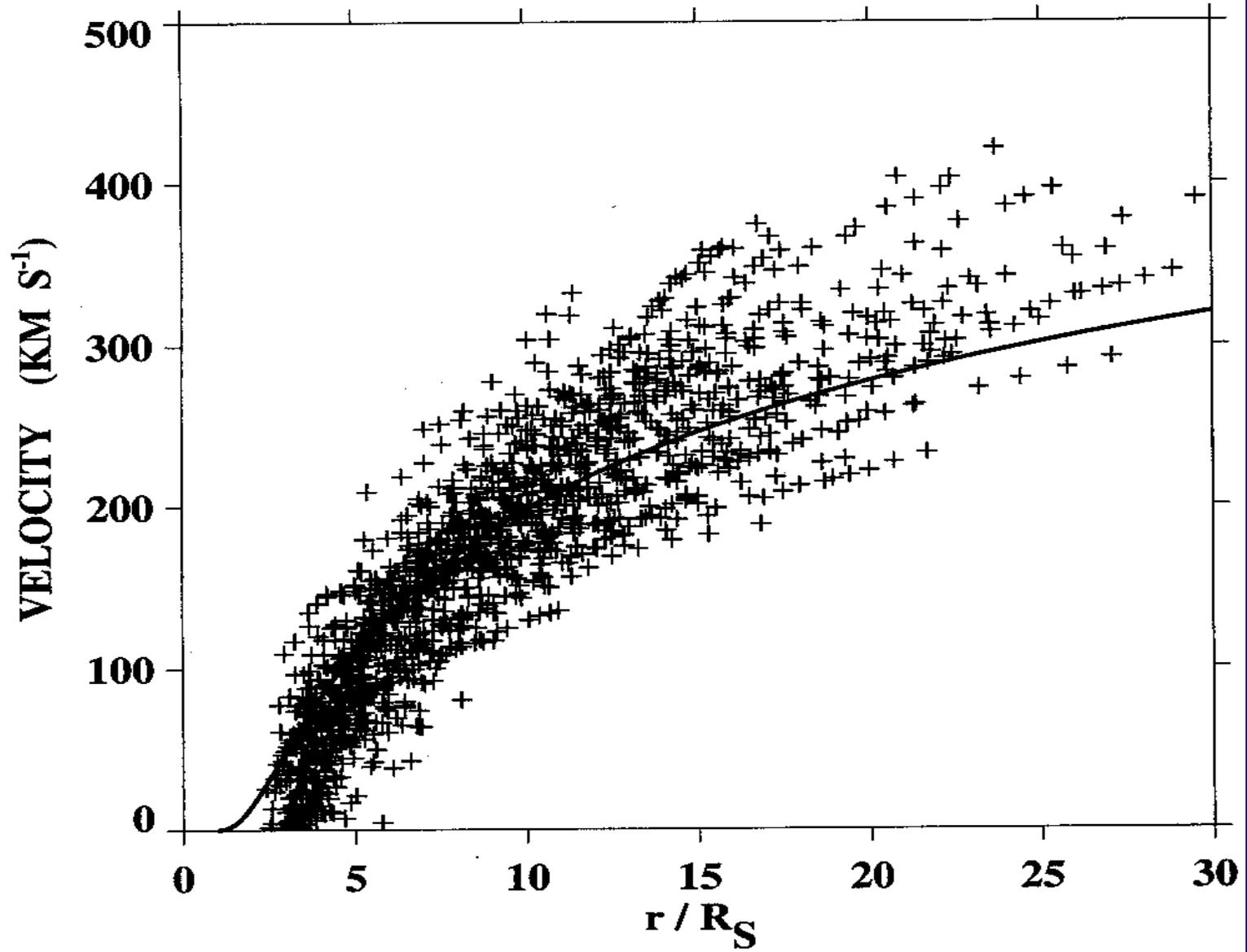
Difference
image

08:45 - 07:40

