Supernovae Remnants with Astrosat

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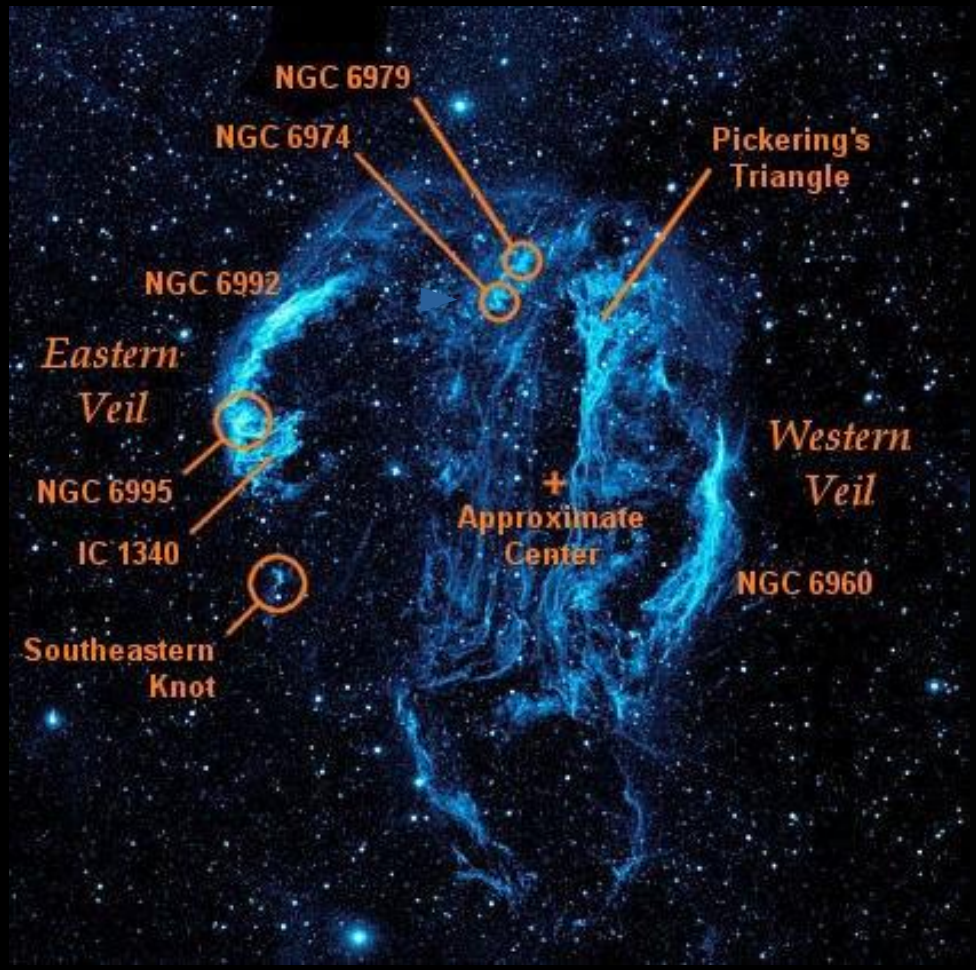


The Cygnus SNR in GALEX / NUV band. ►

Image credit: NASA

Why study SNRs? Because they are there!

(SNRs) play a vital role in many area of astrophysics.

Enrich the ISM with newly nucleosynthesised material from Sne. Responsible for the dynamics and kinematics of gas in the ISM, leading to star formation, formation of super bubbles, galactic outflows..

May be sites for Galactic, ultra-high energy cosmic rays ($E \simeq 10^{14}$ eV) via diffusive shock acceleration in forward shock.

