TSAS IS NOT VERY COMMON

non-detect.

2. In 2006, Not so ubiquitous, some detections, many more

1. In 1994, ubiquitous.

SARS:

TIME VARIAIBILITY OF HI ABSORPTION AGAINST PUL:

3. 5 other sources do not show TSAS with VLBI

2. 3C147 shows detectable structure – could be a spook

1. VLBI discovery by Dieter, Romney, Welch, Sub-

HI ABSORPTION VLBI:

DISCOV craft OF TSAS
(Symmetrically split)

Adding further complexity: "low-N(HI) clouds"
1. Nal differences for binaries are always seen. Size scales 500 to 30000 AU.

2. Star clusters: 

Angular Structure:

Point sampling with binaries, mapping with star clusters. Literature review of Nal. Has it all: time variability, two-variable telescope optical lines.
are associated with Orion/Bridgman.

4. Most (but not all; e.g., HD219288-Weltz) time variations
AV/year.

3. Example: 23 Ori doubles every year; with star motion 0.8
AU/year.

2. When seen, probes very small scales: down to 1 AU

1. Definitely not ubiquitous: 6 detections only (out of 40)

TIME VARIABILITY
normal

components—suggests pressure and other conditions are not unusual in NaI variable

2. CI excitation (a la Jenkins) is not unusual in NaI variable

CI

such as NaI and are rarely seen in dominant ions such as spatial variations are always seen in nondominant ions

1. Spatial variations are always seen in nondominant ions

or temperature variation:

and evidence indeed suggests NaI variations are often just straightforward

Line Intensity \propto N(\text{g}) P_{\text{L}}^{-1.6}

Line Intensity is sensitive to electron density. For constant straightforward,

\text{NaI is a minority ionization species and the line NaI} \ldots \text{ BUT}
I. How well are these correlated with NAL?

2. How well are these correlated with DM fluctuations of globular cluster pulsars?

See next page.

Note: These are extinction corrections, so reflect total column densities. These reddening structure on 20 arcsec scales (but not reddening vector, to derive accurate spatial fluctuations reddened in the HR diagram, whose tracks are roughly orthogonal to the red-

Ivan King (private comm) uses the turnover region of the

and listen carefully you pulsar guys!

hot off the presses...

talking about globular clusters...
I have about 18 of these maps so far, and am likely to end up with

\[ (IH)^2 = 6 \times 10^{19} \text{ cm}^{-2}. \]

that's about

\[ \text{in } E(I - \lambda) \text{ are typically a few hundredths of a magnitude, } \]

are spaced 23 arcsec apart, over a square 3.4 arcmin on a side. The excursions
new information about the ISM. In my current work the spatial cells are
the question that occurs to me is whether these maps offer any

The question that occurs to me is whether these maps offer any

stars in each part of the CMD come from different areas of the image.

starts in each part of the CMD, while the corrections that are then made to
different parts of the CMD, while the corrections that are then made to
method lies in the fact that they are applied to many the geometrical area come from
cluster that has appreciable differential reddening. The leverage of the
individual stars, the sequence becomes markedly narrower, in any
when the corrections determined in this way are applied to
each cell. When the corrections determined in this way are applied to
held up into spatial cells and calculate the median delta-reddening in
measured along the reddening direction. What I do is to divide the
estimate of its reddening, by its displacement from the sequence as
below the trend, and up onto the right-hand branch), each star affords
nearly perpendicular to the reddening direction (the main sequence just
meant magnitude diagram of a cluster. In the part of the sequence that is
The technique...relied on the narrowness of the sequences in the color-
or no structure on a finer scale.
on a 2x finer scale, and get the impression there too that there is little
all the spatial structure that is present. I've done just a little mapping
I get a strong impression from this and other maps that they resolve
30 or 40 of them in the current project...
IS THIS A CHARACTERISTIC POWER LAW FOR CMN

IS THIS SLOPE ROBUST?