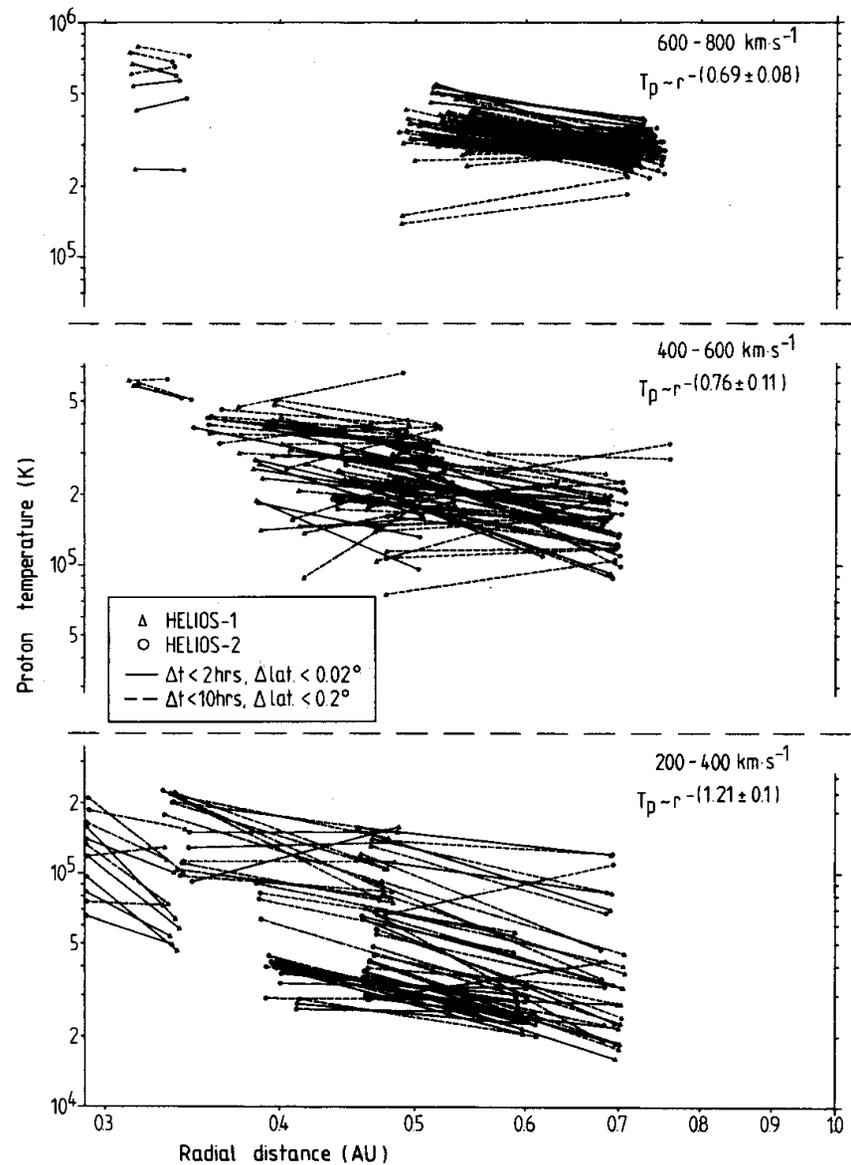
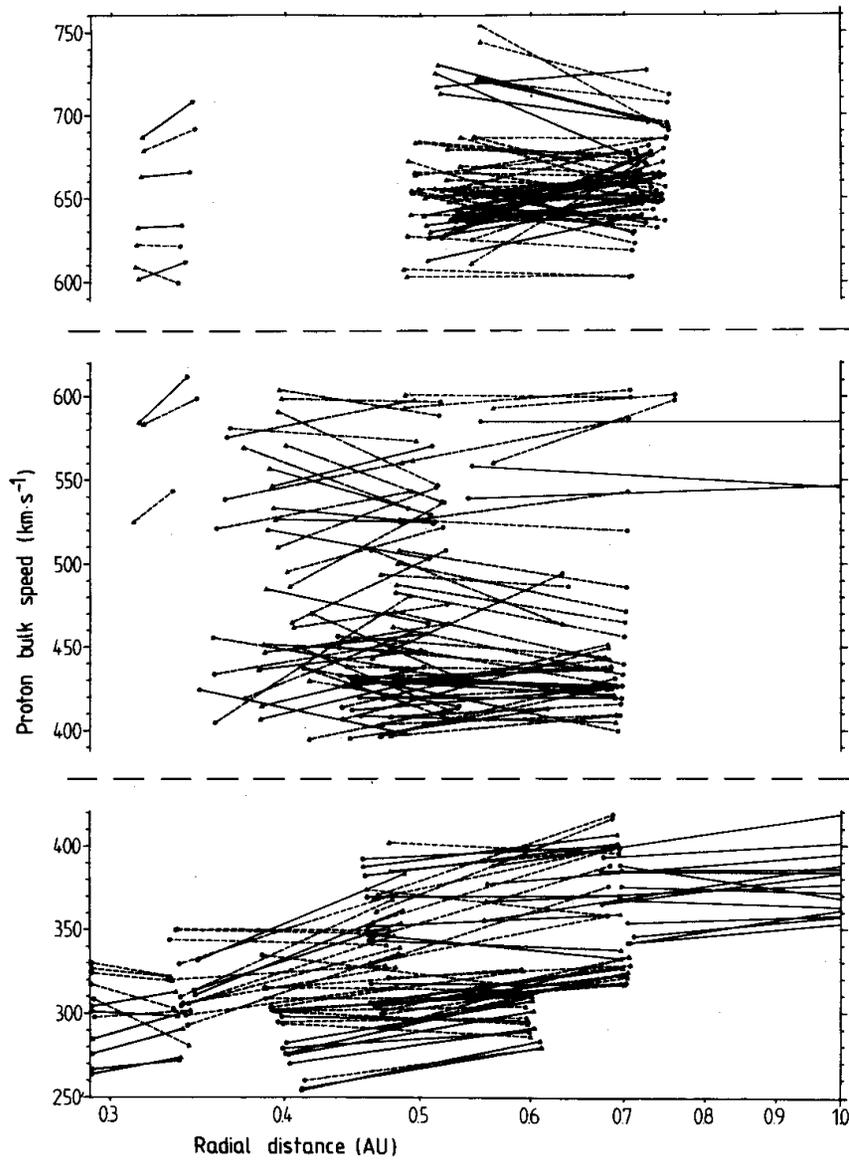