Constrain models of late time shock - ISM interaction,

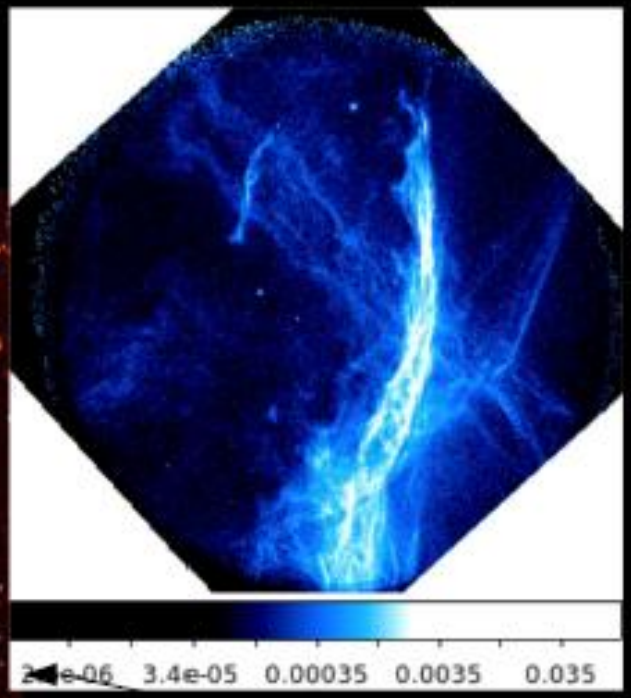
Provides an insight in to the evolutionary state of the pre-SN progenitor and its CSM.

Deep (up to Msec) Chandra x-ray imaging of several SNRs highlighted several complex phenomena, both resolving and raising questions about the nature (clumpy, gaseous, or dusty) and the physical properties of the ISM.

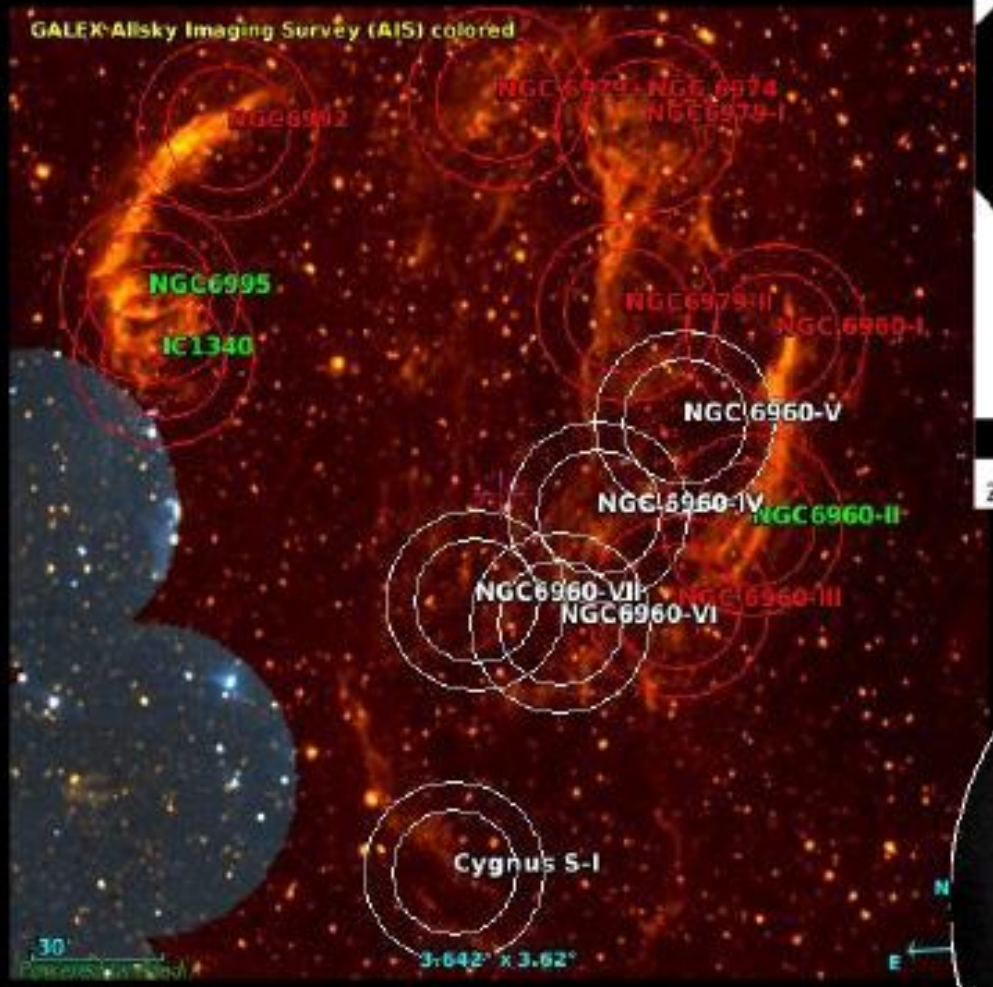
For SNRs that are both optical and X-ray bright, it is important to complement the high temperature ($10^{6\text{-}7}$K) phenomena with UV imaging, sampling regions of $10^{4\text{-}5}$ K gas both in filaments and other interacting medium.

