

# ASKAP 2030: A view from the (interstellar) scintillators

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(Manly Astrophysics)

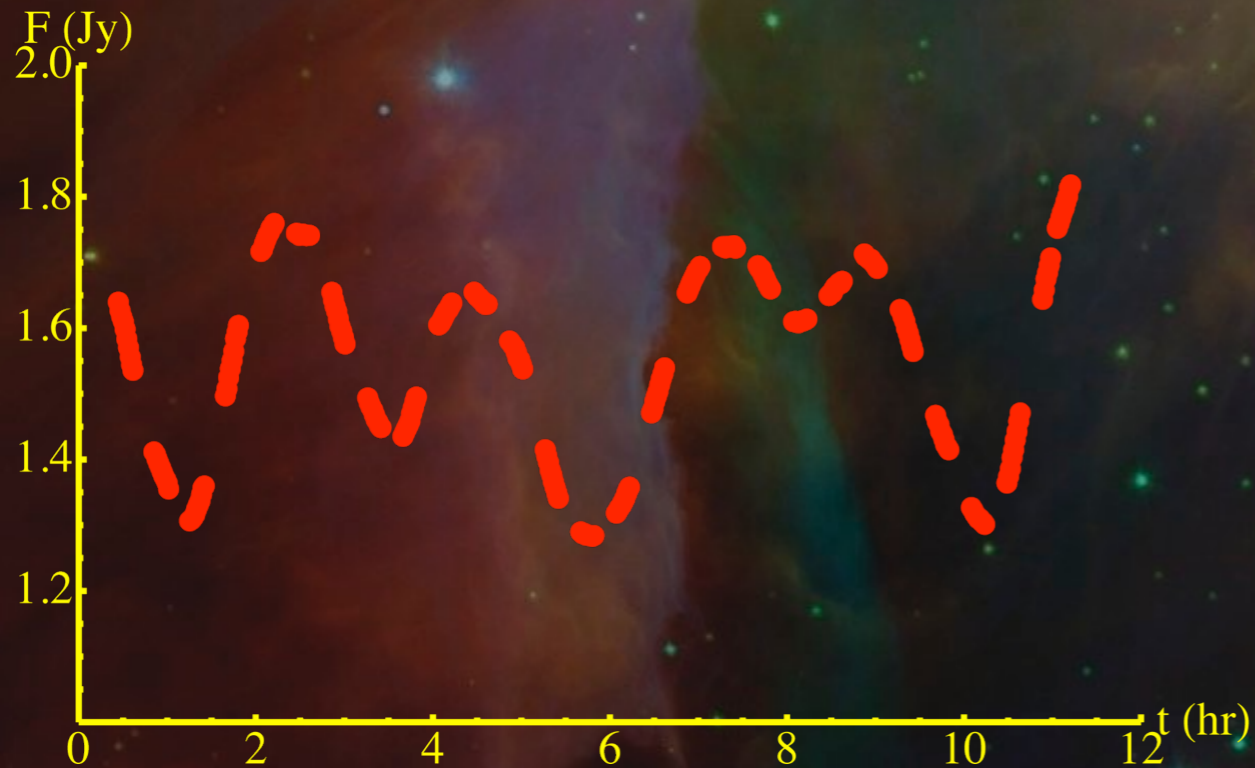
With input from Yuanming Wang (Swinburne)

## Key Points

- Scintillation is not caused by interstellar turbulence
- Actually due to zillions of tiny “scattering screens”
- No understanding of nature / origin of these screens
- There are no known  $\lambda\lambda\lambda$  counterparts
- ASKAP has provided important insights
- ASKAP 2030 will be able to characterise the local population’s kinematics, sizes/shapes, physical associations(?) ...

Teaser possibility: are screens the tidal remnants of dark gas clouds ?