08:45



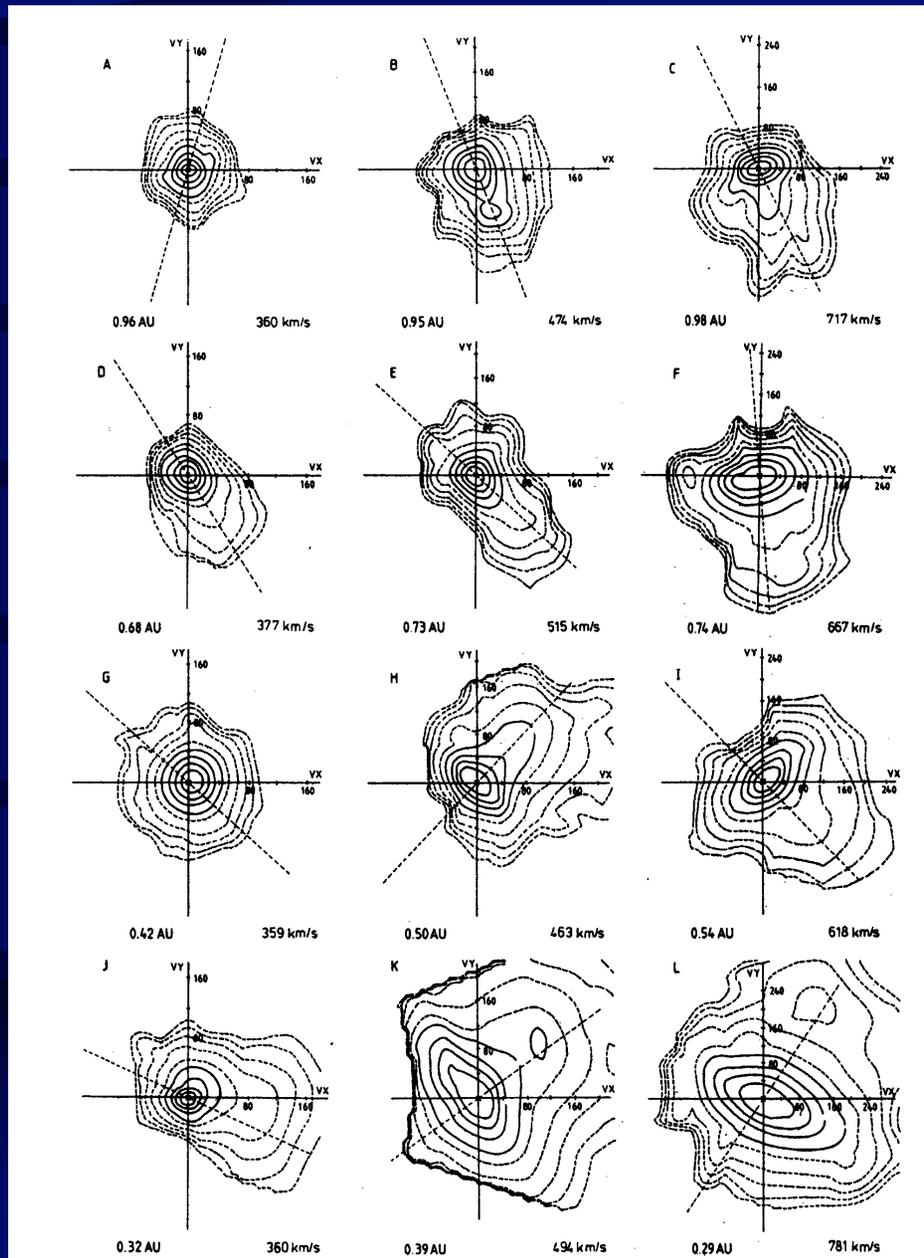


Speed of LASCO blobs along edge-on streamers



Alignments of Helios 1 and 2

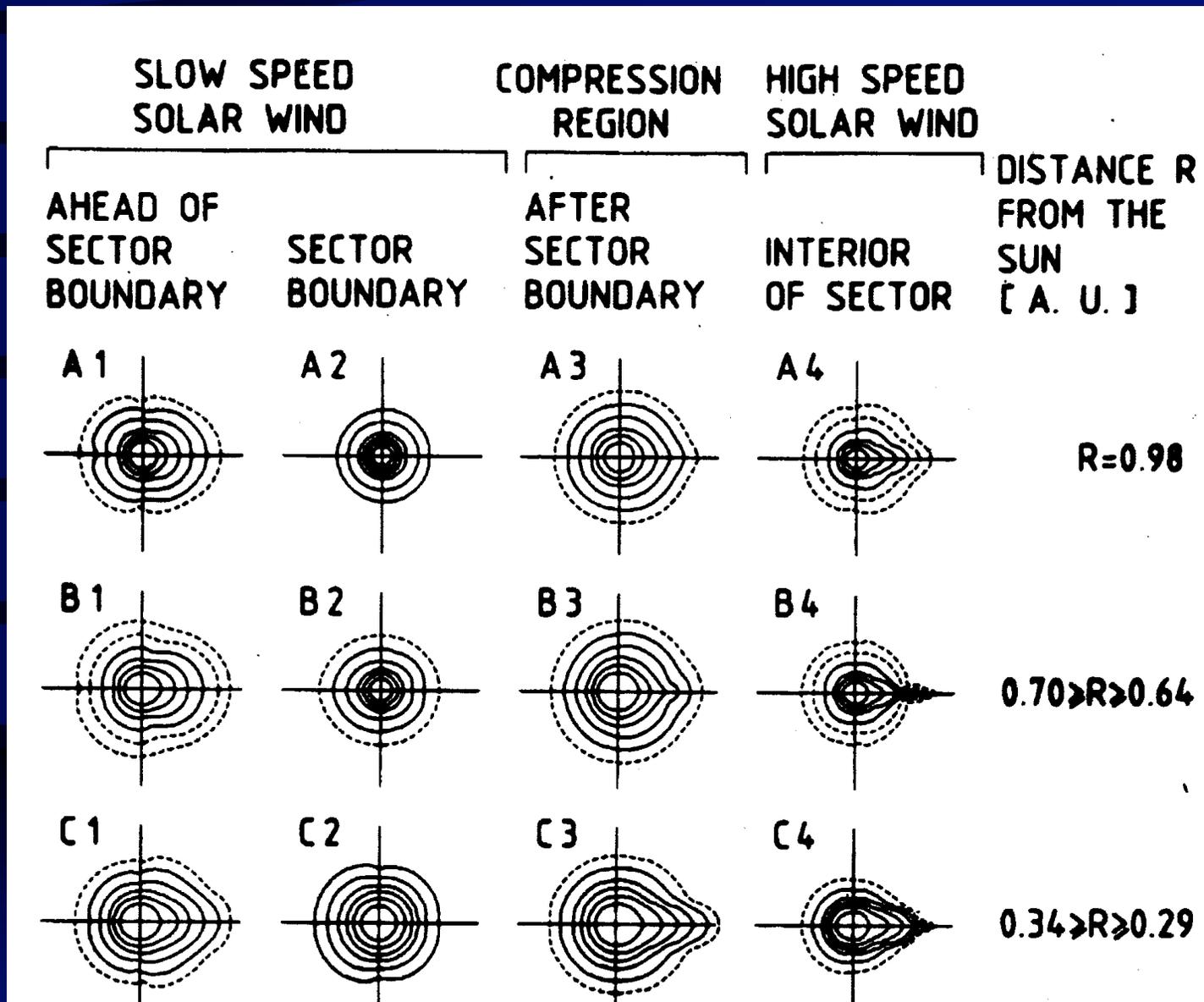
Proton distribution functions observed by Helios



