DEEP CHANDRA OBSERVATIONS OF PULSAR TAILS: PSR B0355+54

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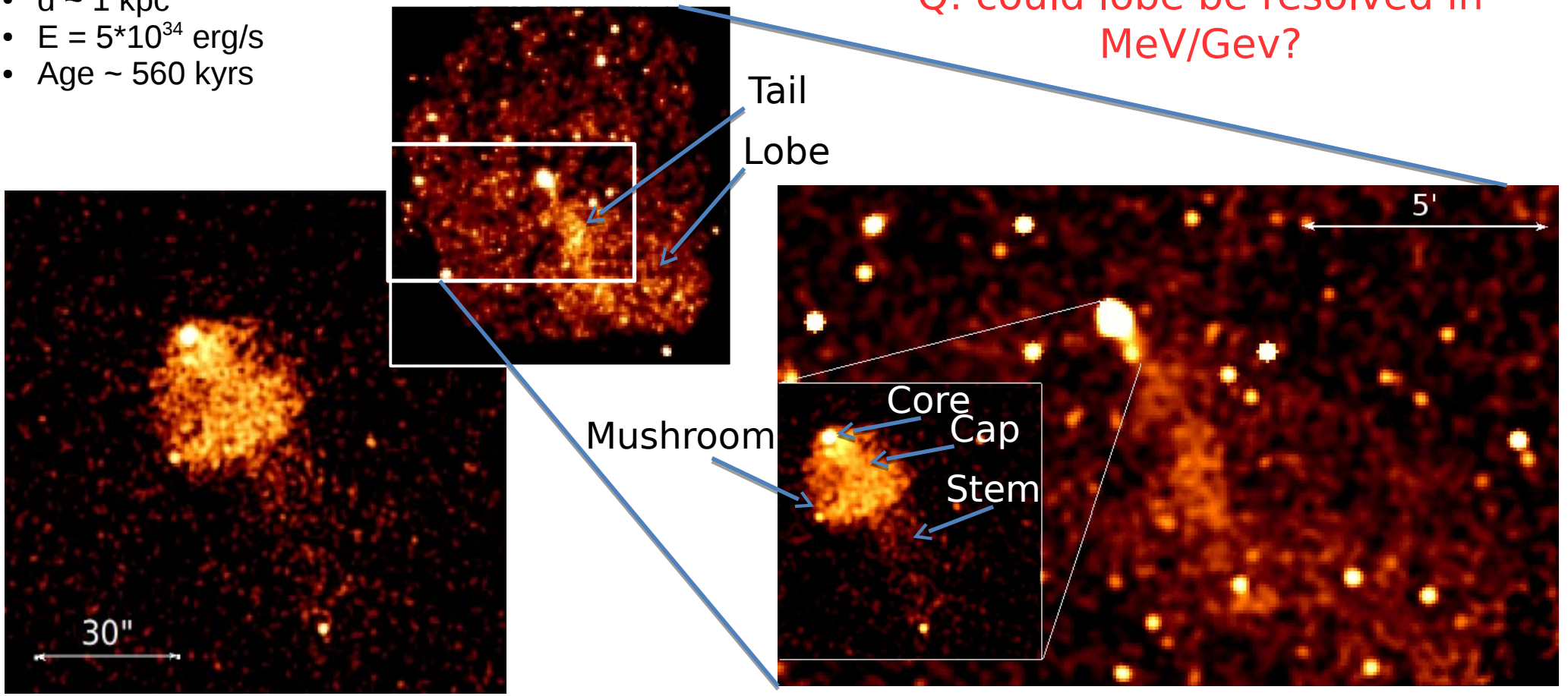
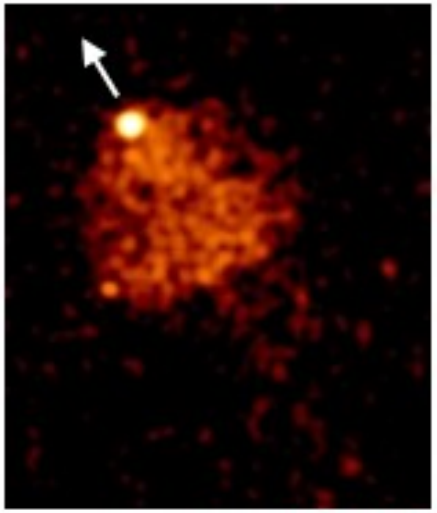
- Total observations ~ 395 ks with Chandra ACIS
- v_t ~ 61 km/s (Chatterjee et al. 2004)
- d ~ 1 kpc
- E = $5*10^{34}$ erg/s
- Age ~ 560 kyrs