The (planned and observed) UVIT observations:

▼NGC 6960-I (F155)



▲NGC6995 (F155)

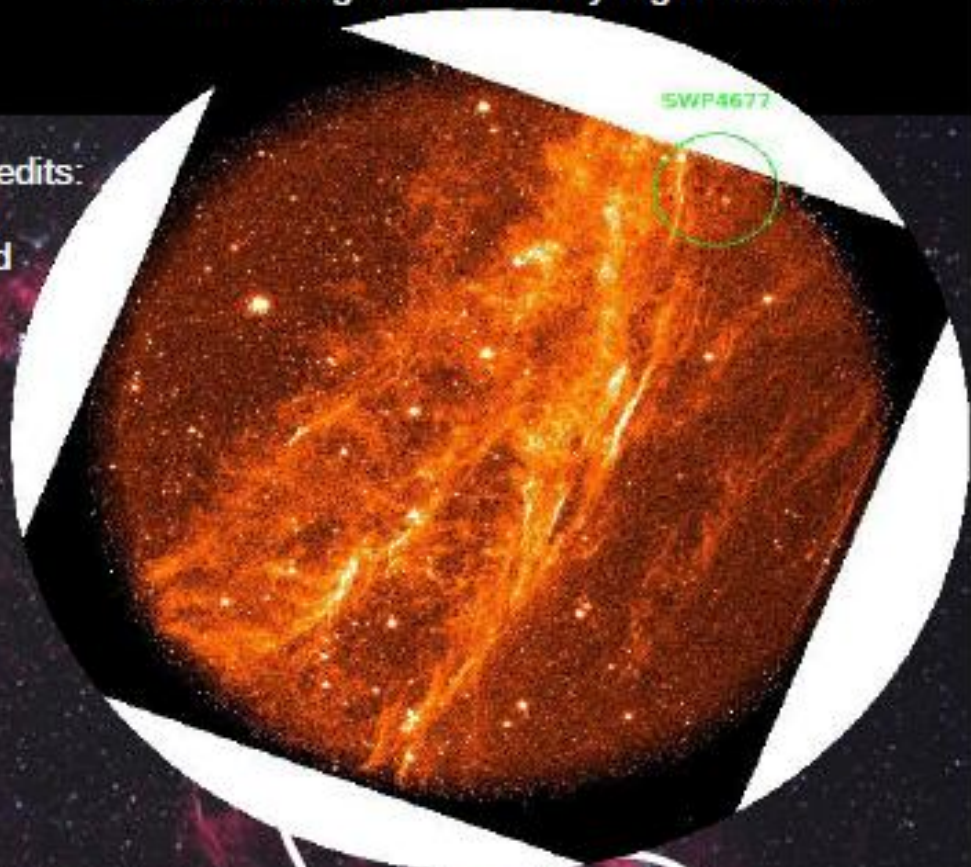


▲IC1340 (F155)

