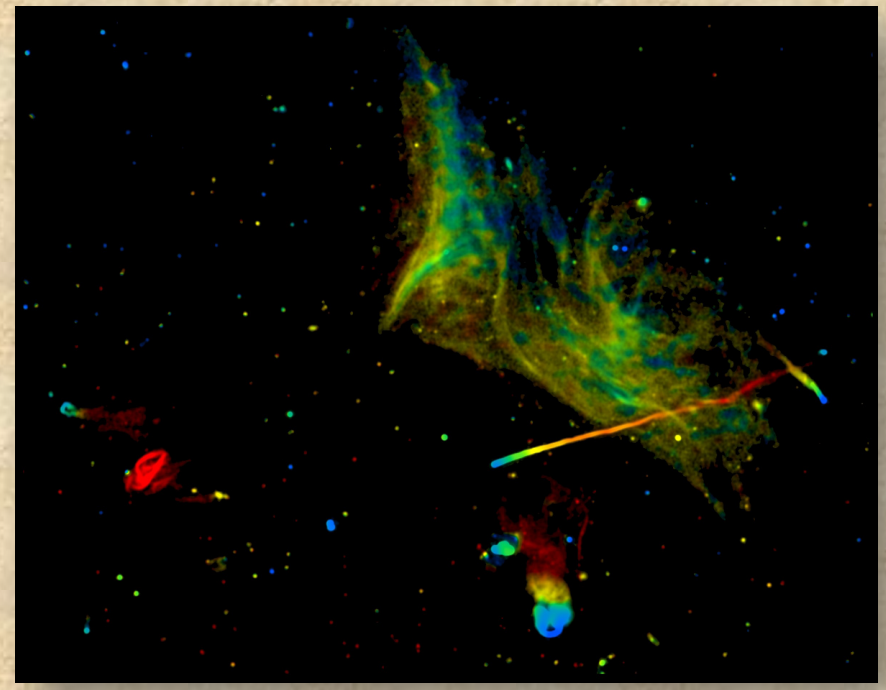
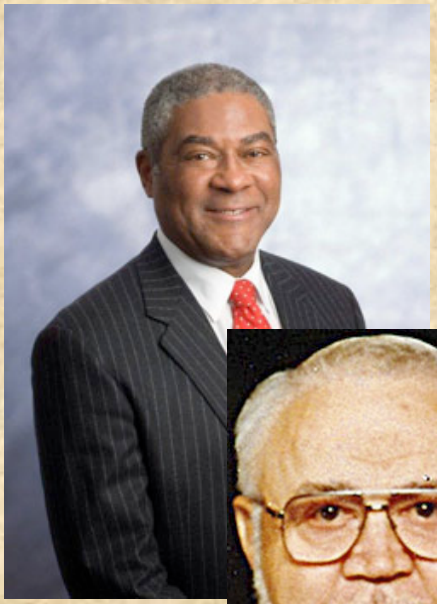
Particle Acceleration Questions in Abell 2256



Work in progress, collaboration with Frazer Owen, Jean Eilek

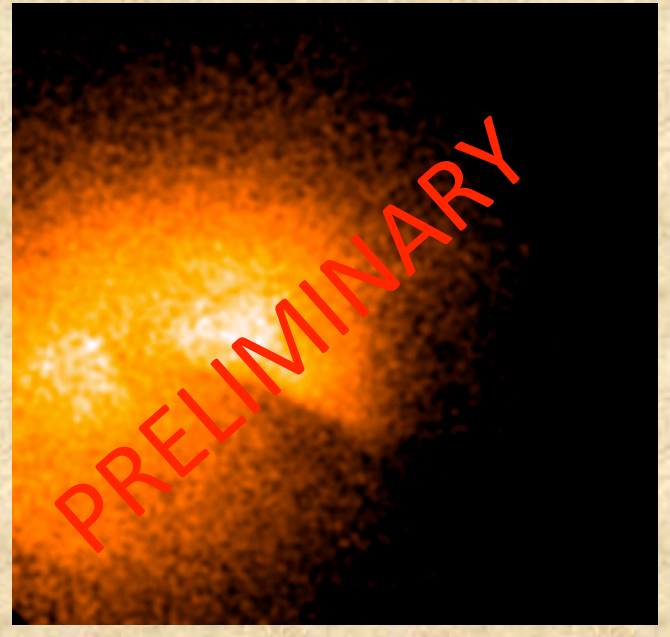
Who is Thomas Jones?

Who is Thomas W. Jones?

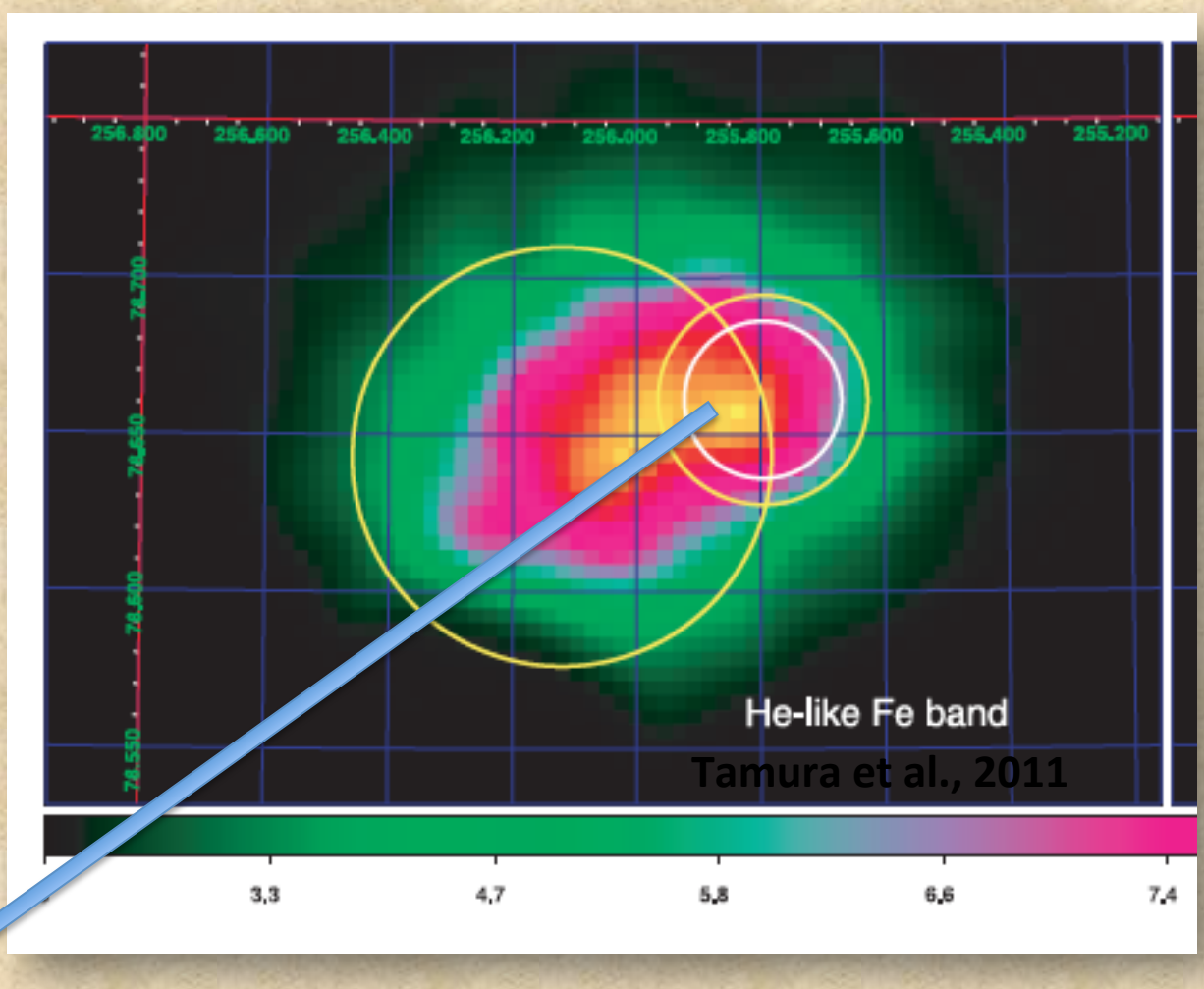


Harvard Board of Trustees
Playwright
Genealogist
Insurance Agent
Pro Bowl Running Back
(American Football)
Deceased
Sports physiologist
Astrophysicist
Opthamologist

What is Abell 2256?