1 AU

0.3 AU

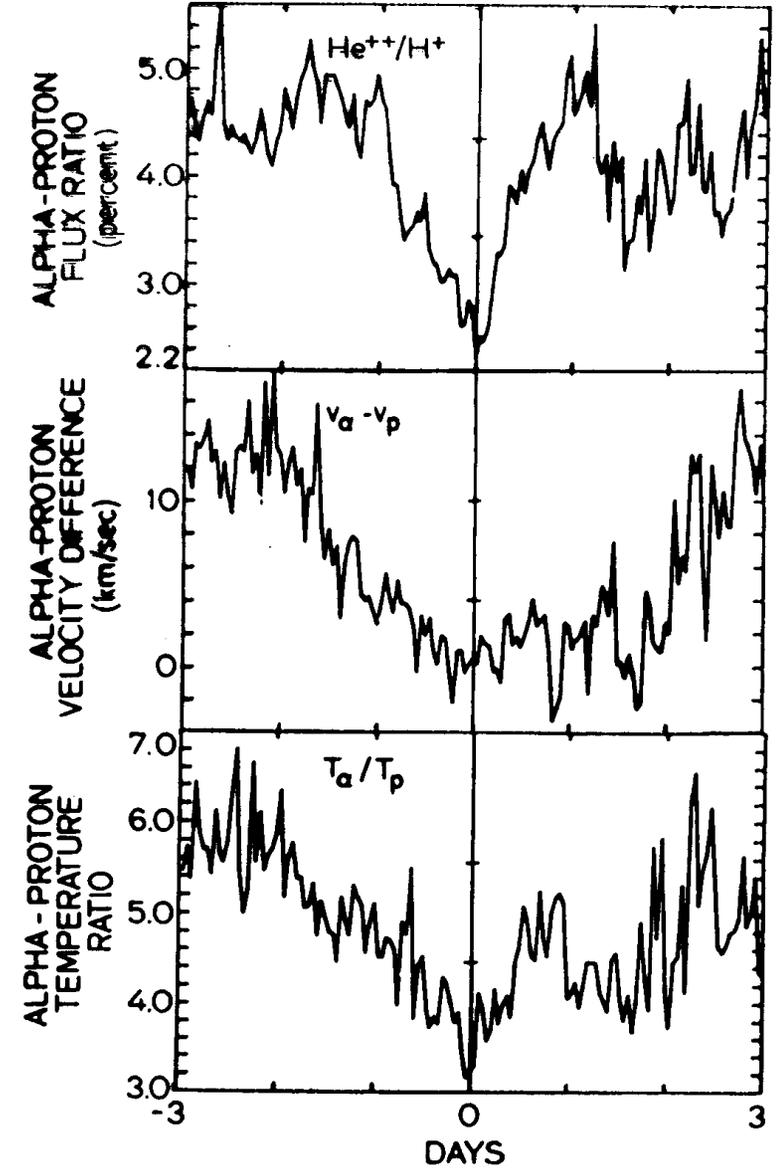
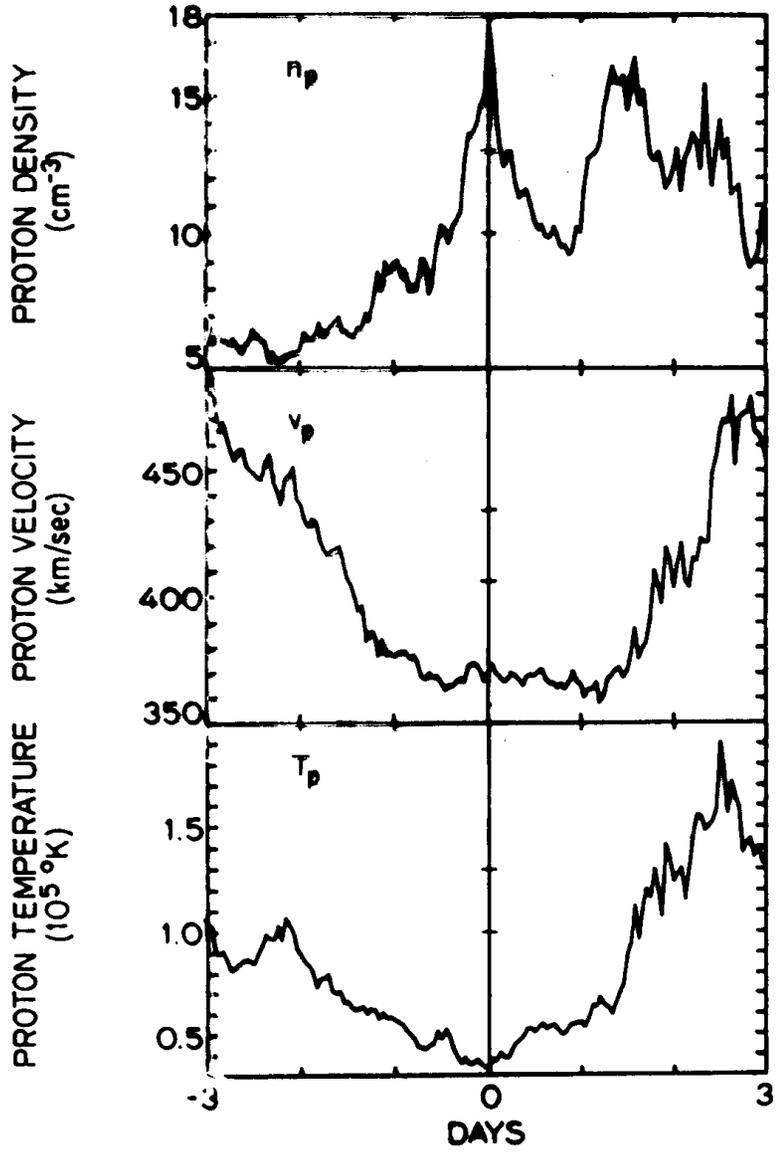
Slow → Fast