Found for gas A (i). And...same as Deshpande, Dwarkakrishna, & Gros (2000)

5 orders of magnitude scale close to Kolmogoroff.

to derive the power spectrum: a power law with index -2.8 over

2. VLA D-array mosaic with GBFT for zero spacing

trying together Burlell-Schmidt, WIYN, and HST images

1. Dust reflection filaments in the plane (subarcsec scale)—

Gibson tied together

A TRUE POWER LAW FOR CMN STRUCTURE?
This is an ideal opportunity to study detailed structures of a super shock.

Her scale sizes don't count as TSAS. But... TSAS has not been swept up by the super-supernova shock.

2. Structure is clearly causal. Probably from NPS superbubble.

1. Scales down to 0.07 pc—or maybe 0.4 pc.

Naomi showed her fabulous map of the angle-hair R-C cloud.
gets... the three and structure levels of the $^3\!P$ CI ground state. He
lem. Jenkins derives pressures from the relative populations of
This is relevant to TSAS because TSAS has a pressure prob-

THE PRESSURE DISTRIBUTION


3. TSAS is a separate statistical distribution of high pressures.

2. TSAS is simply a result of the turbulent cascade.

1. Discrete structures require geometrical factor C and cold temperatures. We observe such objects. (The classes)

We have three different ideas for TSAS:

SUMMARY: THREE COMPETITIONS FOR TSAS
trum is (perhaps) "universal"). But TANS is a rare phenomenon while the turbulent spec-
served characteristics other than the existence of TANS—
4. For Deshpandé: not clear to me what it predicts for op-

with other TANS indicators.

3. For Jenkins: One key should be: correlate GI pressures

are produced by the two statistical ideas?

2. What—exactly—are the observational characteristics that

1. Discrete objects can be clear because of sharp edges

cide in any particular case?

hing depending on WHERE and WHAT. But... how to de-
5. PdB high-resolution observations show HCO+, H2O, OH
6. Provides energy for chemistry
 activation energy.
4. Velocity gradient filaments (from CVI) that mirror the
3. H2 volume densities up to 2000 cm⁻³, L ~ 8 K
2. Filaments follow local magnetic field orientation
1. Filaments on scales ranging down to 1000 AU

13CO and found
HIy-Blaire/Falgarone used IRAM 30 m to map 12CO and
TMS in Molecules Clouds
Similar region: photo of the absorbing clump against N3269

4. Jupiter masses (uncertain)

$K \sim \frac{L}{1000 \text{ to } 20000 \text{ cm}^{-3}} \sim (H)_n^{10^{-20}} \text{ cm}^{-2} (H)_{10}^{N}$

3. Scale size 200 AU (few arcsec)

2. Associated with dense HL. "In the middle of nowhere"

1. Round Galactic TISM toward $(q, \varphi) \sim (142^\circ, 40^\circ)$; not by Lucas X \\thearsen extended the discovery of non-dense-cloud molecules

TISM AS A NEW ISM COMPONENT
A TRULY NEWISM COMPONENT

Who: Why? How?
4. Would be like New York City in the middle of New Mex-
3. Transient?
2. Suspended in z by magnetic field (a la Don Cox)
1. Held together by magnetic field (a la Don Cox)
These are overpressed and heavy; they should fall.
Electron density fluctuations $\eta^e \sim u^e$—they do not pose

and the turbulence itself is described by power spectral

$\Delta$, $C\eta^2$,

selves described by a handful of parameters:

- $\lambda^m$ hides many levels of complication, which are them-

- Scintillation time scale, decorrelation bandwidth

- Angular broadening, temporal broadening

- $D_M$, $R_M$, $E_M$, $S_M$

parameters:

process of turbulence but is well-described by a handful of pa-

Classical pulsar scintillation arises from the complicated

CLASSICAL TIS: STATISTICS
Figure 5: We can’t predict values for $F$, $\delta n^2$, outer scale; they vary with inner & outer Galaxy.
6. Multiple arcs often seen—screens at different distances.