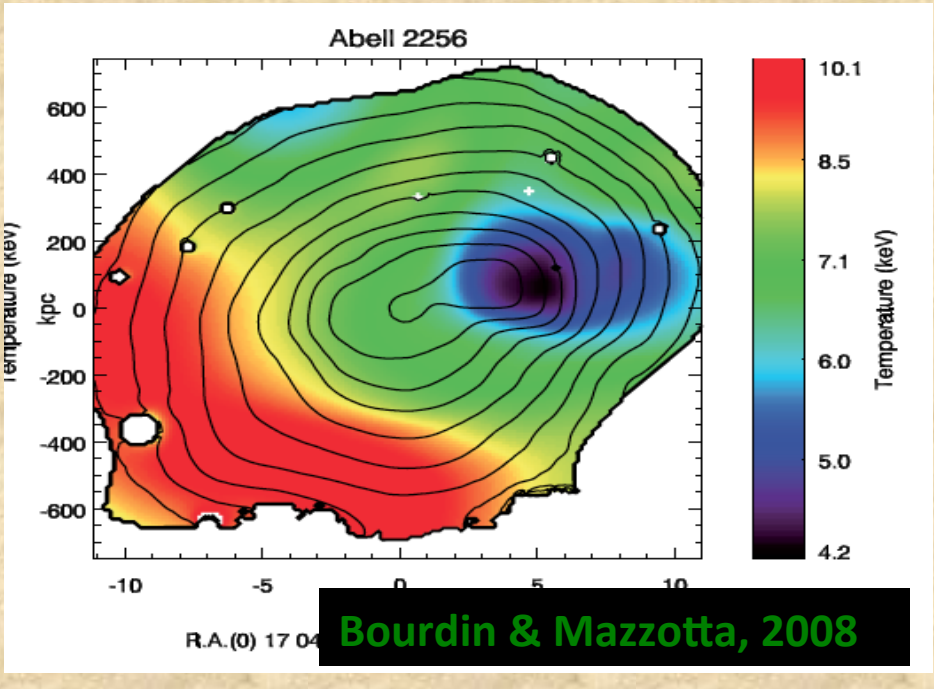


ICM in motion…



Suzaku: Net ~1500 km/s towards us

A2256: ICM structure



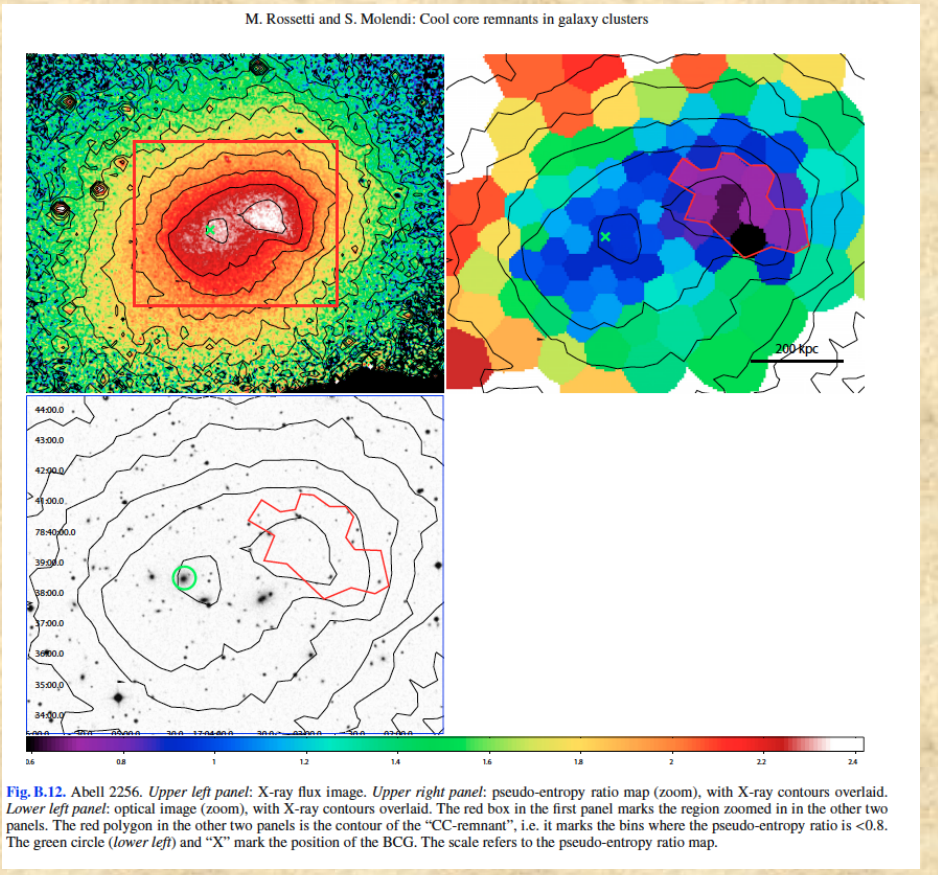
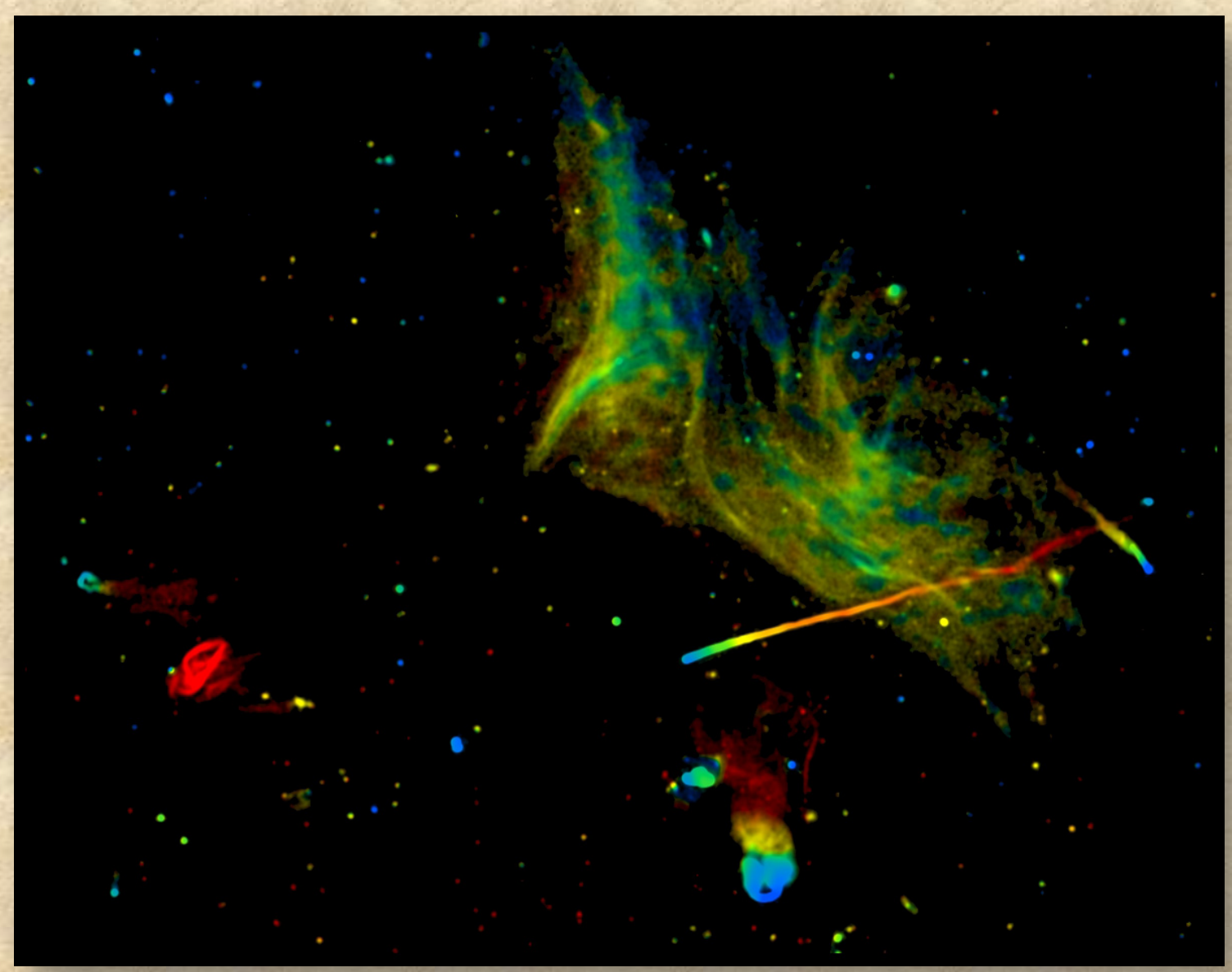
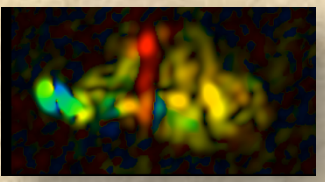