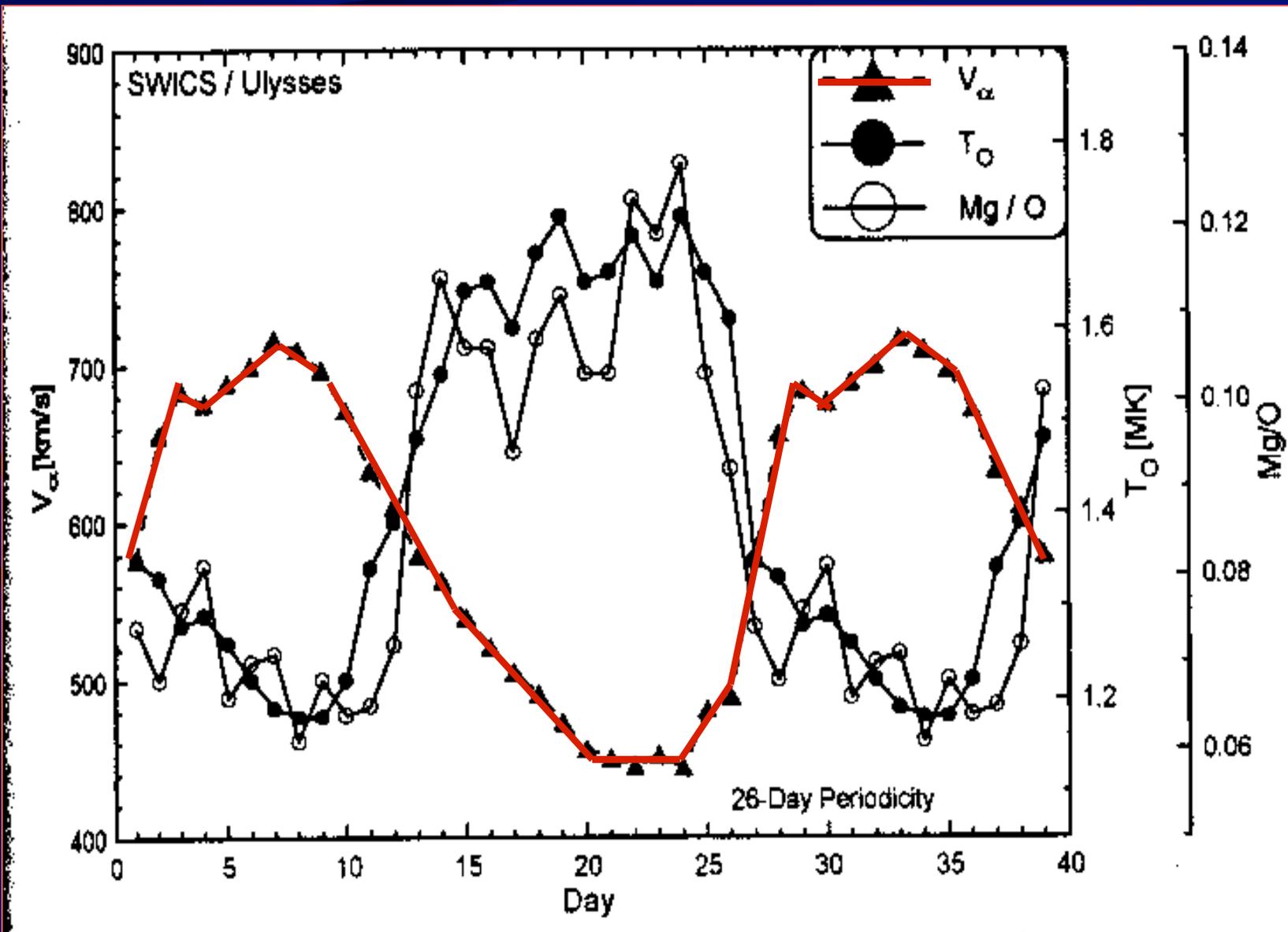
Electron distributions from Helios

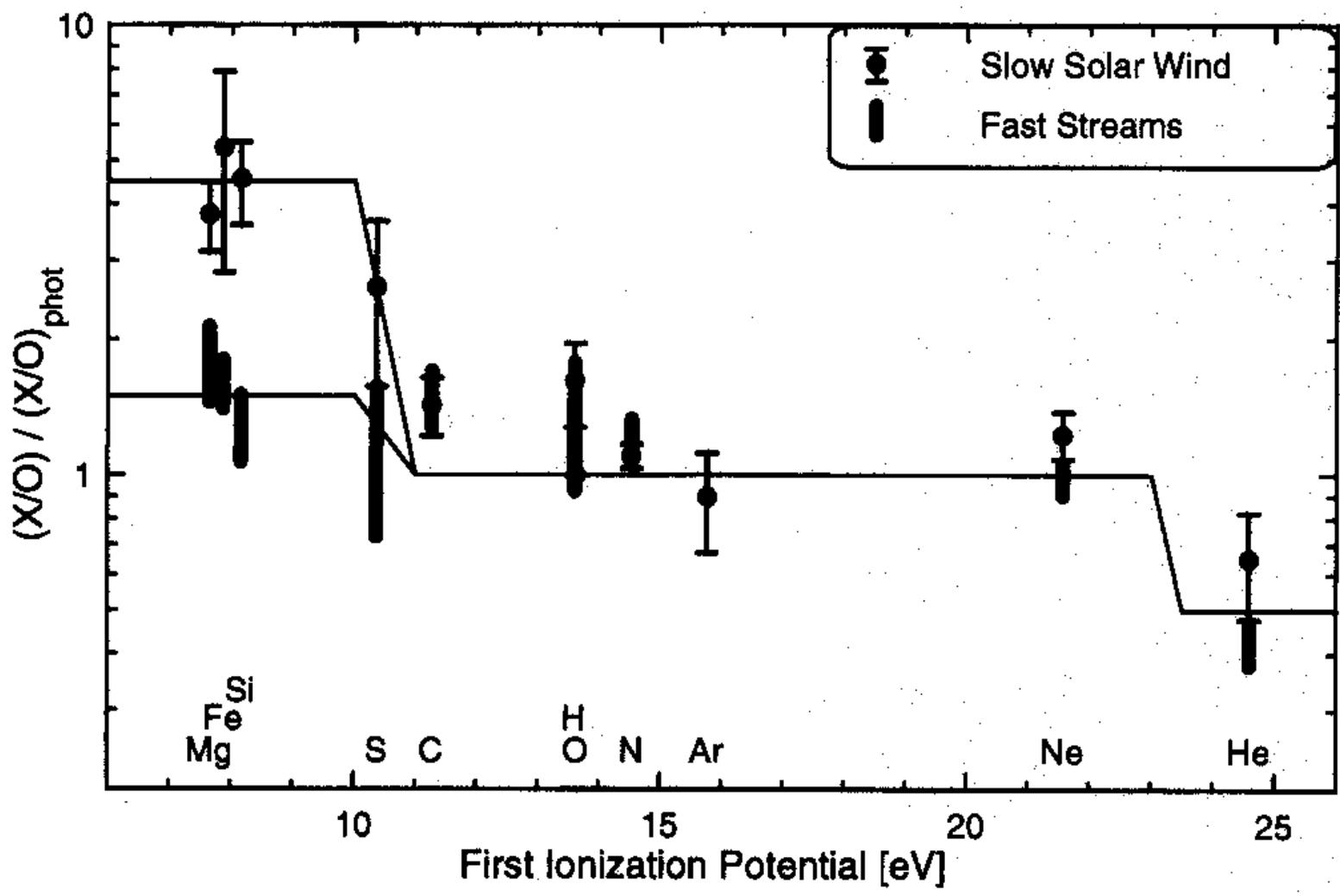
Dynamic Properties

<u>Property</u>	<u>Slow Wind</u>	<u>Fast Wind</u>
Density, cm^{-3}	12	4
Proton Temperature, K	3×10^4	2×10^5
n, T variability	High	Low
Anisotropy	~ Isotropic	Anisotropic
dT/dr	~Adiabatic	Heated
dV/dr at 1 AU	Accelerating	Coasting
Electron heat flux	Low	Outward
Electron Temperature, K	1.3×10^5	1.0×10^5