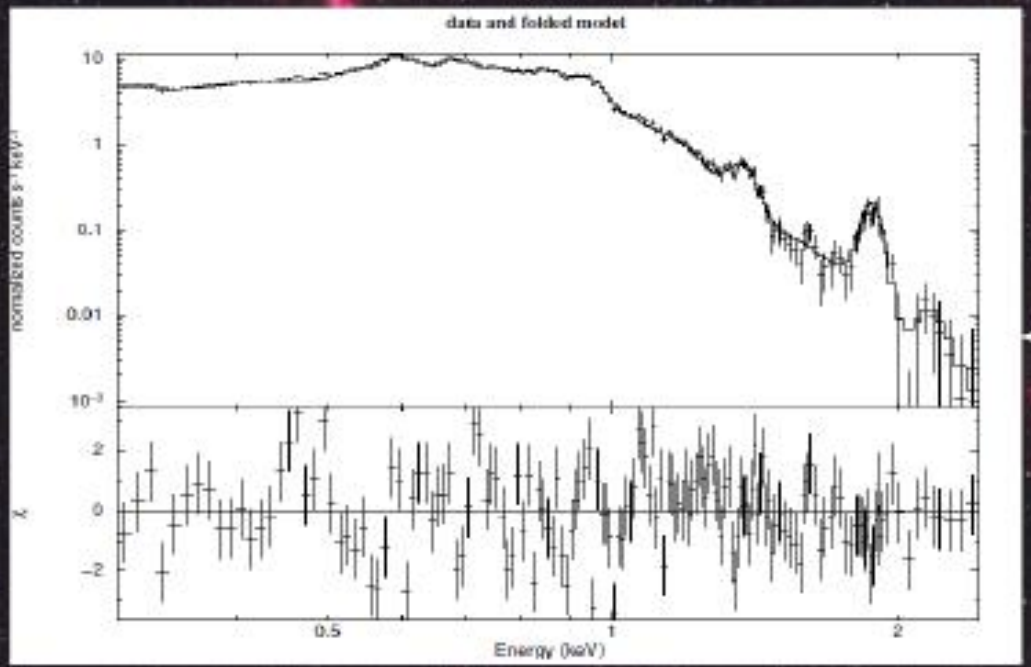
NGC 6960-II ►

RGB image (F155 + F161 + F170)

▼N279 image dominated by MgII emission.



UVIT Images credits: Sutaria, Murthy, Singh, Ray, and Rao. Kumar

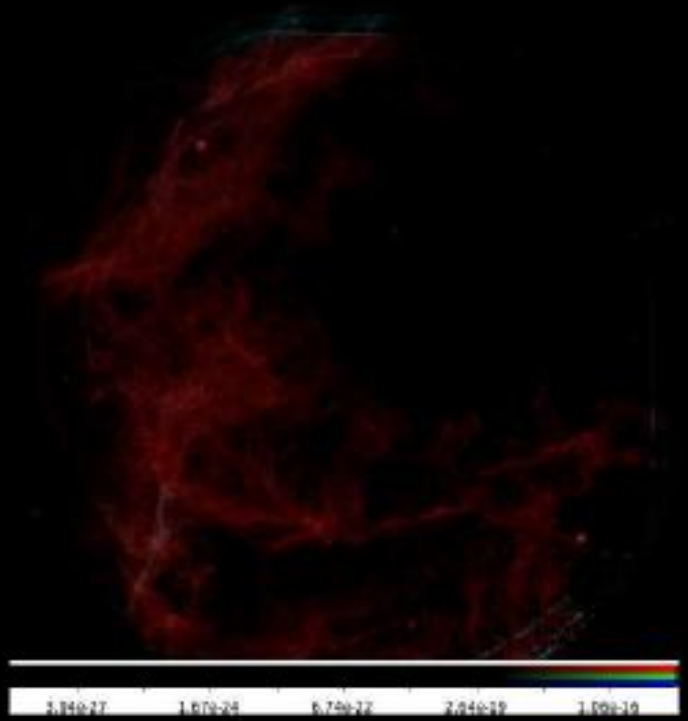


▲Hα + OIII +RVB image
Credit: Steve Cannistra.