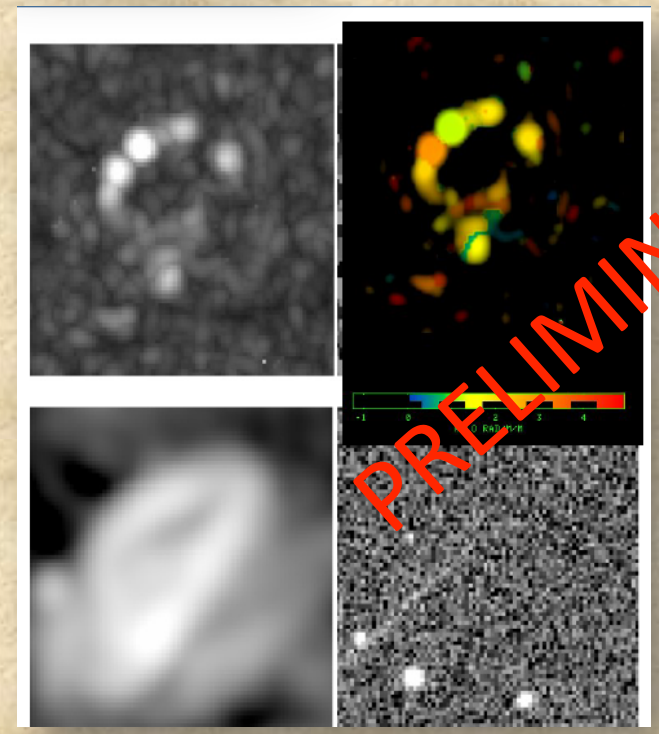
Fig. B.12. Abell 2256. *Upper left panel*: X-ray flux image. *Upper right panel*: pseudo-entropy ratio map (zoom), with X-ray contours overlaid. *Lower left panel*: optical image (zoom), with X-ray contours overlaid. The red box in the first panel marks the region zoomed in in the other two panels. The red polygon in the other two panels is the contour of the "CC-remnant", i.e. it marks the bins where the pseudo-entropy ratio is <0.8. The green circle (*lower left*) and "X" mark the position of the BCG. The scale refers to the pseudo-entropy ratio map.

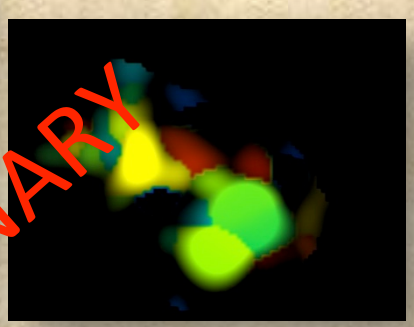
BEAUTY...