Superposed on HCS





Heavy ion properties

Property

Slow Wind

Fast Wind

n_a/n_p

$\leq 0.01 - 0.04$

0.04 - 0.05

T_a/T_p

1 to 3

4 to 6

$V_a - V_p$

$\rightarrow 0$

$\leq V_A$

O Ionization Temp, K

1.5×10^6

1.0×10^6

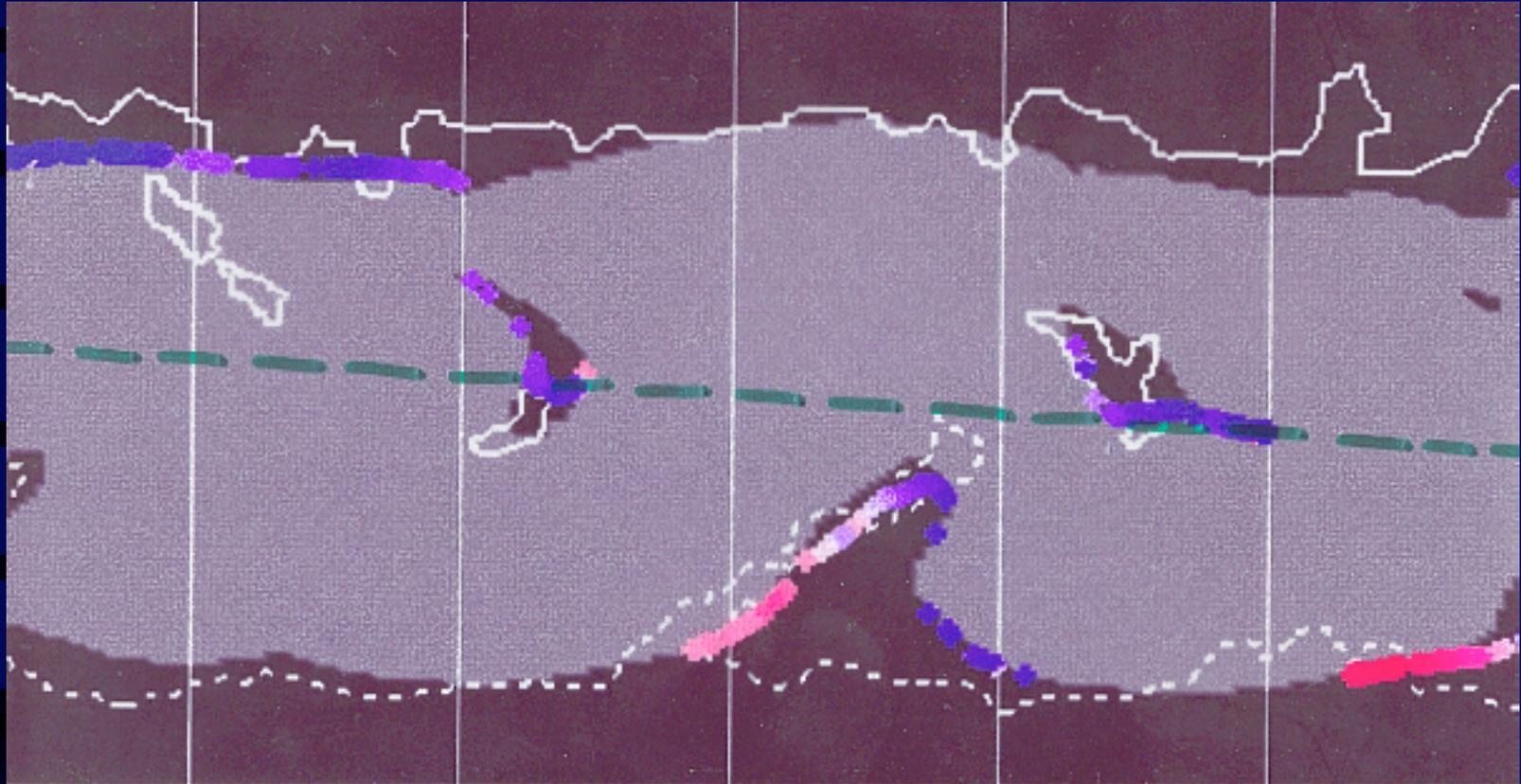
FIP, FIT effects

Large

Small

Magnetic Properties

<u>Property</u>	<u>Slow Wind</u>	<u>Fast Wind</u>
B, nT	3	6
$\beta = 8\pi nkT/B^2$	2	1
Alfven wave flux	Low	High