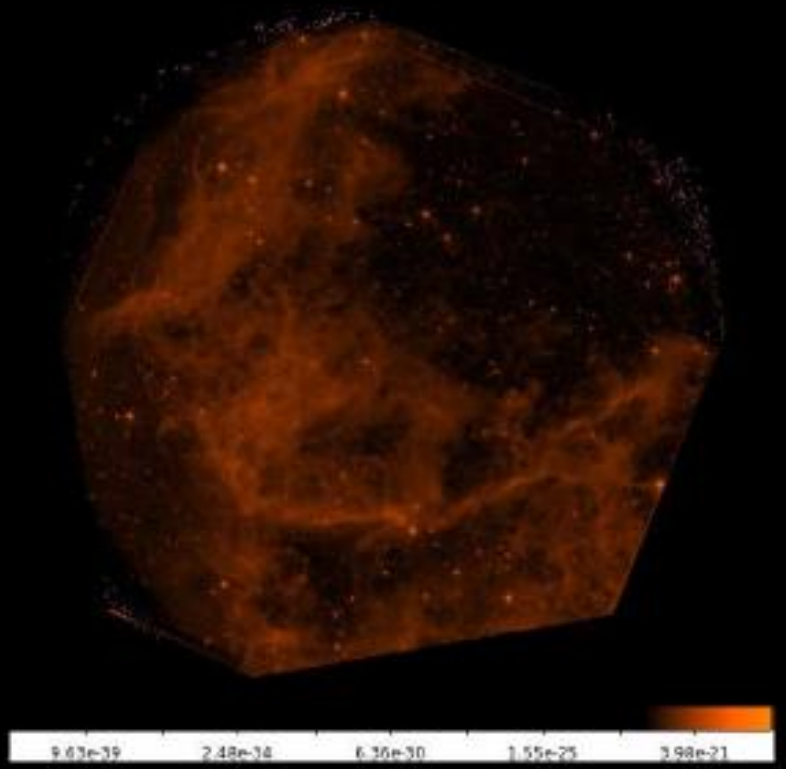
◄SXT spectrum best fit by two termparure component plasma model **(K. P. Singh, Sutaria , Ray, Murthy, Rao, Kumar).**

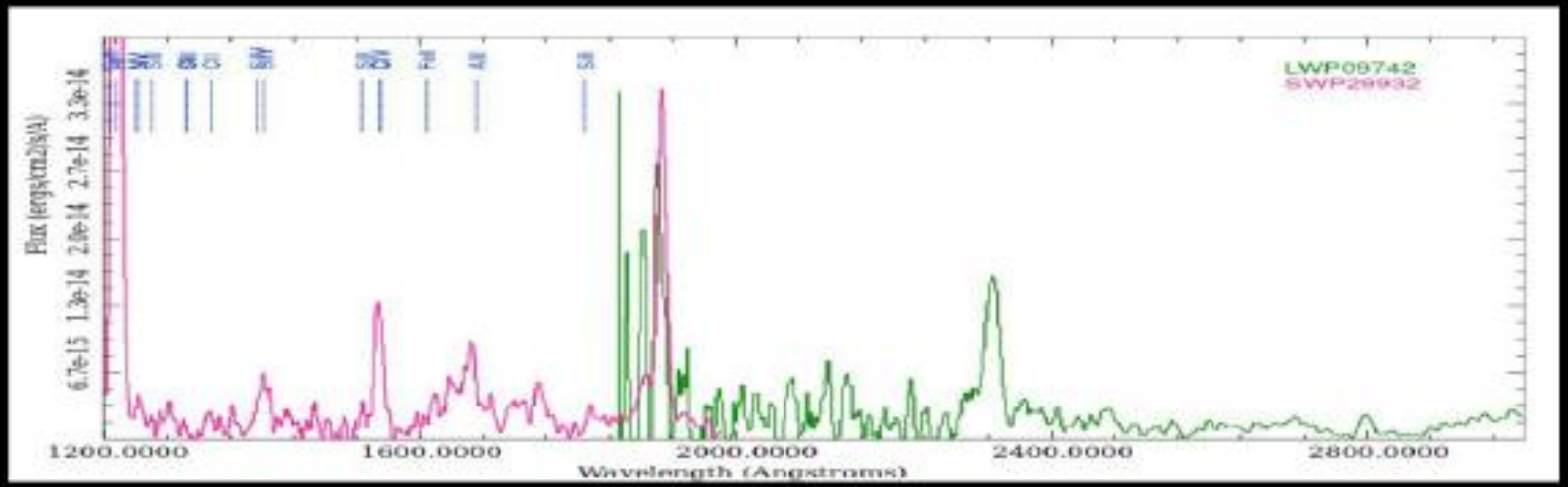
Spectral morphology of NGC 6995 – IUE & UVIT

R(1660 – 1780 A), G (1460-1660 A)
and B (1380-1660 A) composite of NGC6995.