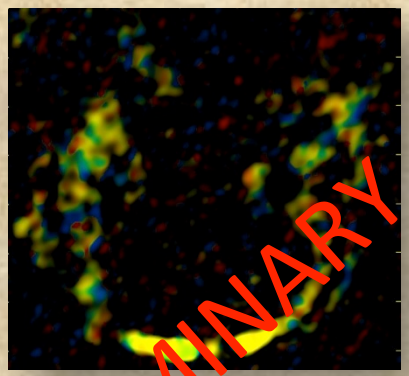


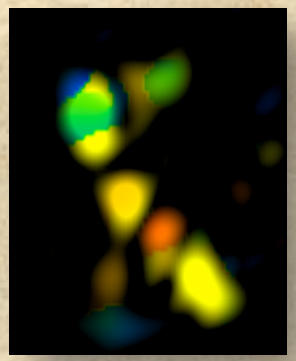
RM variations

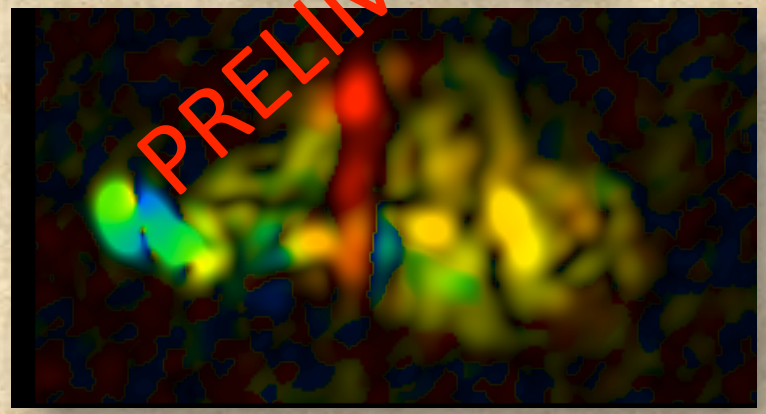


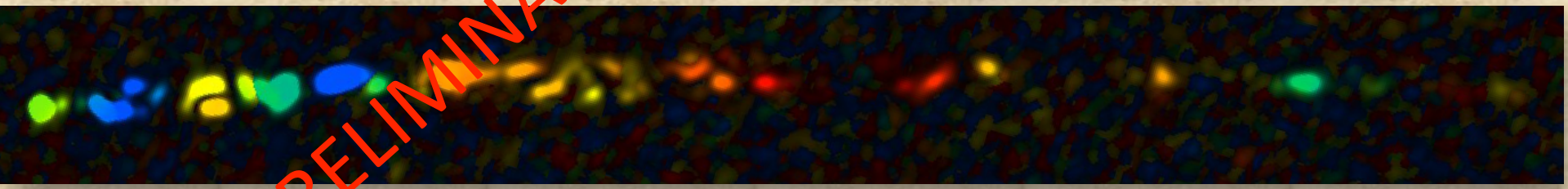










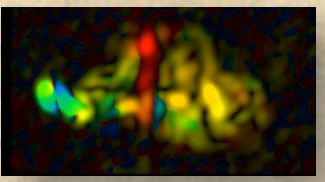


PRELIMINARY

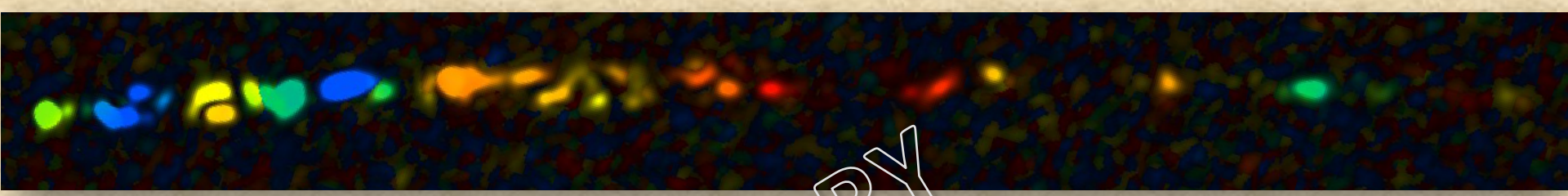
PRELIMINARY

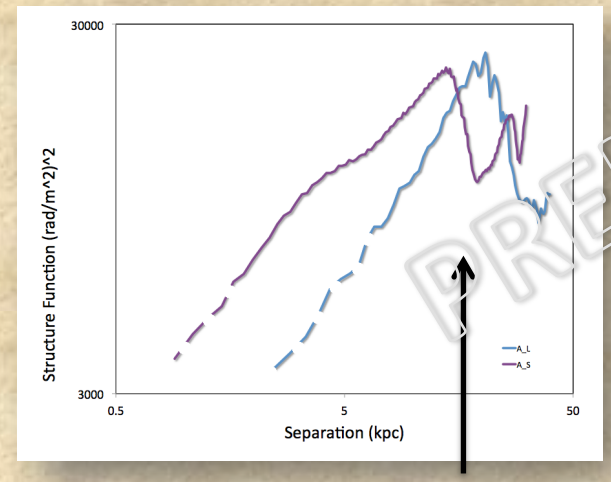
PRELIMINARY

PRELIMINARY

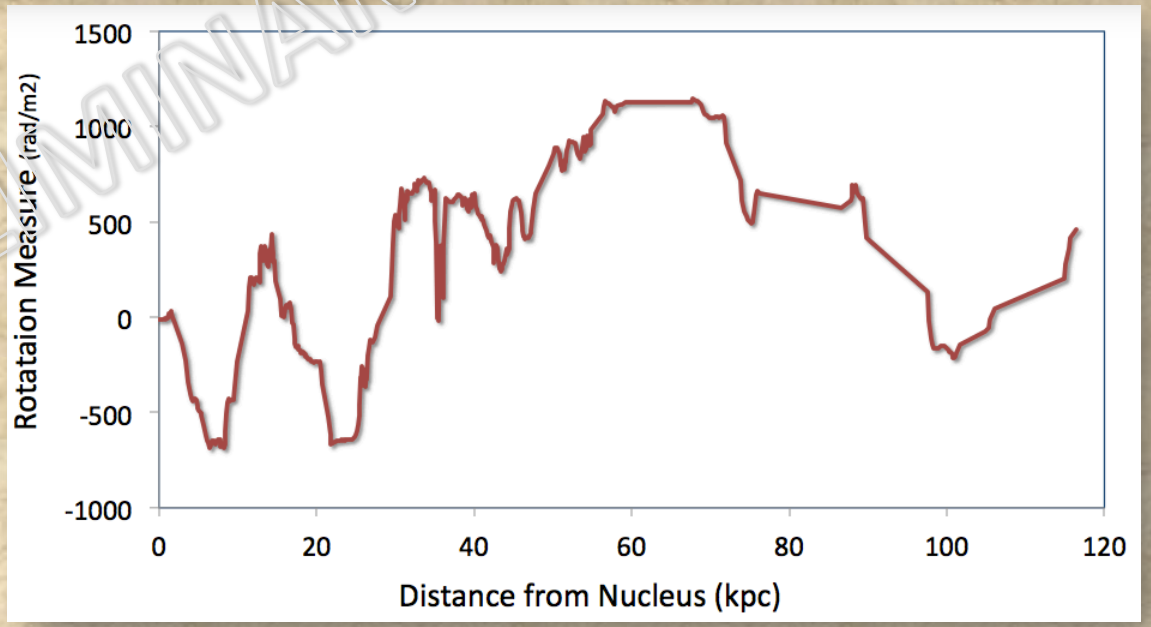


Magnitude & pattern reasonable for unperturbed ICM?



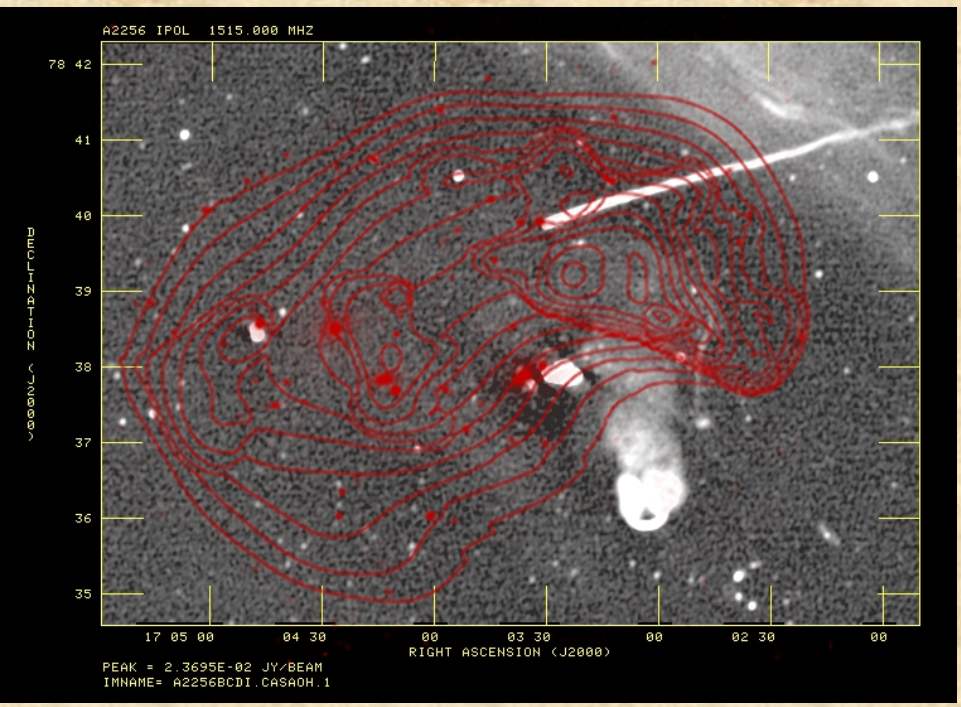


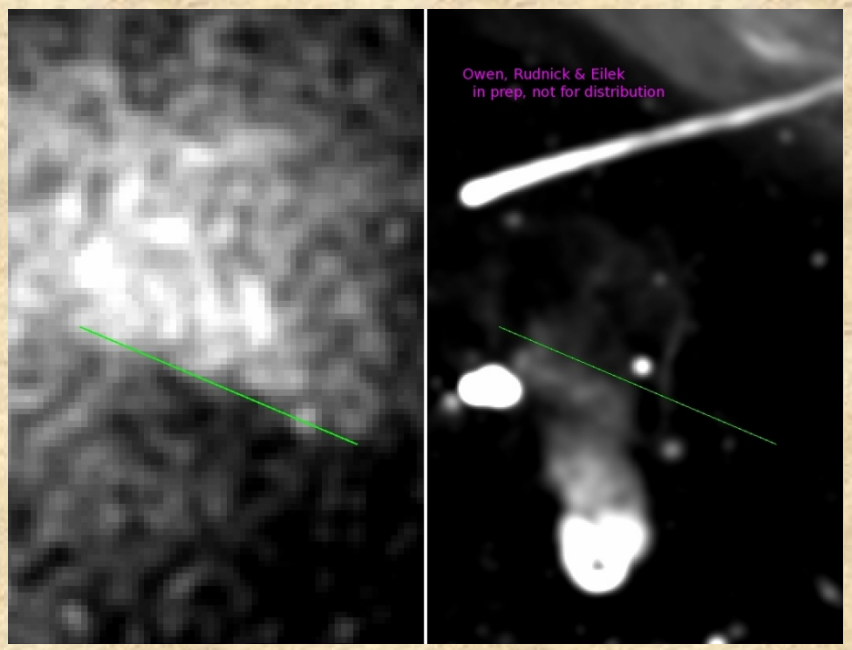
characteristic scale
10 – 20 kpc



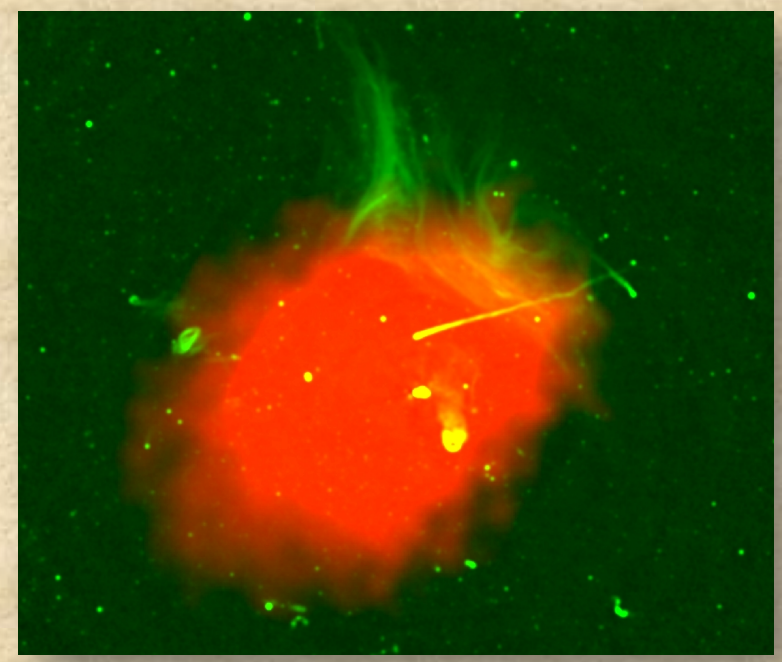
RADIO GALAXY INTERACTIONS

Narrow-angle tail & the Cold Front
If not pressure change, then ???





