RX – J0852-4622

the nearest historical supernova remnant

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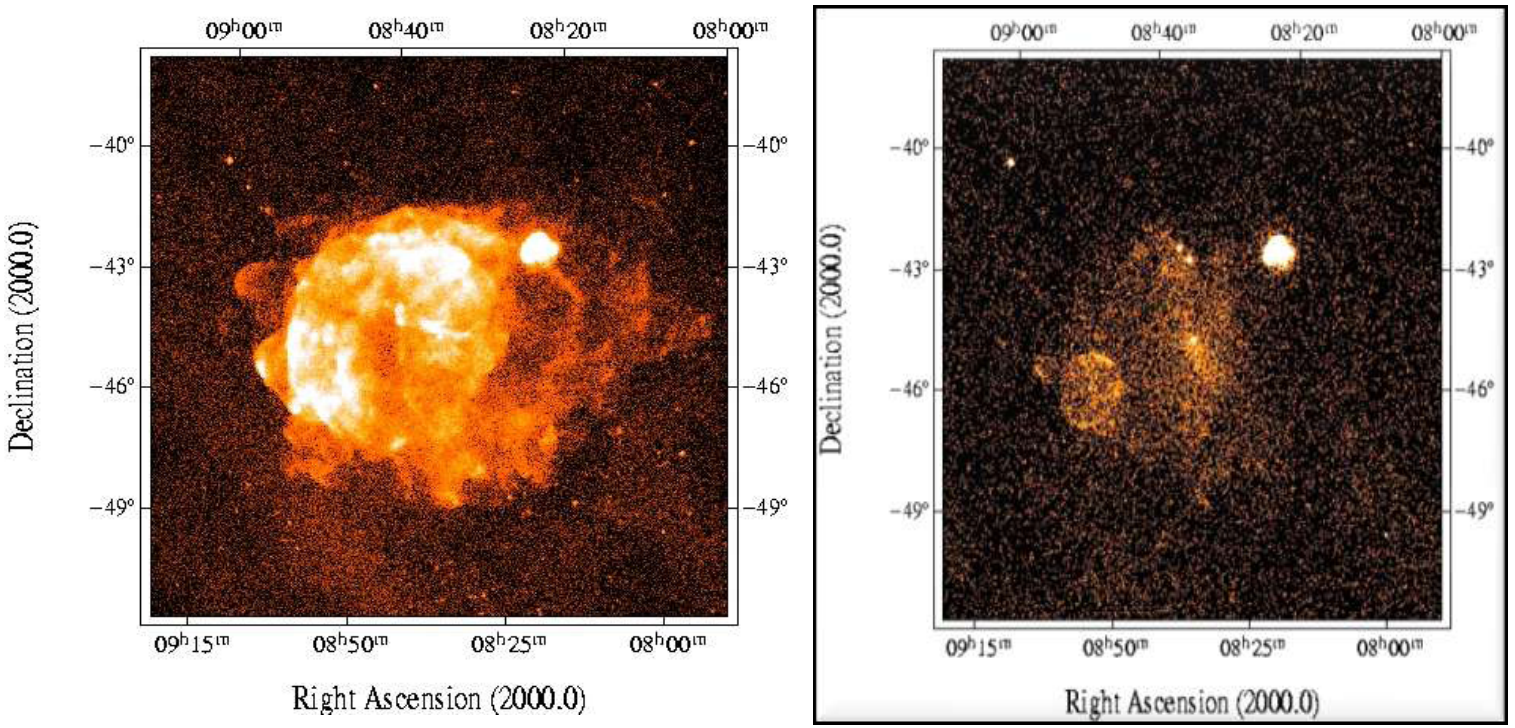
Vela SNR in X-rays (Aschenbach, 1998)

soft X-rays

hard X-rays



2 suggestions for RX-J0852-4622 (Vela jr.) emerged:

near (200 pc), young (680 yrs)

vs.

distant (>750pc), middle-aged (1700 [1000 – 3000] yrs) SNR

both based exclusively on the X-ray measurements

SUMMARY OF MEASUREMENTS

radio (GeV electron synchrotron)

soft X- rays (apparently missing)

hard X-rays (TeV electron synchrotron)