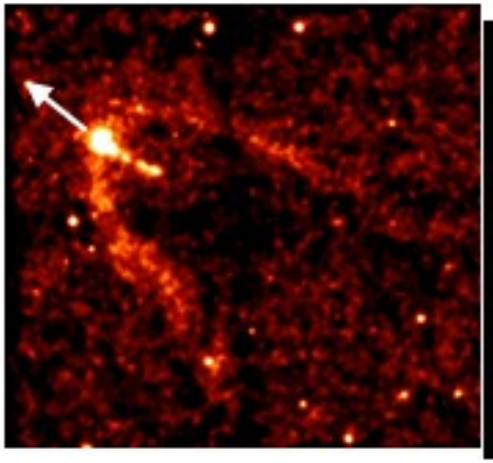
Structure on different scales

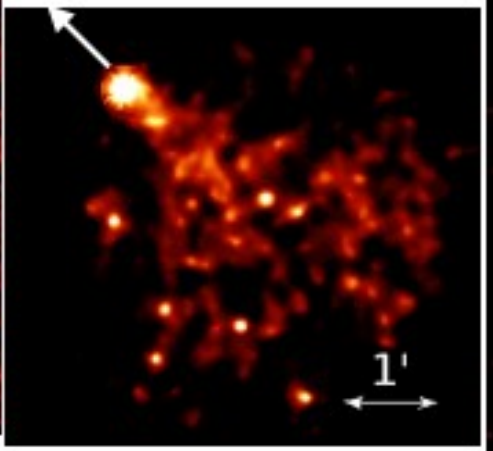
Q: could lobe be resolved in MeV/Gev?

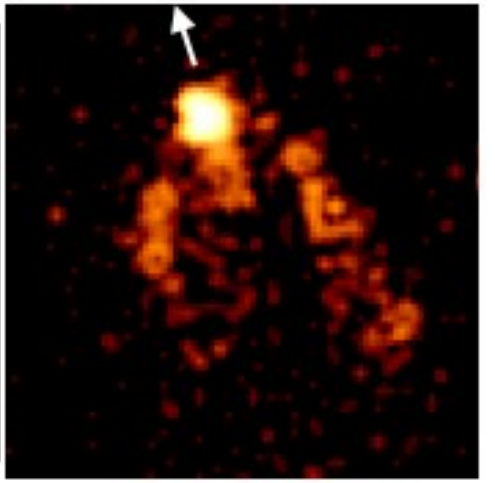


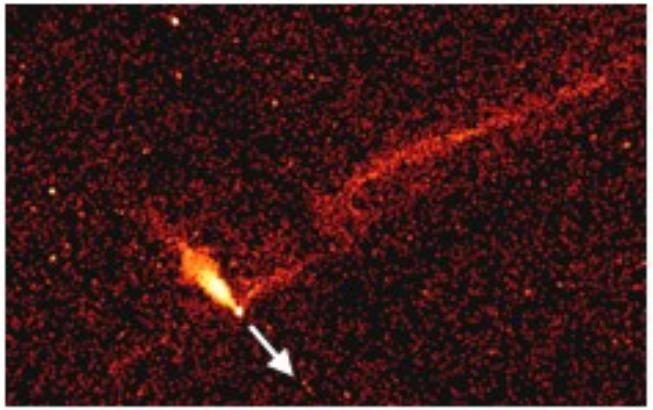
Comparison:

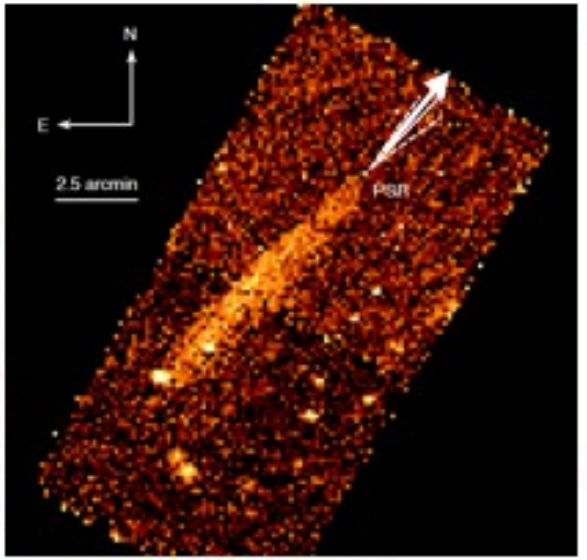


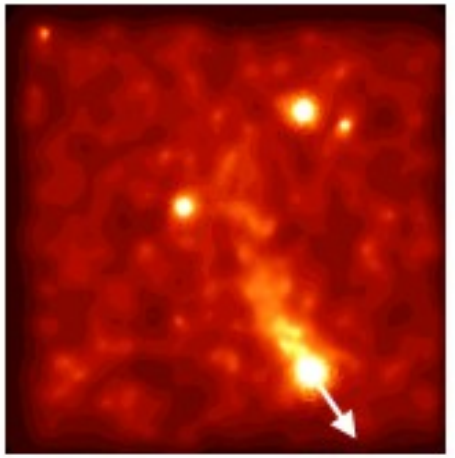


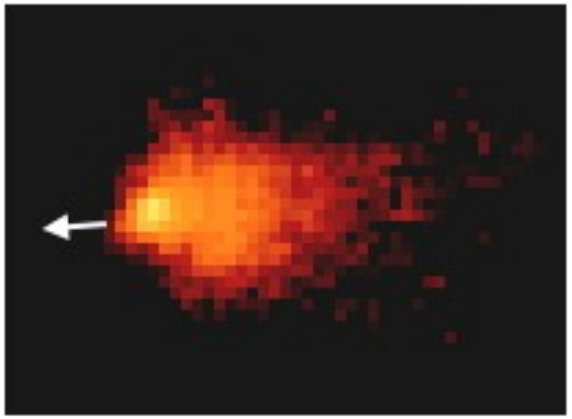


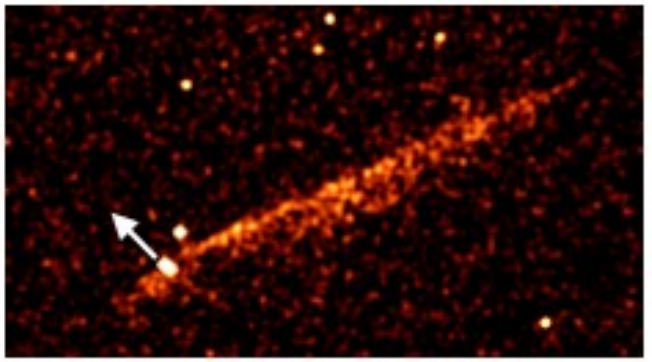


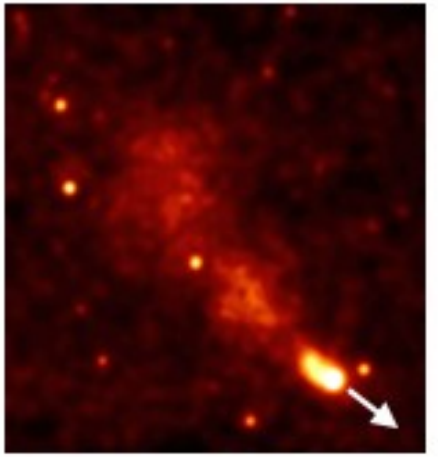










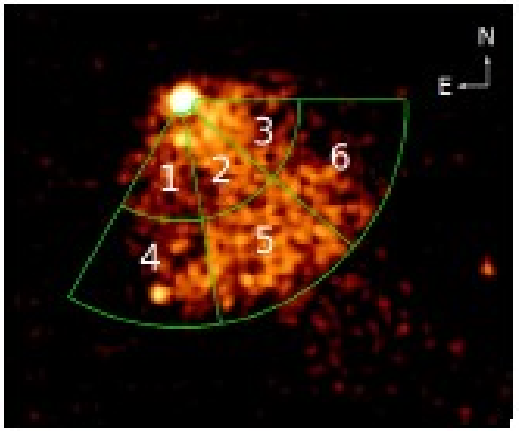


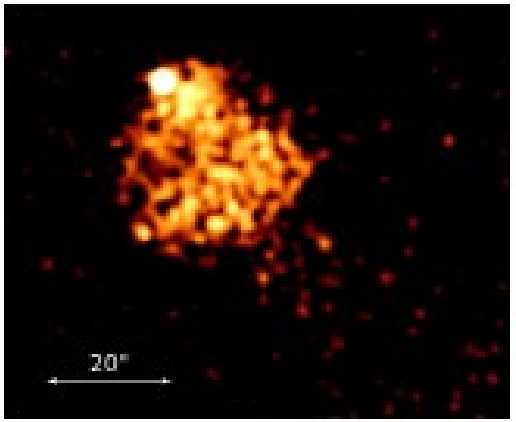
- Variability in 8 months
  - Left: All 8 observations merged
  - Center: 1st 4 obs, (135 ks) from 11/19/12 to 12/14/12
  - Right: 2nd 2 obs (134 ks) from 3/30/13 to 4/6/13

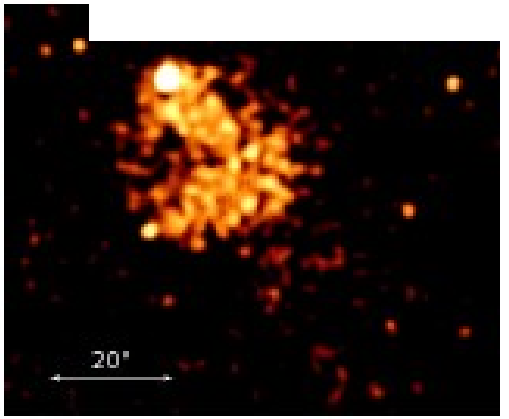
Mushroom Count Rates

Region Name	Region Number	1st Obs Flux ($\times 10^{-9}$)	2nd Obs Flux ($\times 10^{-9}$)	Percent change[1]
Near Left	1	9.52 ± 0.93	6.87 ± 0.82	$-27.87\% \pm 3.7\%$
Near Mid	2	12.7 ± 1.07	12.5 ± 1.10	$-1.97\% \pm 0.24\%$
Near Right	3	12.7 ± 1.07	10.1 ± 1.03	$-20.5\% \pm -2.4\%$
Far Left	4	5.81 ± 0.46	5.19 ± 0.47	$-10.6\% \pm 1.2$
Far Mid	5	12.2 ± 0.66	11.9 ± 0.72	$-2.0\% \pm 0.17\%$
Far Right	6	6.39 ± 0.66	5.08 ± 0.46	$-20.58\% \pm 2.2\%$
Background		0.803	0.817	-1.3%

[1] (Final-intial)/initial
[2] Count rates restricted to 0.5-7.0 keV energy range







Summary of Results

- Spectral fit for each PWN region with absorbed power-law
- Core: 1.73±0.09, Mushroom: 1.42±0.09, Tail: 1.65±0.08, nH: $0.54*10^{22}$ cm^{-2}
- Divided tail into 2 sub-regions: modest cooling along tail ($\Delta\Gamma \sim 0.2$) up to 5' from psr

Questions

- Can lobe/tail or other structures be resolved in MeV/GeV?
- Possible time variability in higher energies and similar timescales?