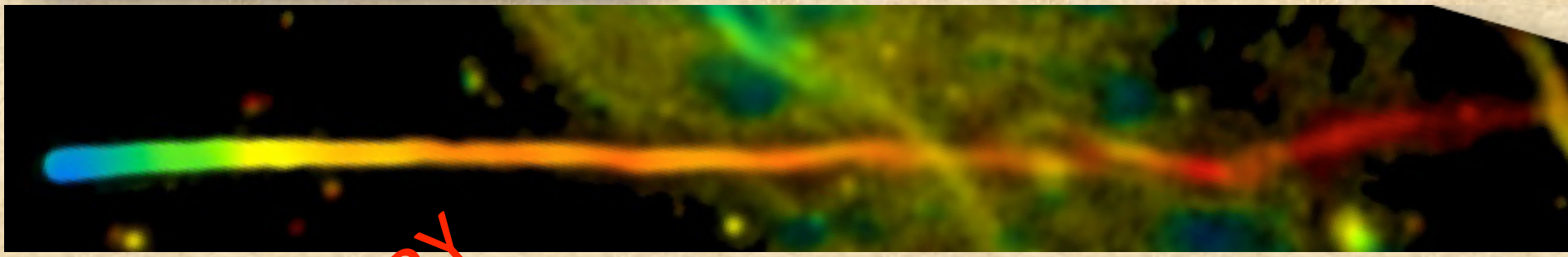
Surface brightness enhancement ~2

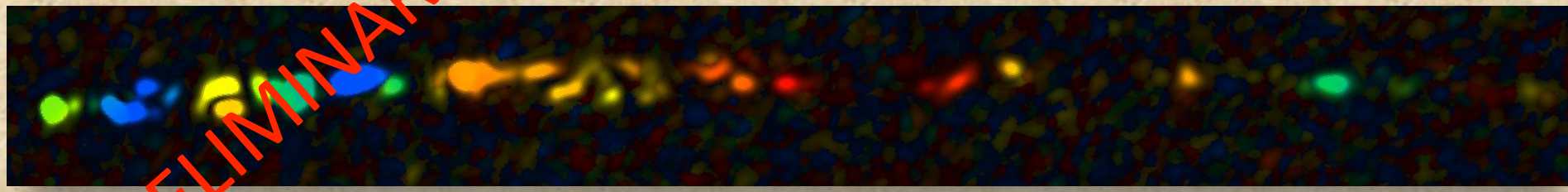


750 kpc long (projected)

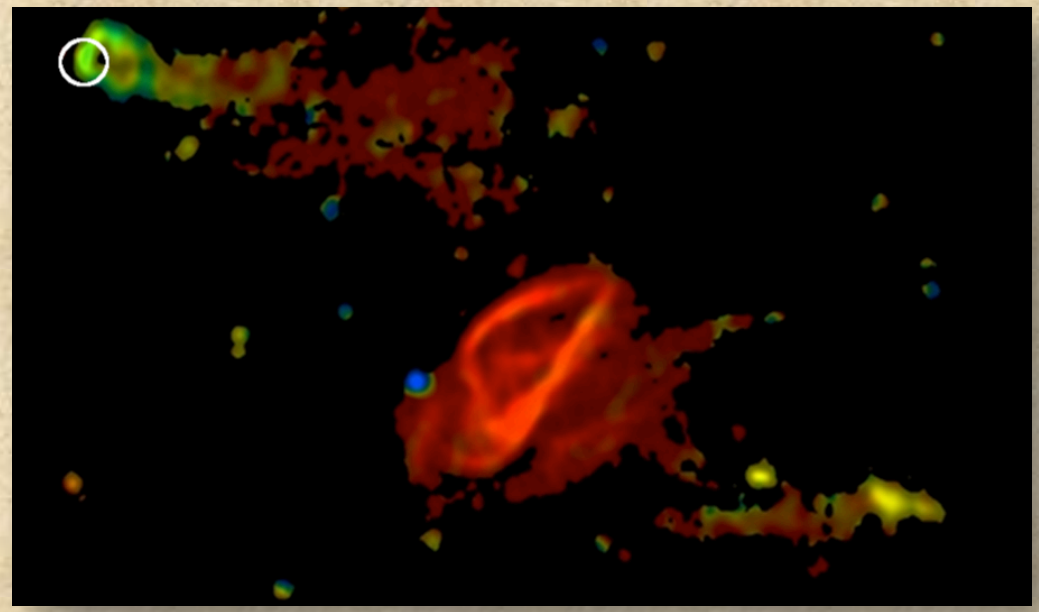
Spectral aging →

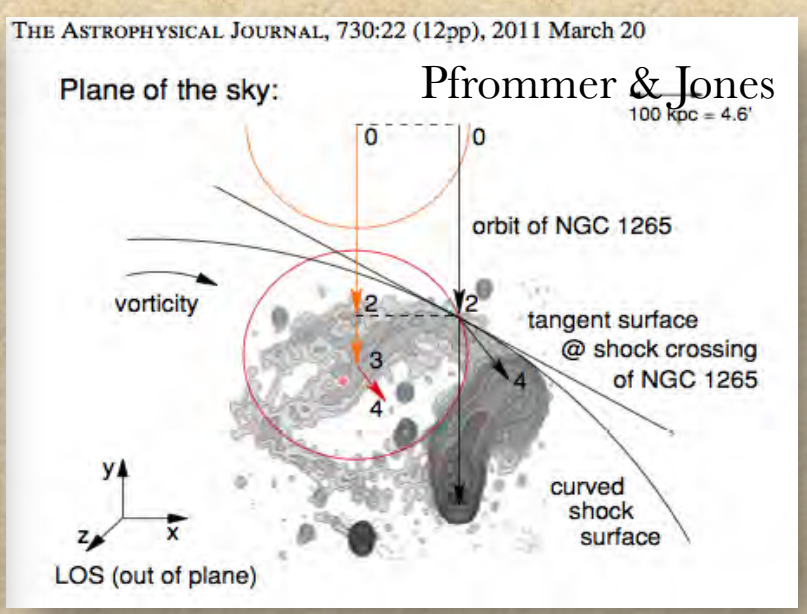
v_{flow} > 3000 km/s





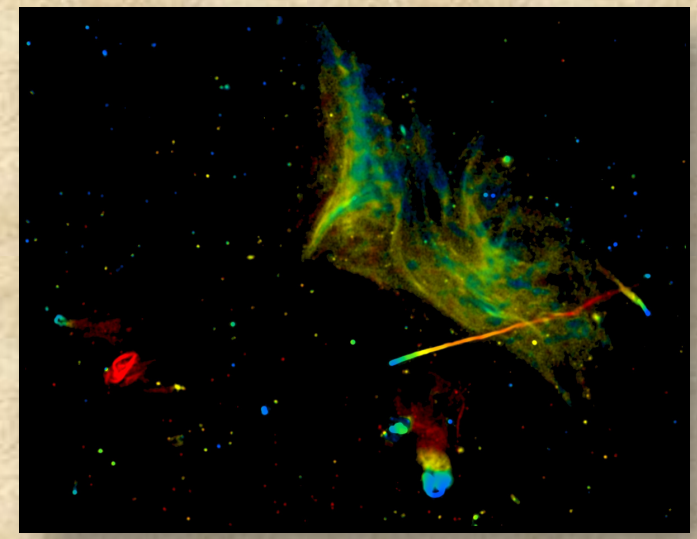
PRELIMINARY

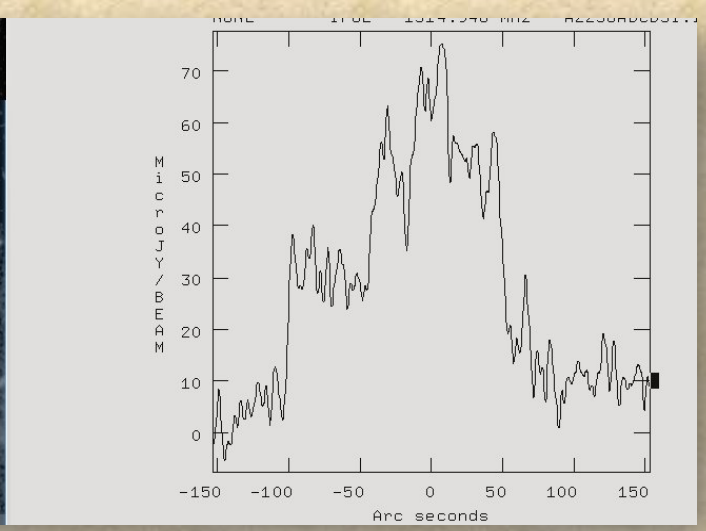



THE ASTROPHYSICAL JOURNAL, 730:22 (12pp), 2011 March 20
Plane of the sky:
Pfrommer & Jones
100 kpc = 4.6'
0
0
orbit of NGC 1265
vorticity
2
2
tangent surface
@ shock crossing
of NGC 1265
3
4
4
y
z
x
curved
shock
surface
LOS (out of plane)

One RELIC to rule them all

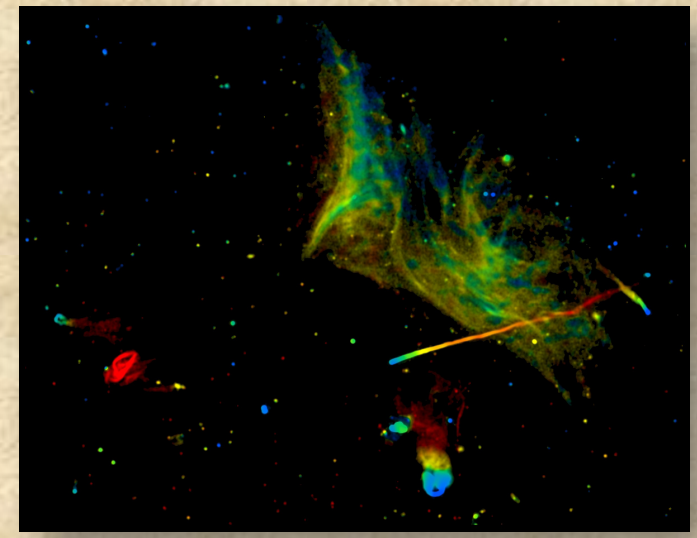
Where's the shock?