# Zillions of tiny scattering screens



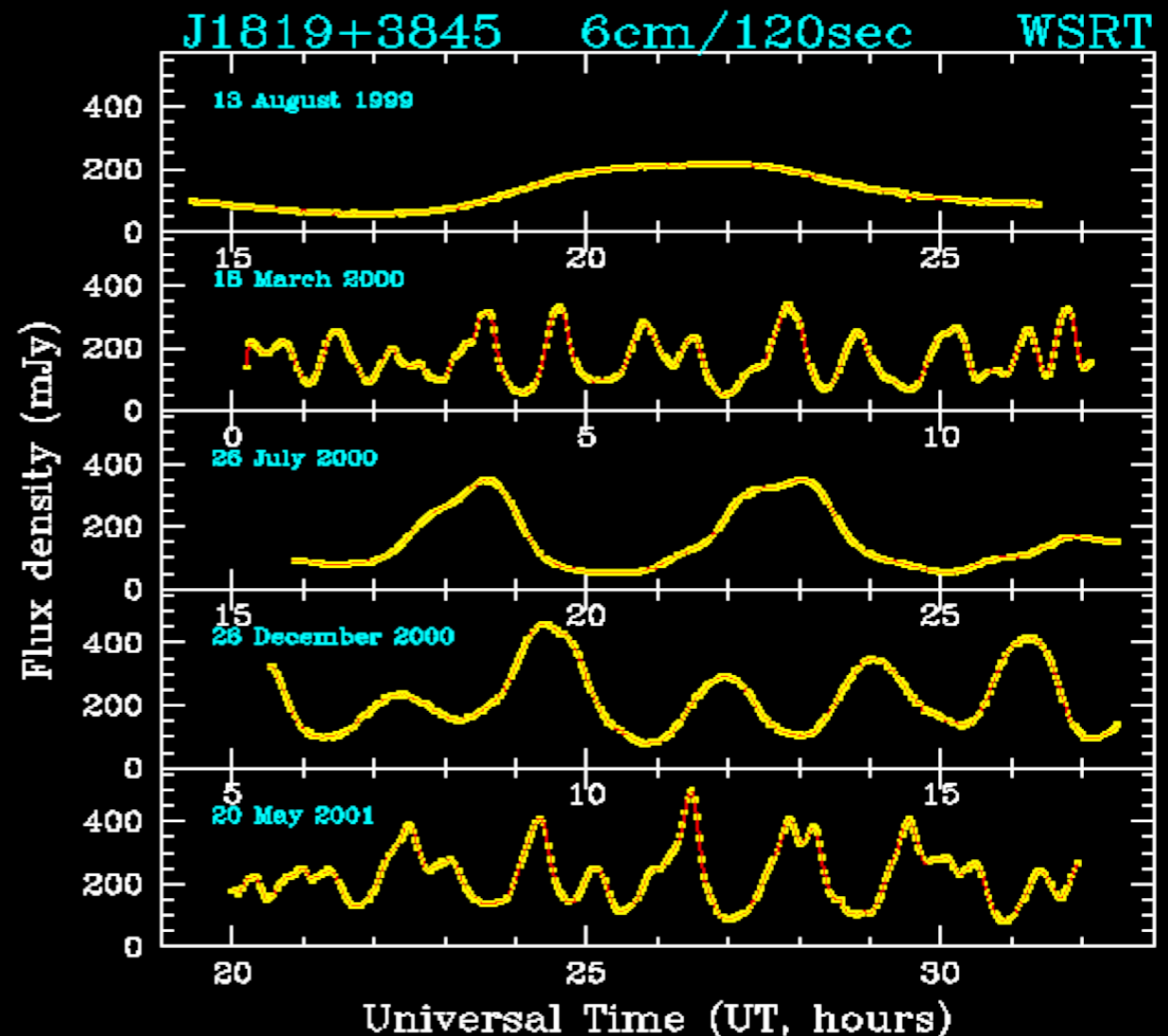
PKS 0405-385 @ ATCA @ 5 GHz  
Kedziora-Chudczer, Jauncey et al (1997)

Episodic scintillation  
Lasted only a few months

J1819+3845 @ WSRT @ 5 GHz  
Dennett-Thorpe & de Bruyn (2003)

Seasonal change in timescale yields  
a velocity  $\rightarrow D_{screen} \sim$  few parsec

Episodic scintillation  
Lasted more than a decade



# Pulsar spectroscopy is complementary

Dan Stinebring++ (2001)