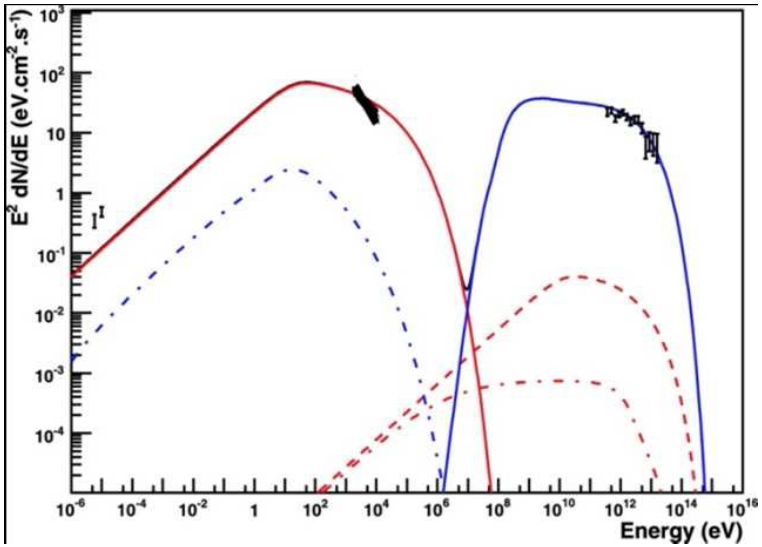
MeV γ-ray line radiation (radioactive Ti, Al, and Ca; low significance)

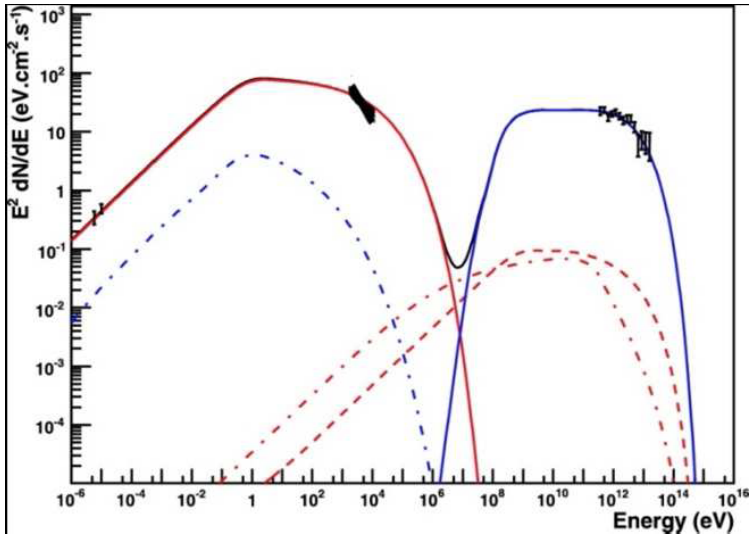
GeV γ-ray continuum (consistent with hadronic origin)

TeV γ-rays (hadronic origin; i.e., hadronic cosmic ray collisions with ambient matter)

BROAD BAND SPECTRA COMPARED WITH HADRONIC MODELS

(Aharonian et al., 2007)





near (200 pc, n_a = 0.2 cm^{-3})

distant 750 pc (n_a = 2.0 cm^{-3})

common feature (near&distant): large discrepency (spectral shape/slope) in the X-ray band

can this be recovered?

2 key X-ray measurements:

1. size: radius r = 1^o
2. expansion velocity: 0.84´´/yr (+/-) 18%

ie, for d = 750 pc R = 13 pc & v_s = 3000 km/s
(10 keV X-ray emission!?)

involved mass = 500 M_O
ie. Sedov type (adiabatic) SNR,
age = 1700 yrs, explosion energy $E_o = 5x10^{52}$ erg
(eq. 50 SN) !!!!
SN explosion in cavity proposed
but what process cleared the space to an
almost perfect spherical empty bubble?

distance is a problem

(d < 450 pc, t < 2100 yrs, problem solved for adiabatic expansion)

for d = 200 pc R = 3.4 pc & v_s = 800 km/s (kT = 0.86 keV)

involved mass <0.8 M_O

ie., no Sedov type remnant, but free expansion or explosion in stellar wind

for t = 680 yrs v = 4900 km/s & $v_{s,exp}$ = 3100 km/s from stellar wind model

ratio of v_s and $v_{s,exp}$ requires rapid slow down of v by x4

achievable by rapid density increase by x16 (pressure equilibrium)

model: explosion in low density stellar wind interacting with either an earlier stellar envelope ejection or with the base of a preceeding red supergiant wind (expected from stellar evolution theory)

requirements for Vela Jr.: $(dM/dt)/v_w < 10^{-6} M_O/300$ km/s

consistent with wind properties of a blue supergiant (c.f. , SN 1987A)

increase by a factor of ~ 200 of $(dM/dt)/dt)/v_w$ (consistent with properties of red supergiant wind) are sufficient for the deceleration