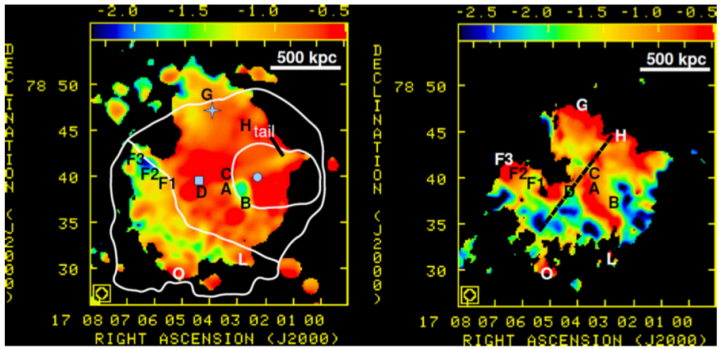




One RELIC to rule them all

Where's the shock?





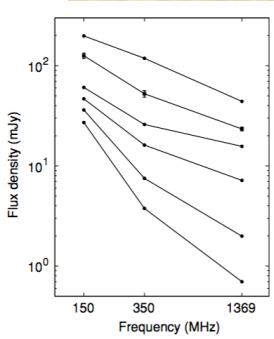


Figure 2. Gray scale (color in the online version) represents the spectral index of radio emission in A2256 between 350 and 1369 MHz (left) and between 150 and 350 MHz (right). The synthesized beam is 67″ × 67″. The symbols square, circle, and star (left panel) represent the centroids of the PC, the SC, and the Gr, respectively

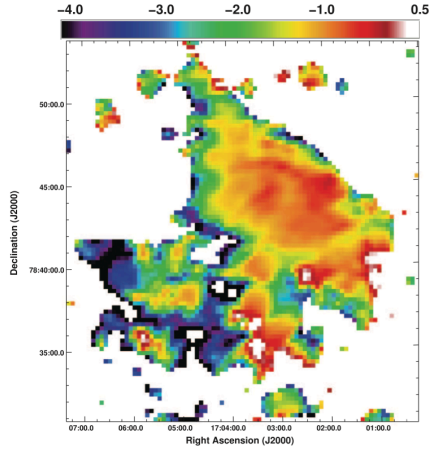


FIG. 4.—Spectral index map between 1369 and 1703 MHz. The color bar at the top runs from spectral indices of −4.0 to +0.5, where $S_\nu \propto \nu^{\alpha}$. The spectral index of

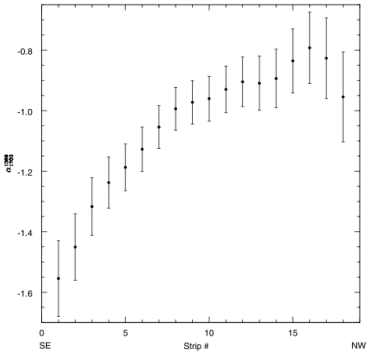
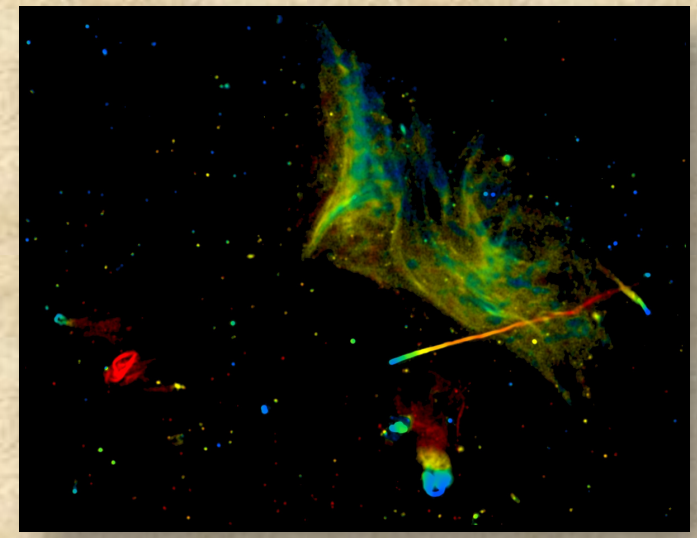
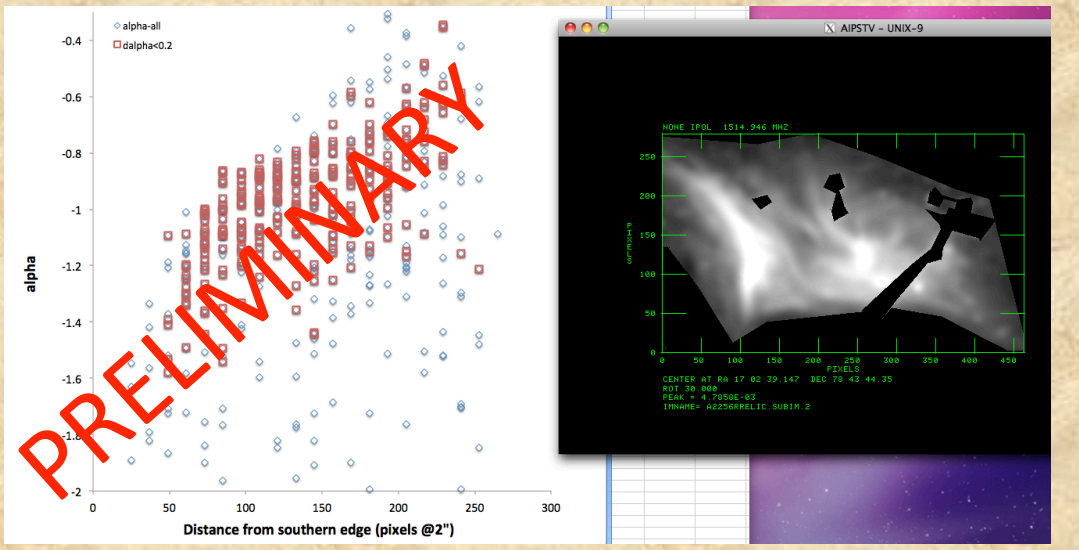


FIG. 5.—Average spectral index in 18 strips of width 6.′5 parallel to the long edge of the relic. The average spectral index in each strip is plotted for strips 1–18, where strip 1 is near the southeast relic edge and strip 18 is near the northwest relic edge. Note that while there are 18 strips plotted with the spectral index they are not all independent, as there are 3 pixels beam^{-1} and thus roughly six independent resolution elements across the width of the region used to estimate the spectral index profile. The error bars show the 1 σ errors on the spectral index.