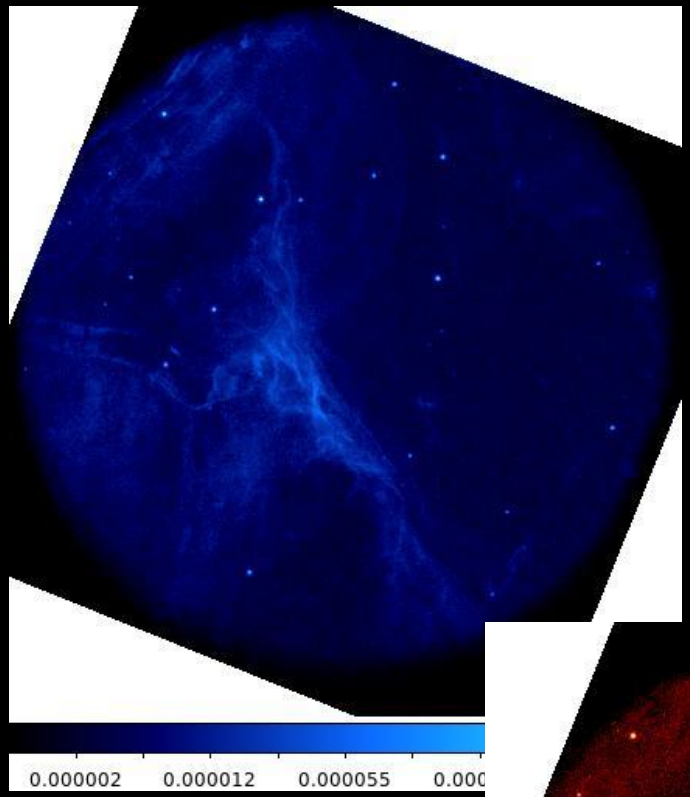


The same field in the (2750-2800 A) band.



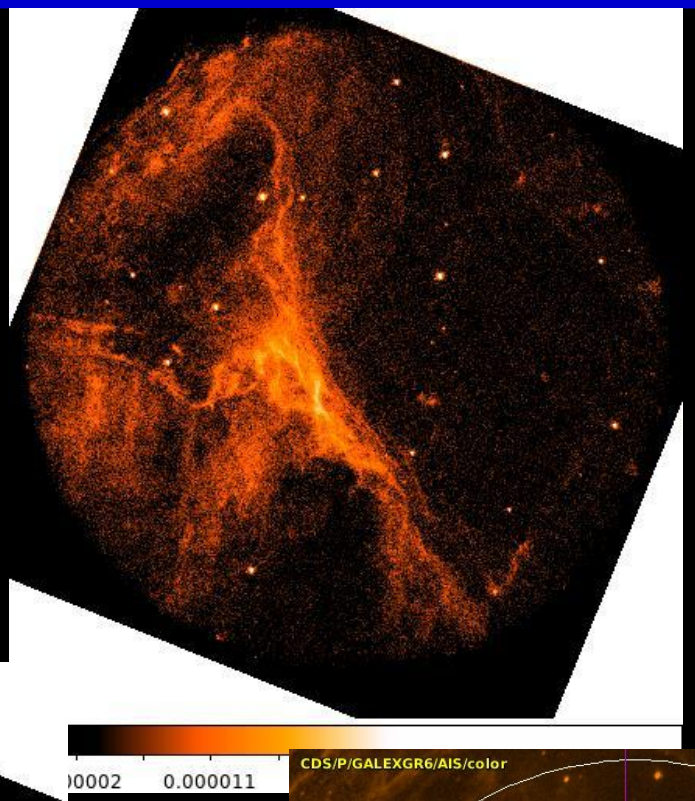


The southern segment of NGC6960 (segment-VIII)