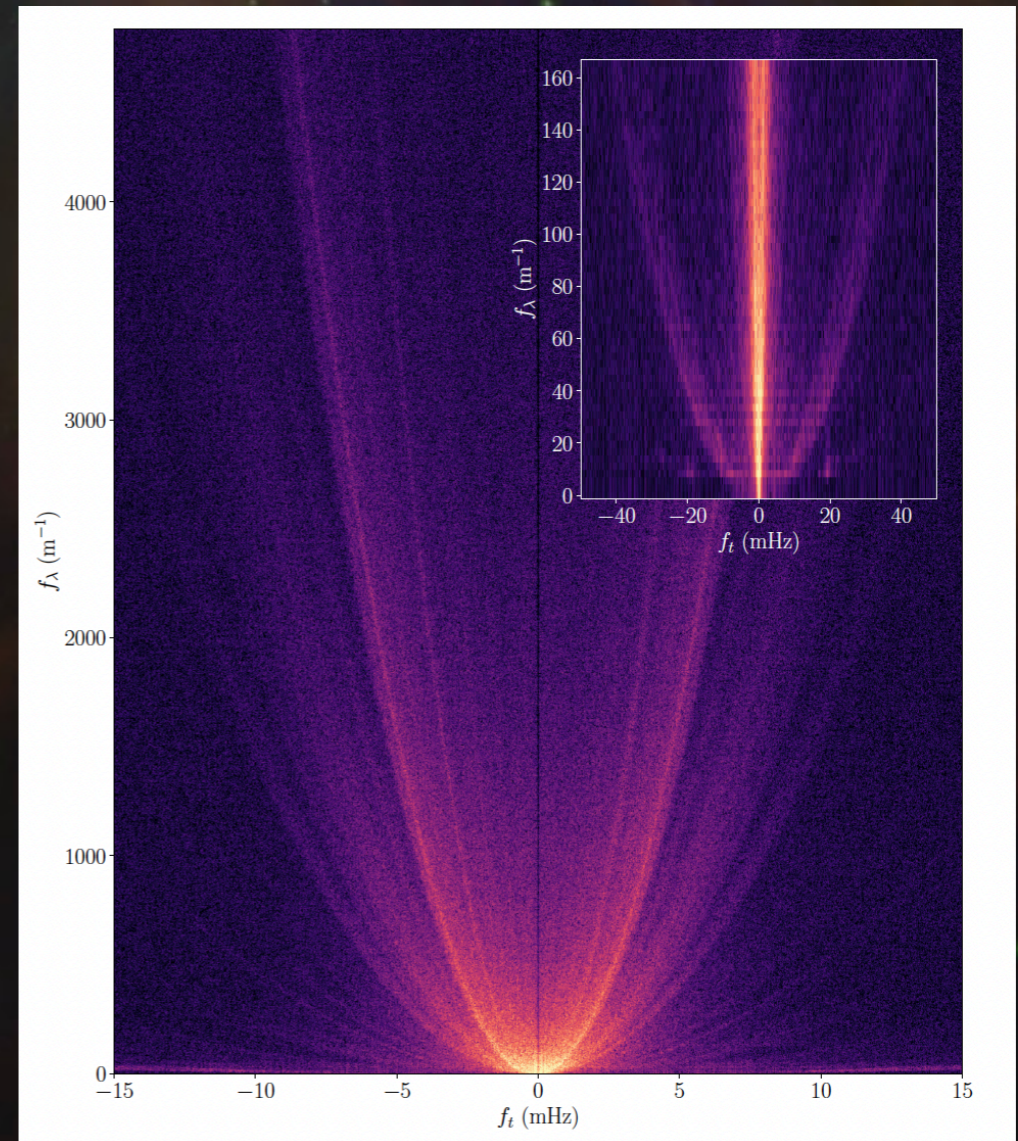
Parabolic arcs discovered in Arecibo data

Dan Reardon++ (2025):