One RELIC to rule them all

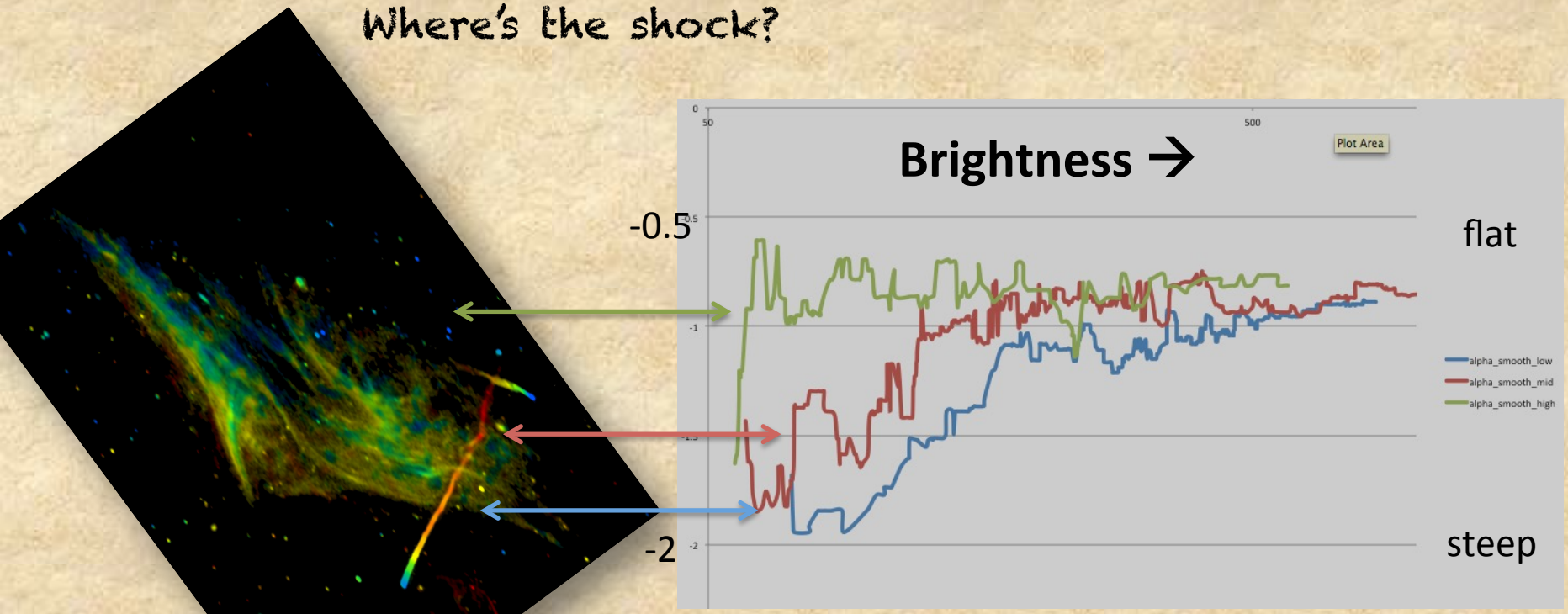
Where's the shock?





One RELIC to rule them all

Where's the shock?



Where's the shock?

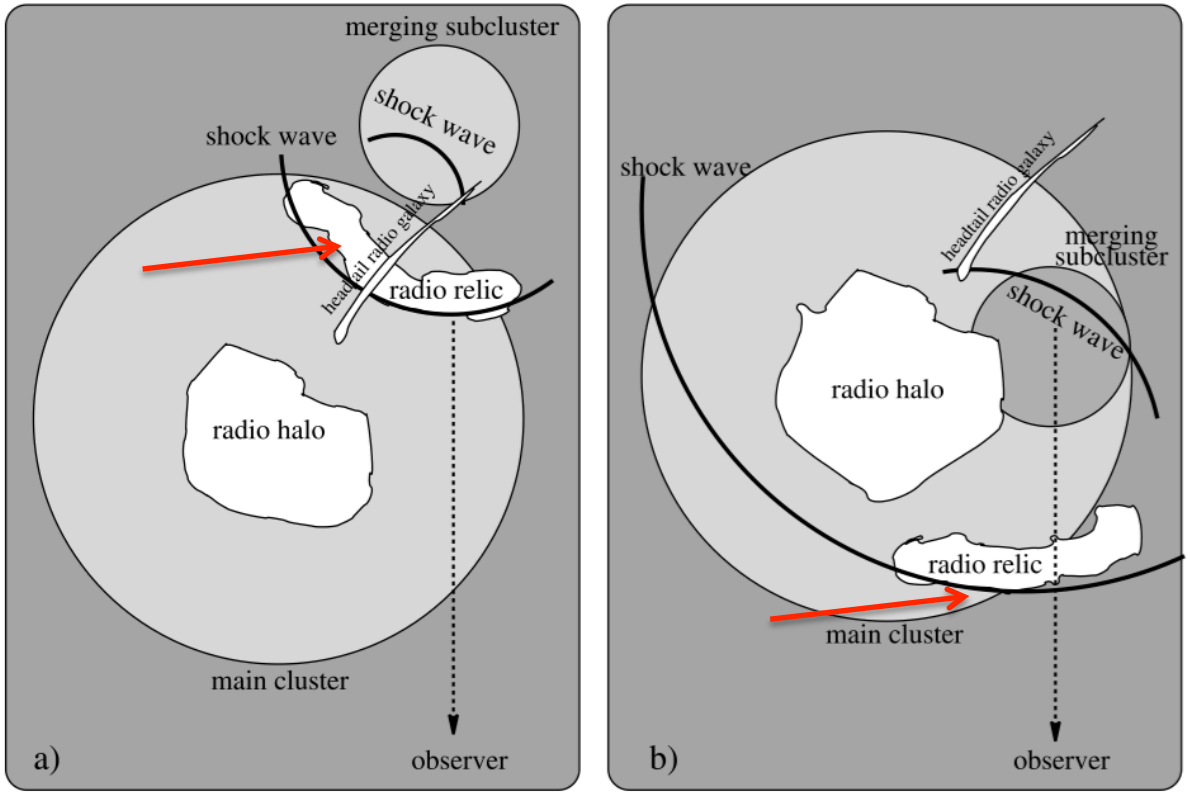
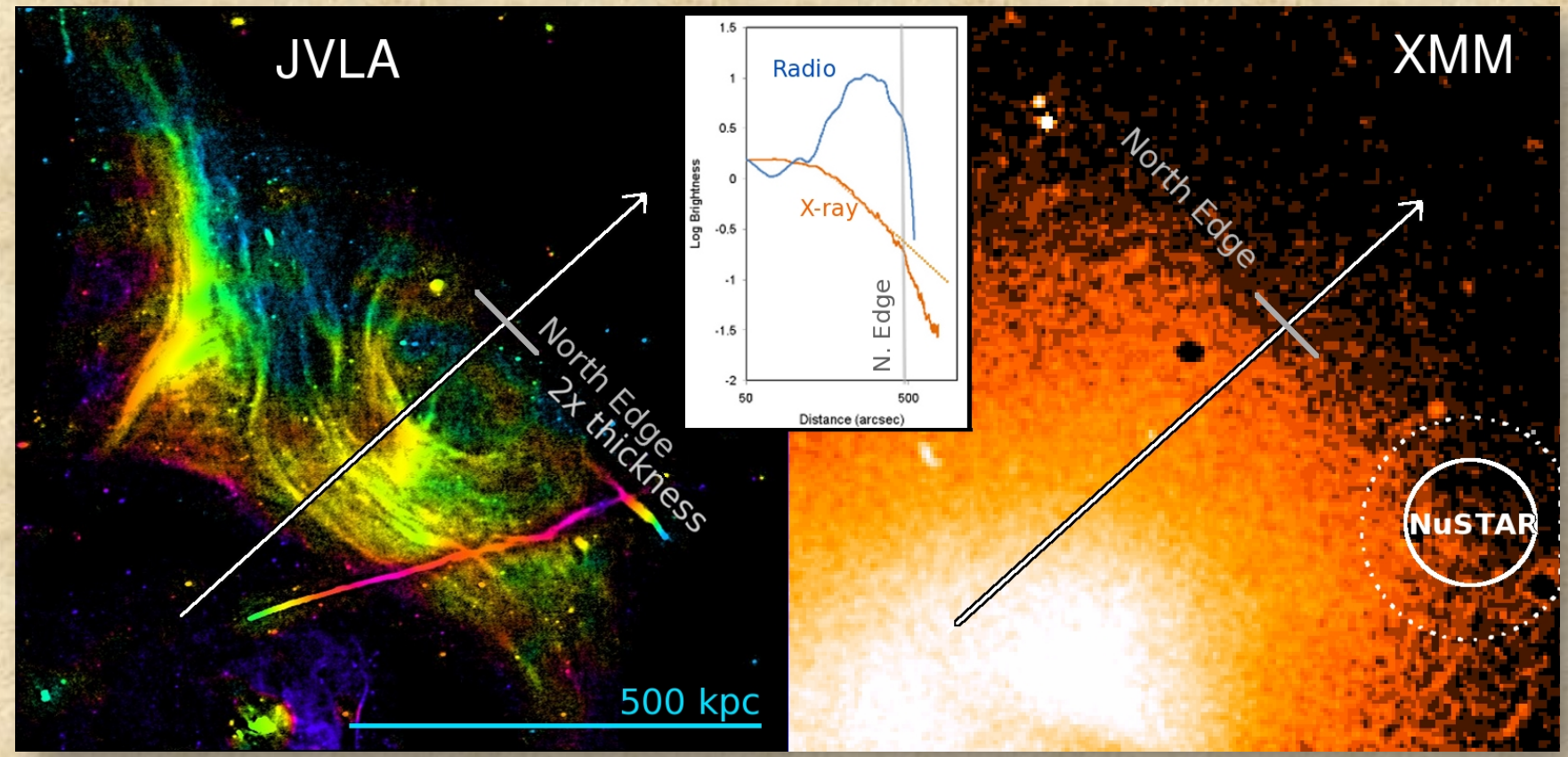
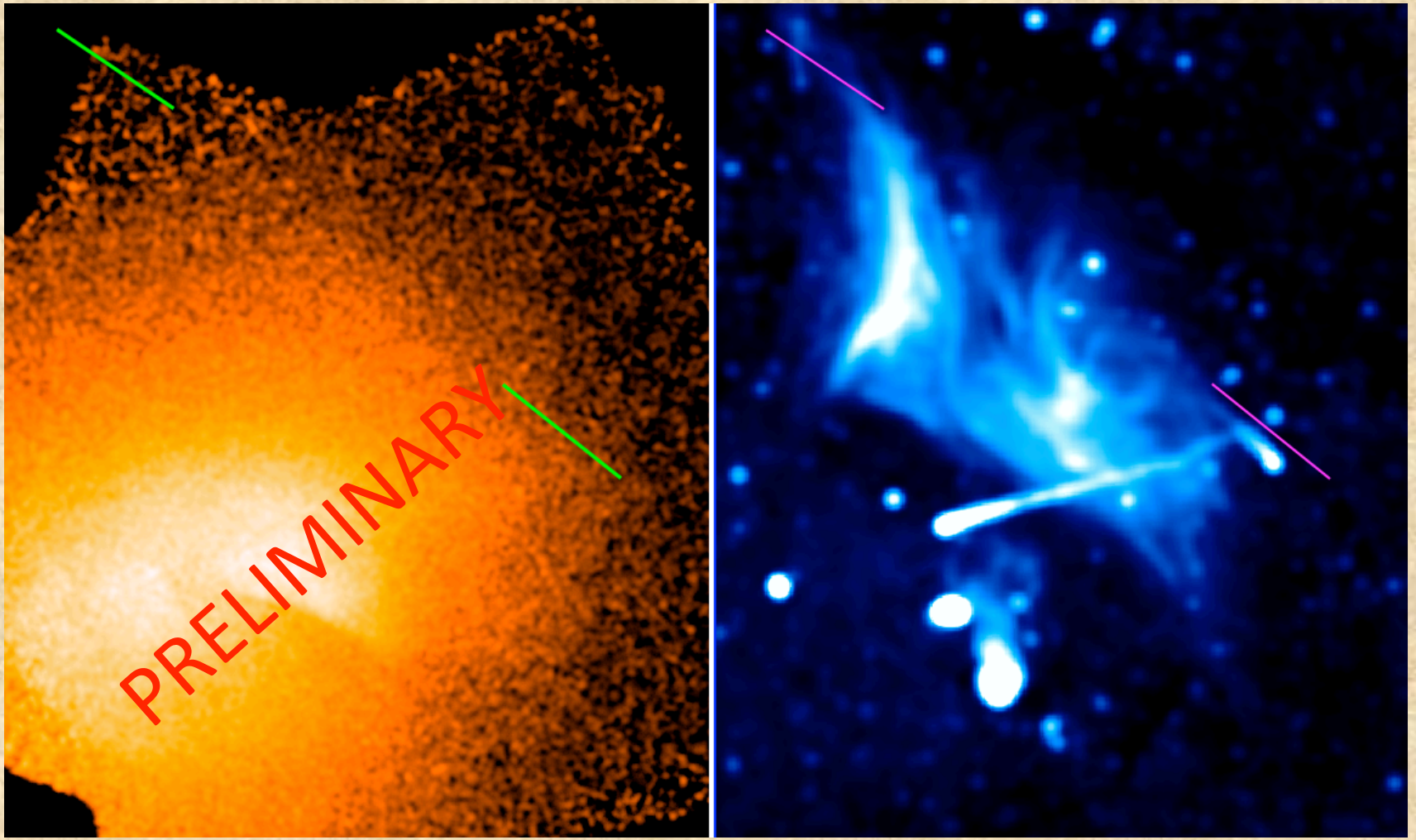