5. The theory: arc curvature depends on distance.

4. Explained as thin screens with Kolmogorov turbulence.

3. \[ \text{mini-}
\begin{align*}
\text{ES}\text{E}\text{s}\text{r}\text{e}\text{n}\text{e}\text{n}\text{a}\text{l}\text{e}\text{s}^\prime},
\text{produced by size 1 A.U., density 200 cm}^{-3}.
\end{align*}
\]

2. Inverted arc substructure—scattering centers within the cies.

1. Ubiquitous

In the images, we see parabolic arcs. They are tra images. In the Fourier conjugate plane of the classical dynamic spec-

TIS: SCINTILLATION ARCS.
tions and should not be so described.

They need not be spherical blobs.

Could be a few tens of AU. They plane-of-sky extent is limited to a few pc. Their line-of-sight thickness is limited to a few pc. Their

No!

Are they really thin screens?
10^{-4} \text{ and } 3 \times 10^{-2} \text{ pc}

(b) For J1819+3845, transverse dimension between $3 \times 10^{-4} \text{ pc}$.

LOCAL BUBBLE?

(a) Distances are 10 and 2 pc—BOTH WITHIN THE

2. For two: P1275-326, J1819+3845.

1. Very rare, only 3 known.

There are also intra-hour variables (1HV) (IHVs)

3. 50% changes in 1 hour.

2. Pronounced annual cycle

1. IDV occurs for $>1\%$ of sources.

Properties of intra-day variables (IDV) include

INTRA-DAY VARIABLES AND INTRA-HOUR VARIABLES
TEMI III SOLVE WITH RAM PRESSURE

5. 7 \sim 10^4 \text{ We believe, Big Thermal Pressure Prob-}

4. \text{ Ne } \sim 10^{16} \text{ cm}^{-2}, \text{ n } \sim 10^0 \text{ cm}^{-3}.

3. Such lenses must be plentiful: \sim 10^4 \text{ pc}^{-3}.

2. Explaned as an AL-size Lens Structure moving fast (100

1. Very rare: cover 0.001 of sky

Properties:

ESF (Walker)
2. Within a dozen pc it contains the second out of three
HI-producing screens (P127-326).

1. Within a few pc it contains the most spectacular
HIV-PProducing screens.

HIvisors.

Haps a boundary of one of Jeff Linsey's clouds (or a col-
- producing scattering screen (1819+3845). This is per-
- empty and boring. But:
edough magnetic fields to matter (Don Cox); and is otherwise
of hot gas; has some fluid (Pristilla Priscilla, Jeff Linsey); has

Since Kindergarten I have learned that the local bubble is full

ON THE LOCAL BUBBLE

SOME CONCLUDING REFLECTIONS
spectrums? Do they connect? Are they the same power same slope? In their observable regimes, their power spectra have the larger scales would be easy to see. Their TSAS observations reveal scales of tens of AU upwards. Smaller scales wouldn't be easy to see.

1. ISS reveals ionized turbulent scales from hundreds of km to hundreds of AU—a factor of 10^6. Larger ISS scales tend to think of TSAS as huge, but... We HI folks tend to think of TSAS as tiny; pulsar scintillators on TSAS vs TSIS some concluding reflections
to talk with one another.

The relevant partners are measuring related quantities and need

in the foreground gas,

\( (IH) \) reveals changes in extinction, and therefore \( N_e \).

\( SFAR\)!

3. A clever new technique by Ivan King using - Mikodi

\( ne \) (and therefore, to some degree, \( N_e \))

and the foreground gas, which in turn depend on \( IH \) and

\( INA \) absorption lines revealed change in \( N_e \) in

the gas

1. Pulsars DM reveals changes in \( N_e \) in the foreground Galactic-

TERS for studying small scale structure in the ISM:

At this meeting we heard of three uses of GLOBULAR CLUS-

ON GLOBULAR CLUSTERS

SOME CONCLUDING REFLECTIONS