PSR J0437-4715 MeerKAT L-band

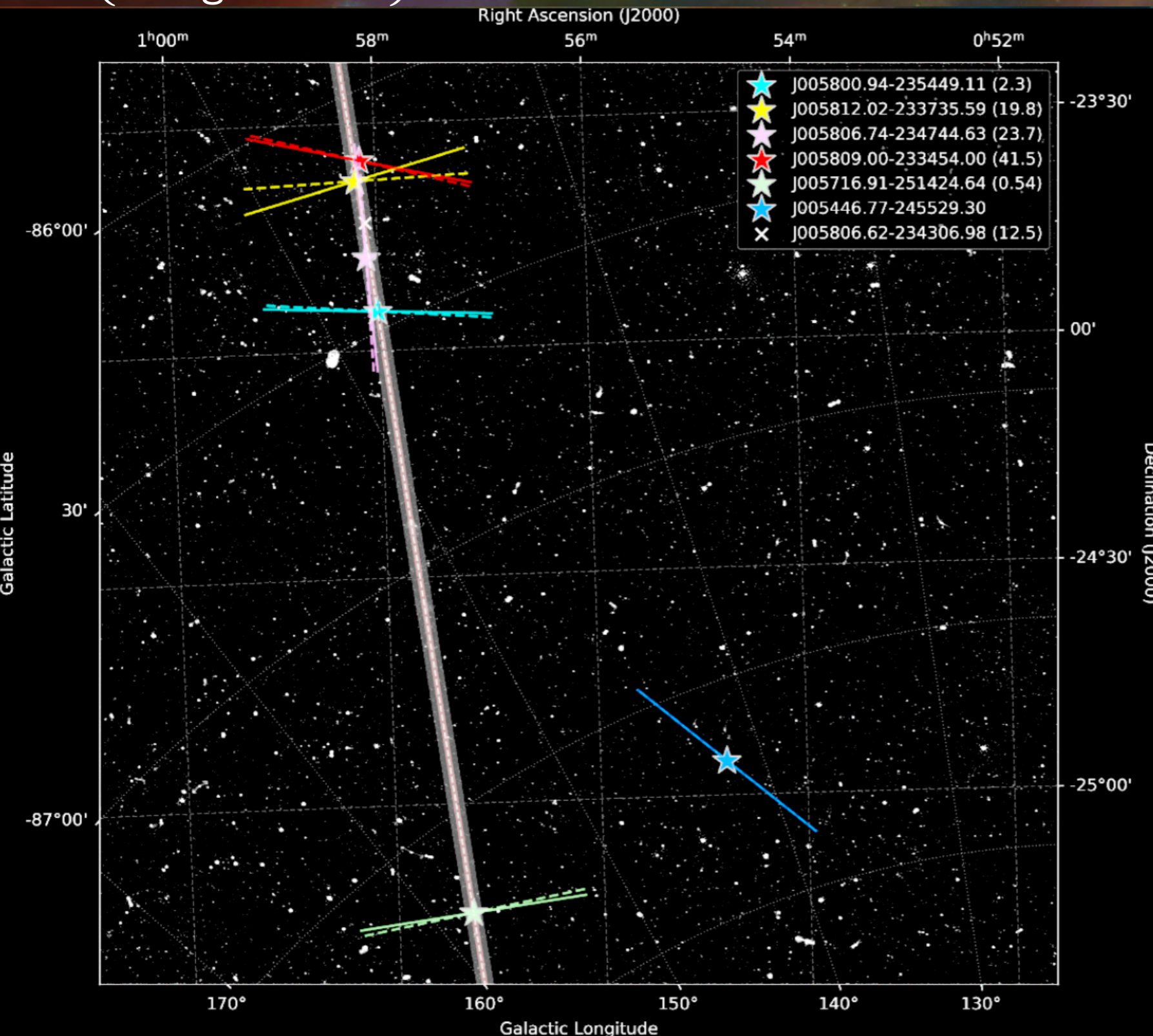
$D_{psr} \sim 150$  pc but 20+ arcs seen