FIG. 11.—Possible geometries of the merger. Scenario *a* is an early stage of the merger, for which the shock waves have not had time to pass over the cluster cores, whereas scenario *b* is a more developed stage.

Have we found the shock?



Chandra & the shock?

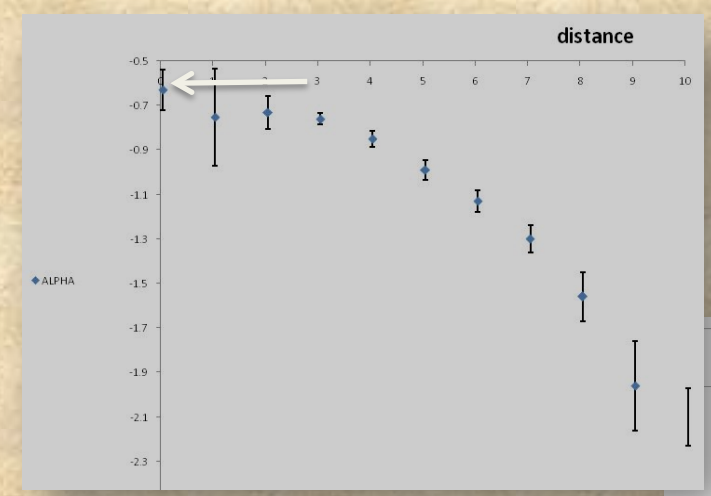


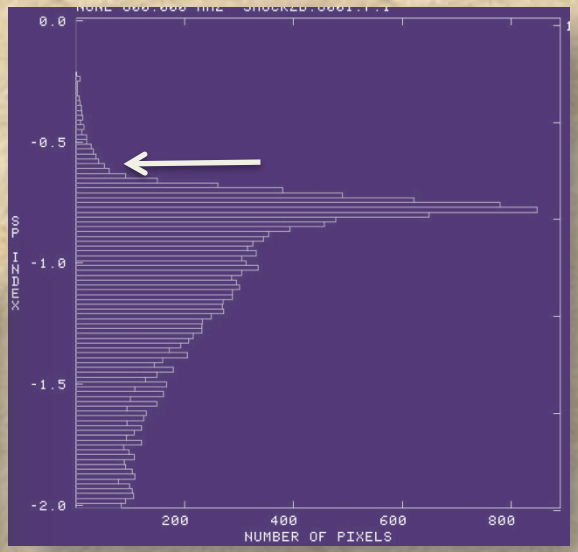
Challenges in determining low frequency index (→ shock strength)

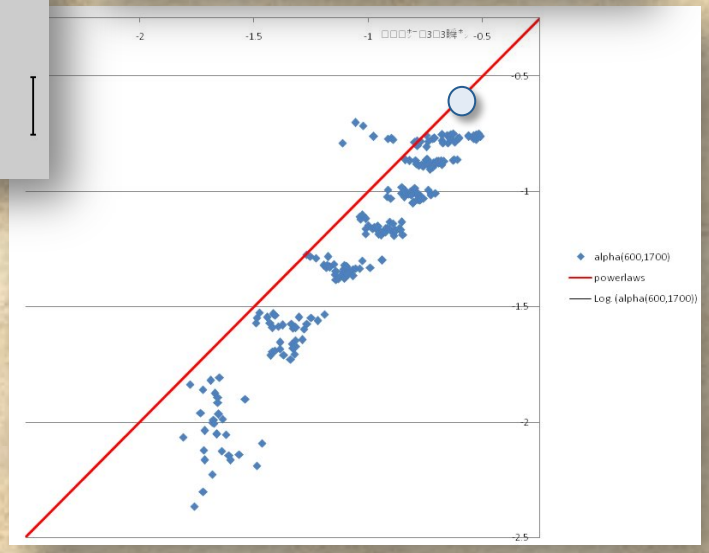
A beautiful shock – TWJ & HK

Spectral Index
Steep ← Flat

→







How will we ever sort out particle acceleration?