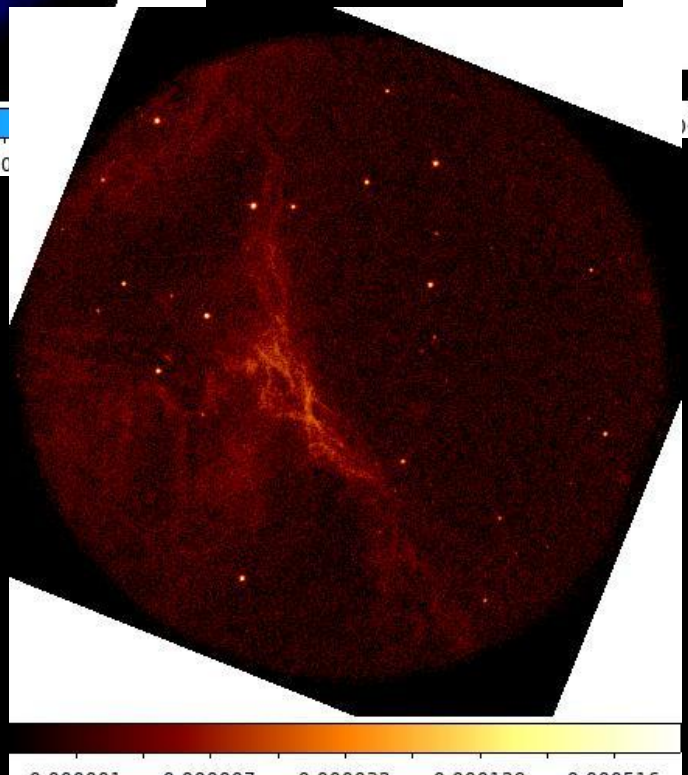
F169W (~1500 – 1750 A) ►

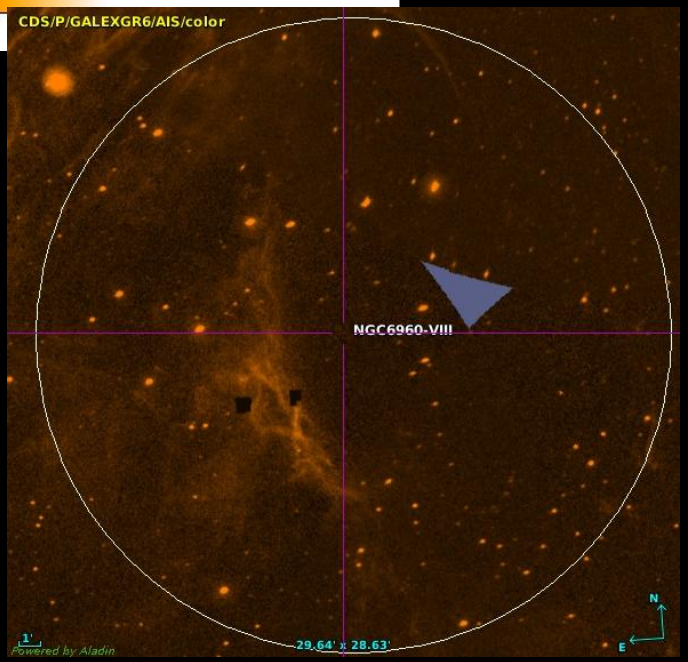
F172W (~1680-1750 A) ▼



Galex NUV (1770-2831 A)

▲ F154W (~1400 – 1750 A)





Other Results and Conclusions:

Flux: While NGC 6990 (Western Veil) emits dominantly in N279, F170 and F160, with little emission in F155, this Is reversed in the Eastern Veil, which Is brighter in F155 than in F170!

Property of molecular cloud which the Shock has run into, or an asymmetric Explosion? Or both?

Shock velocities from IUE between 100-200 km/s.

Comparison with Galex show NUV continuum as well as line emission.

Filters	Flux (erg cm^{-2} Å^{-1}s^{-1})	Normalized wrt NUVN2
BaF2	7.36794E-12	5.320
Sapphire	6.99997E-12	5.055
Silica	6.43248E-12	4.645
NUVN2	1.38480E-12	1.000