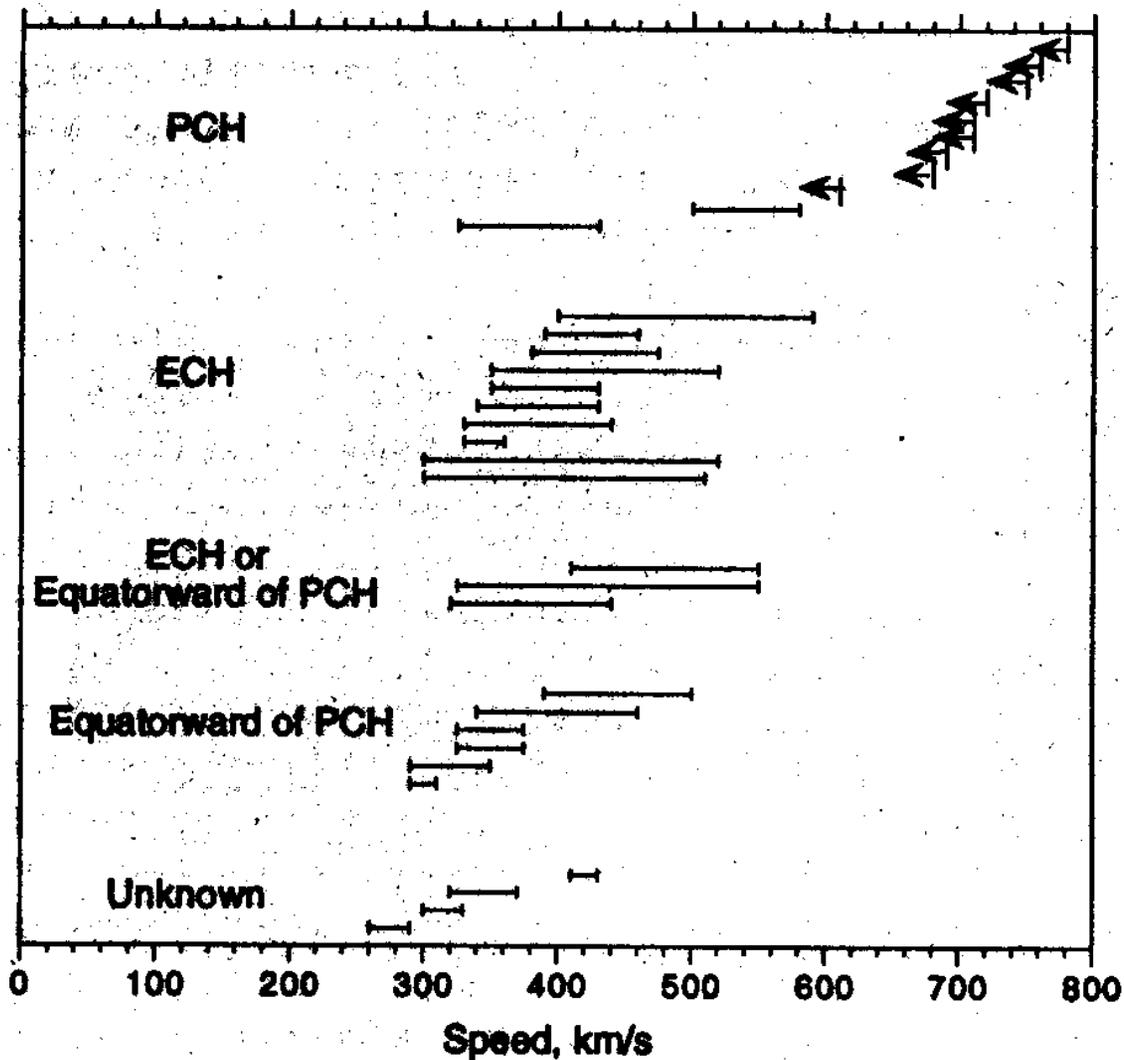


MHD model of sources of Ulysses plasma

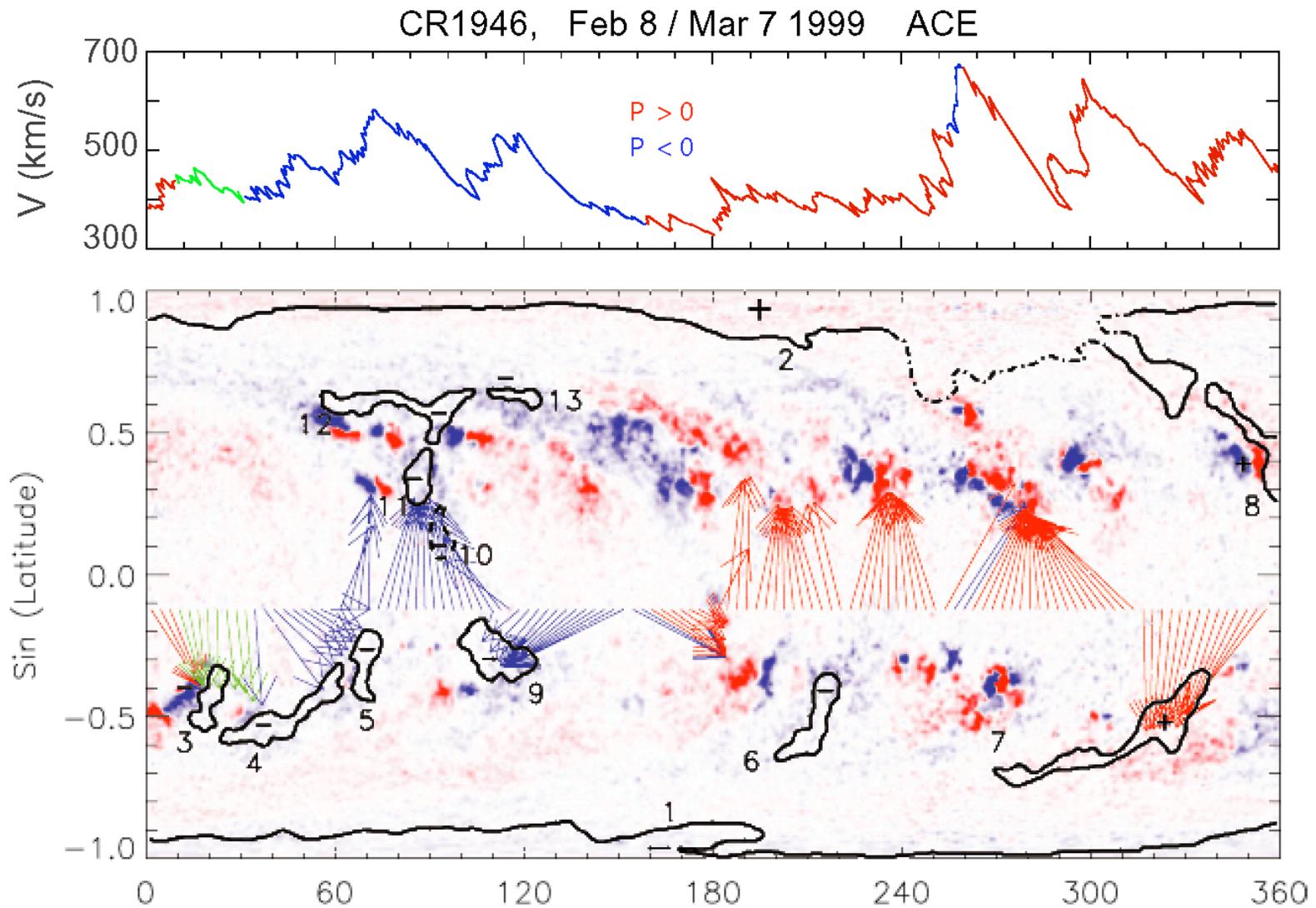
by Z. Mikic

Blue = slow

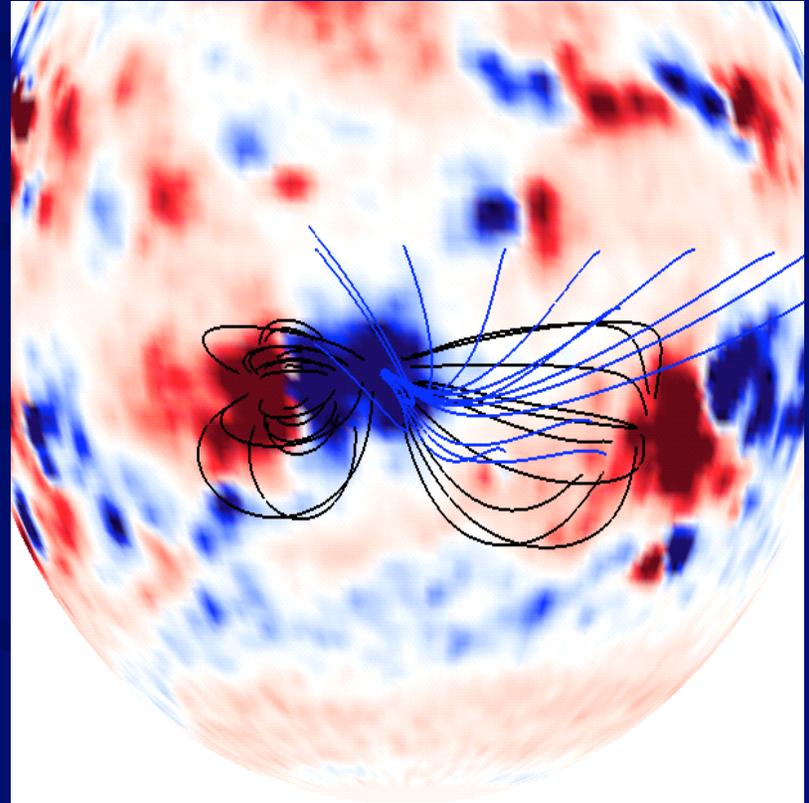
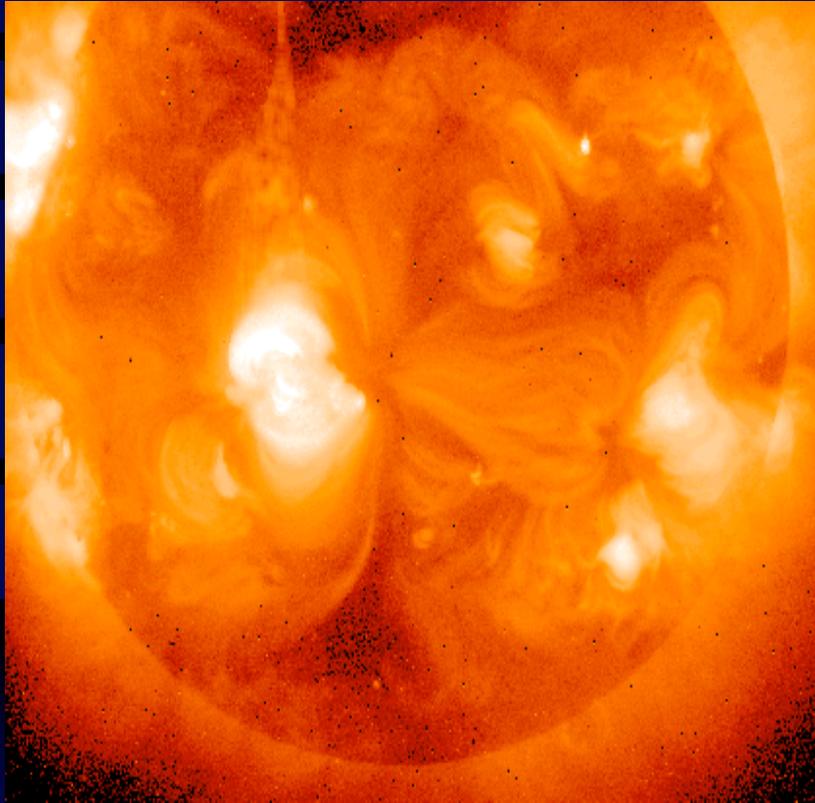
Red = fast



PCH = polar coronal hole;
 ECH = equatorial coronal hole



Sources of ACE data from potential field model



HCS vs non-HCS slow wind (ACE, 1999)

	<u>HCS</u>	<u>non-HCS</u>
V_{\min} , km/s	332 ± 40	379 ± 9
Δt , hrs	52 ± 19	28 ± 10
n_{\max} , cm^{-3}	33 ± 11	13 ± 4
$\langle n \rangle$, cm^{-3}	13 ± 4	9 ± 1
Streamers?	Yes	No

No statistically significant differences in T_{O}
or in minimum or average T , B , $n_{\text{a}}/n_{\text{p}}$

Sources of the slow solar wind?

- Boundaries of large coronal holes
- Small coronal holes
- Active regions
- Sides/tips of streamers
- Quiet Sun

Summary of Differences between Fast and Slow Winds

- Solar sources
- Composition
- Acceleration mechanism(s)
- Interplanetary dynamics