Each arc is from a single screen,  
with distinct distance and kinematics



# ASKAP-VAST: screen morphology

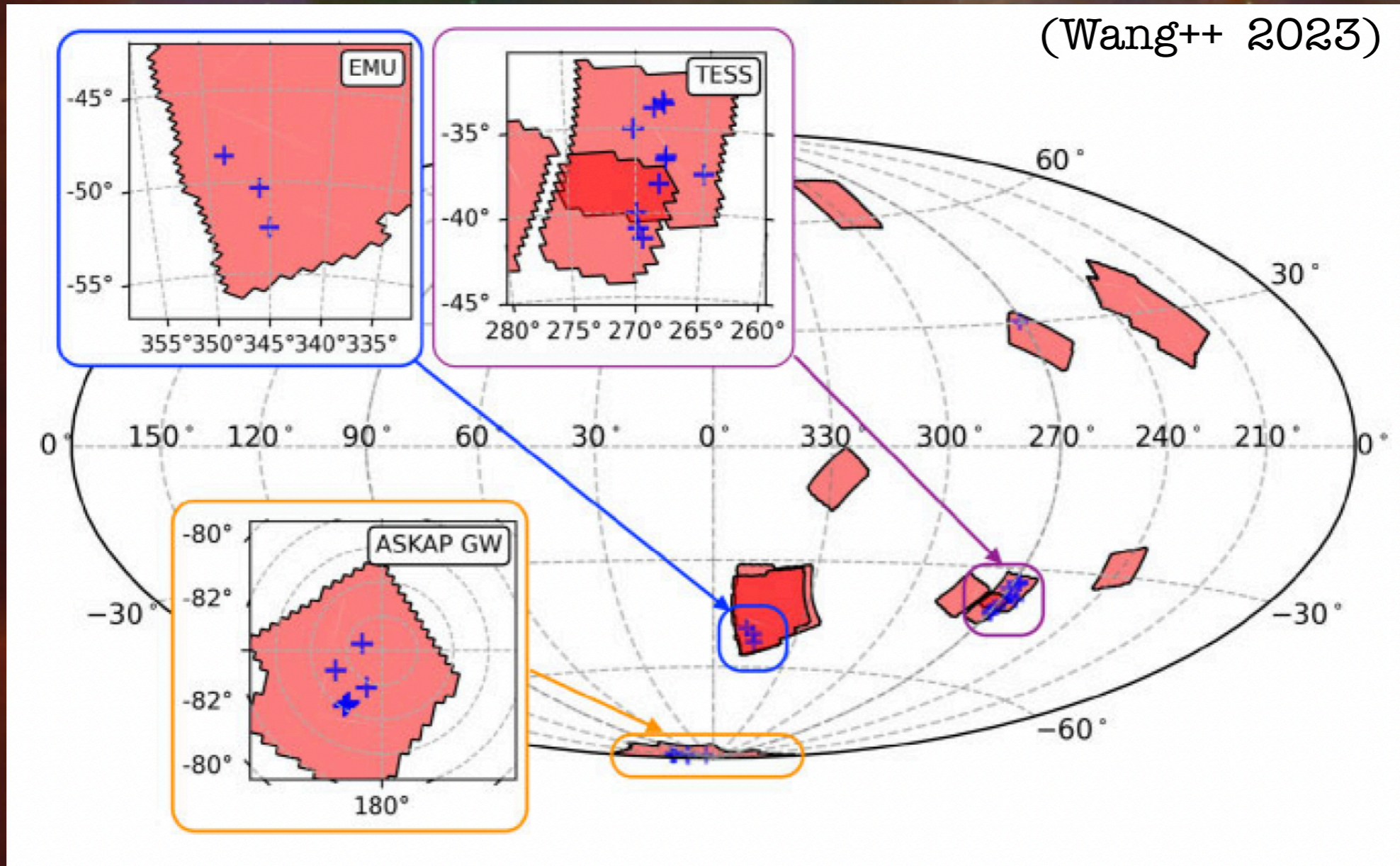
(Wang++ 2021)



Plasma microstructure is perpendicular to macro:



# ASKAP-VAST: clustering of local screens



Clustering is already clear in the pilot survey data.

Stronger evidence in the main surveys  
(Yuanming's results, not yet published)

# The scintillating future

- Monthly visits to all scintillators to determine screen kinematics
  - Constraints on astrophysics; and, extra dimension for clustering
- Monthly visits to blank fields to eliminate kinematic censorship
- Long-term evolution of the scintillation amplitude
- Proper motions of screens on sky?
- Higher sensitivity to help delineate screen “boundaries”

## ASKAP 2030 wish list

- Difference-imaging artefacts “everywhere” below thermal noise
  - Use LST matching? If so, need precise control over correlator starts
- Ability to schedule several visits to nearby fields within 12 hours
  - No increase in data rate, if flexibility is desired (?)
- Better sensitivity – lower  $T_{\text{sys}}$