remark: 0.86 keV,

close to temperatures of Vela, ie. no spectral discrimination possible,

X-rays easily mixed up, proper background estimate impossible

(aggrevated by the high surface brightness of Vela in the area of Vela Jr.,

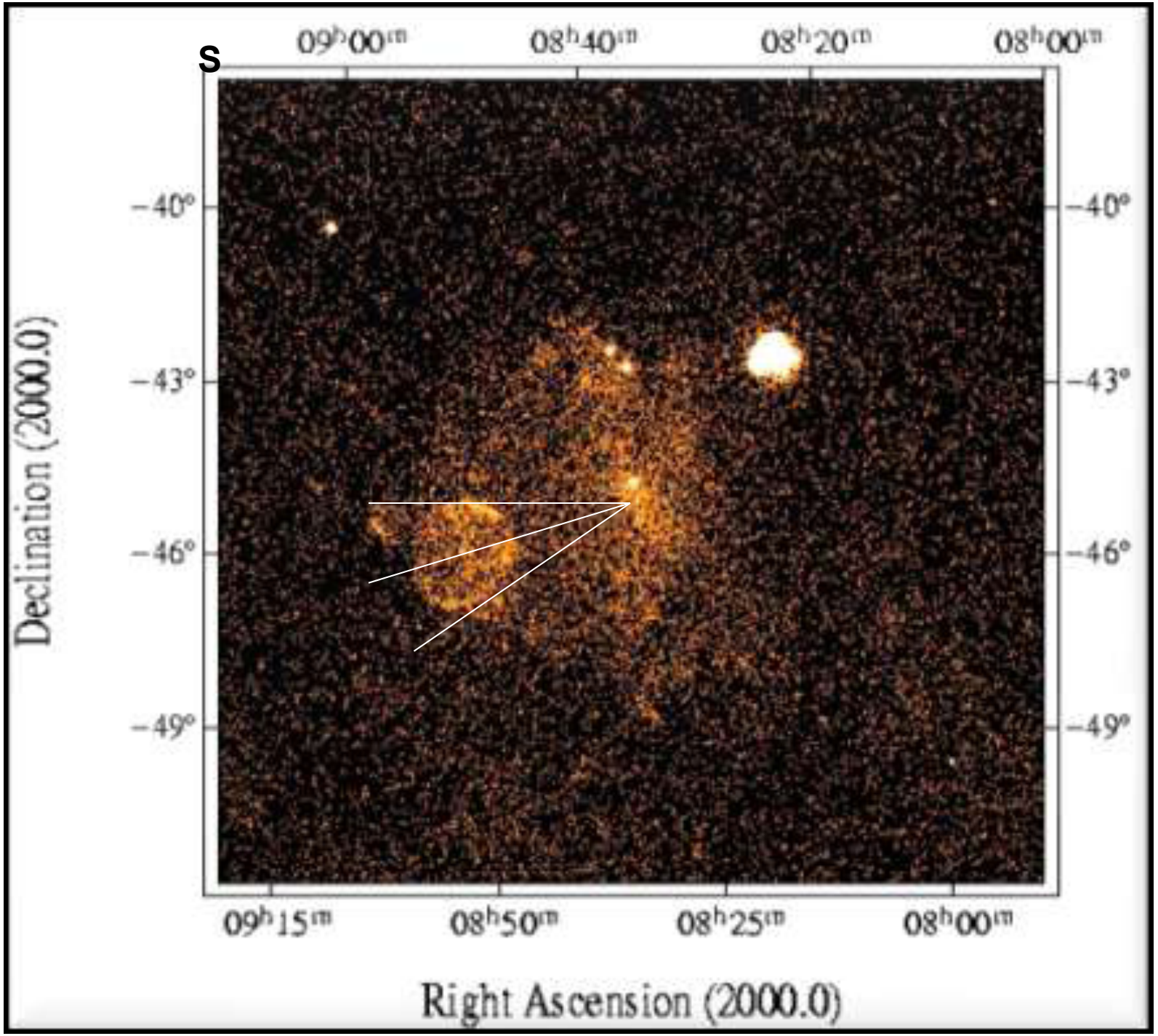
what is the Vela Jr. contribution? – soft thermal plasma emission from the shocks may not be missing)

CONCLUSION

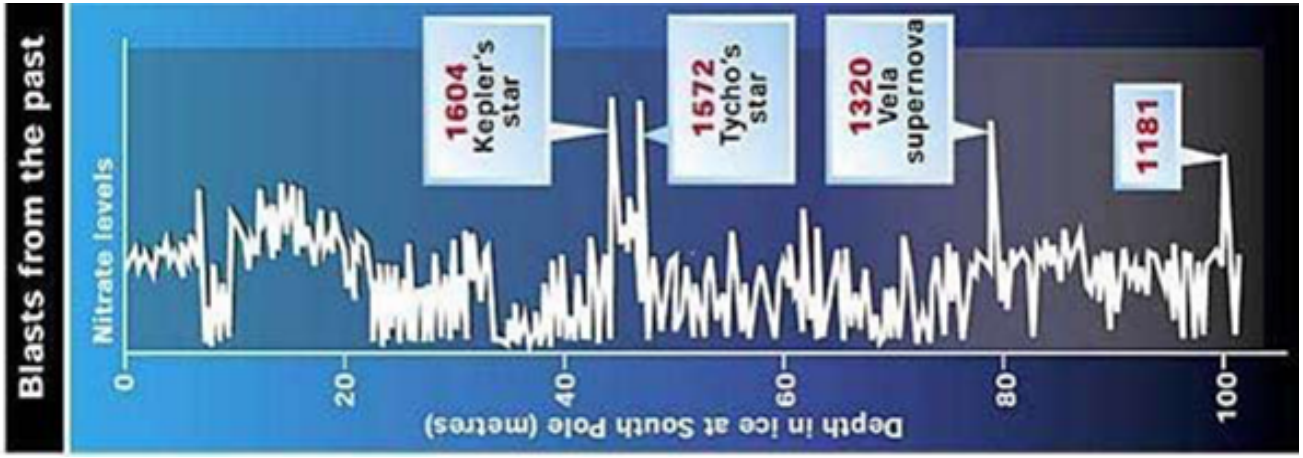
the model Vela Jr. distant and middle-aged has serious energy problems
for the nearby and young model scenario constistent with SN & SNR knowledge works

review the X-ray data with the possibility to also cover the radio data
(suggestions available, moved to discussion)

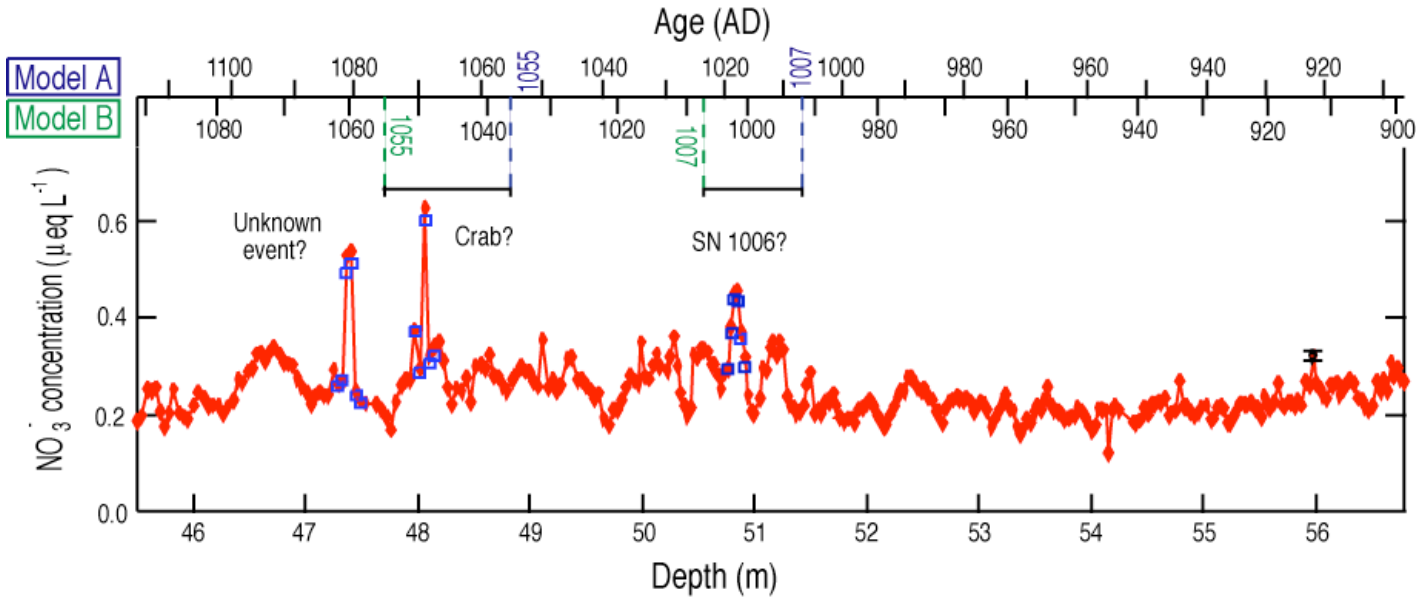
these conclusions depend very sensitively
on the ambient matter densities derived from the TeV measurements


S
09h00m
08h40m
08h20m
08h00m
−40°
−43°
−46°
−49°
Declination (2000.0)
09h15m
08h50m
08h25m
08h00m
Right Ascension (2000.0)

artic ice core (Burgess & Zuber, 1998)



antartic ice core (Motizuki et al., 2009)



support II

Great Zimbabwe Monument (SN sighting? 1248 – 1350)