The shaping of the Honeycomb nebula supernova remnant

Matt Redman

James Barrett, Laura Boyle, Karol Fitzgerald, Nevenoe Guegan, Eamonn Harvey, John Meaburn

Redman et al 1999, Redman et al 2003, Meaburn et al 2010

NUI Galway
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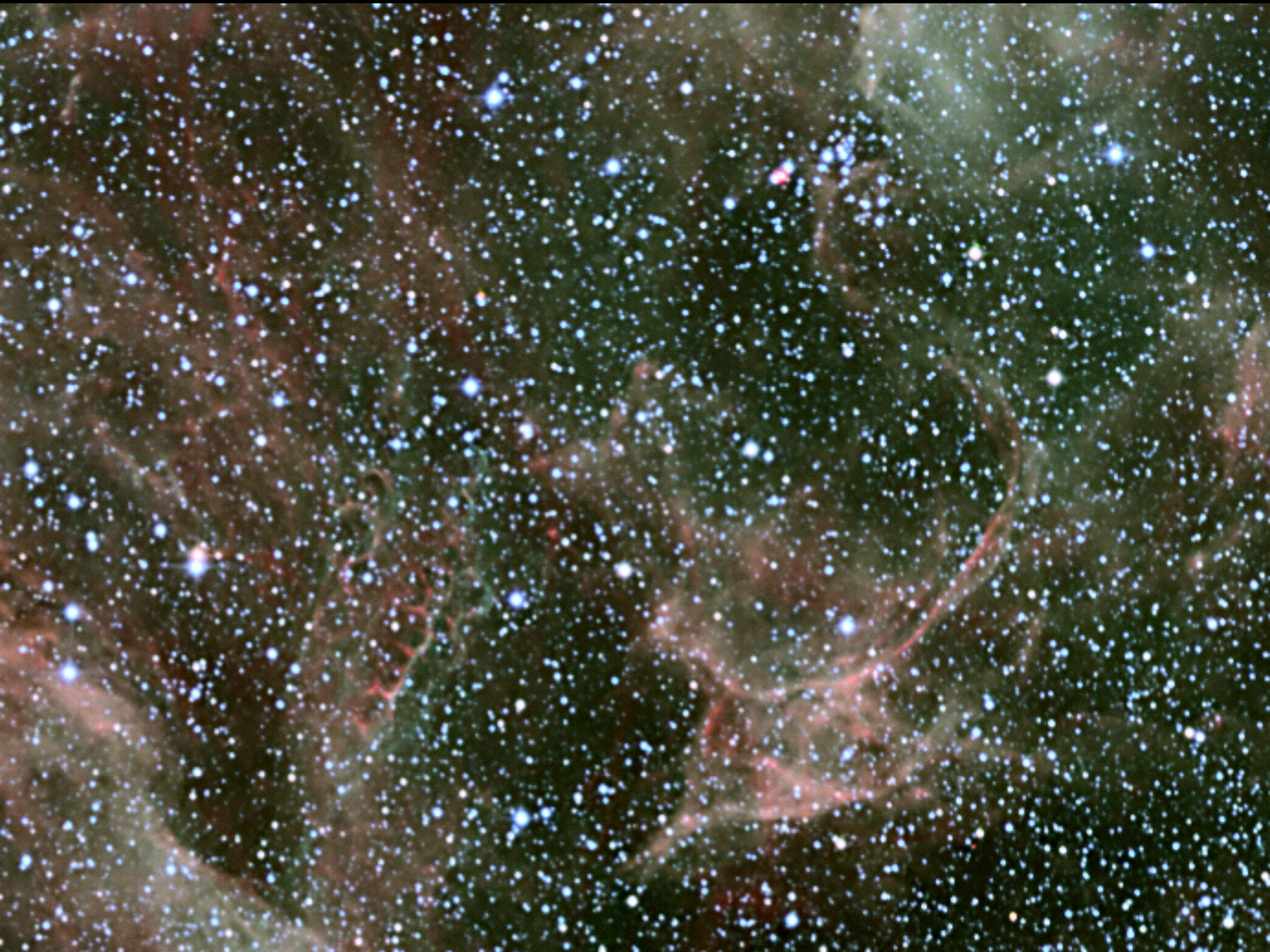
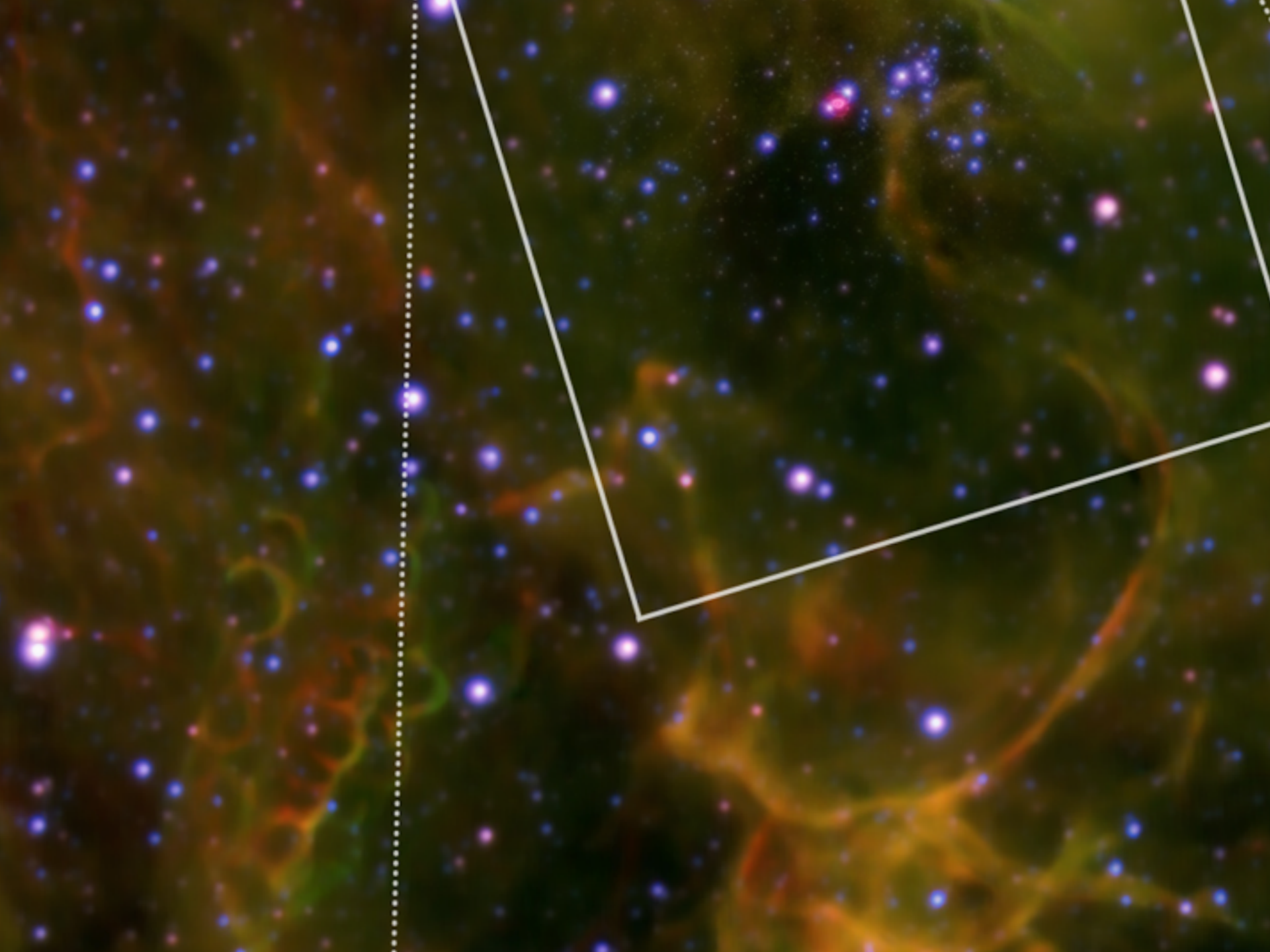
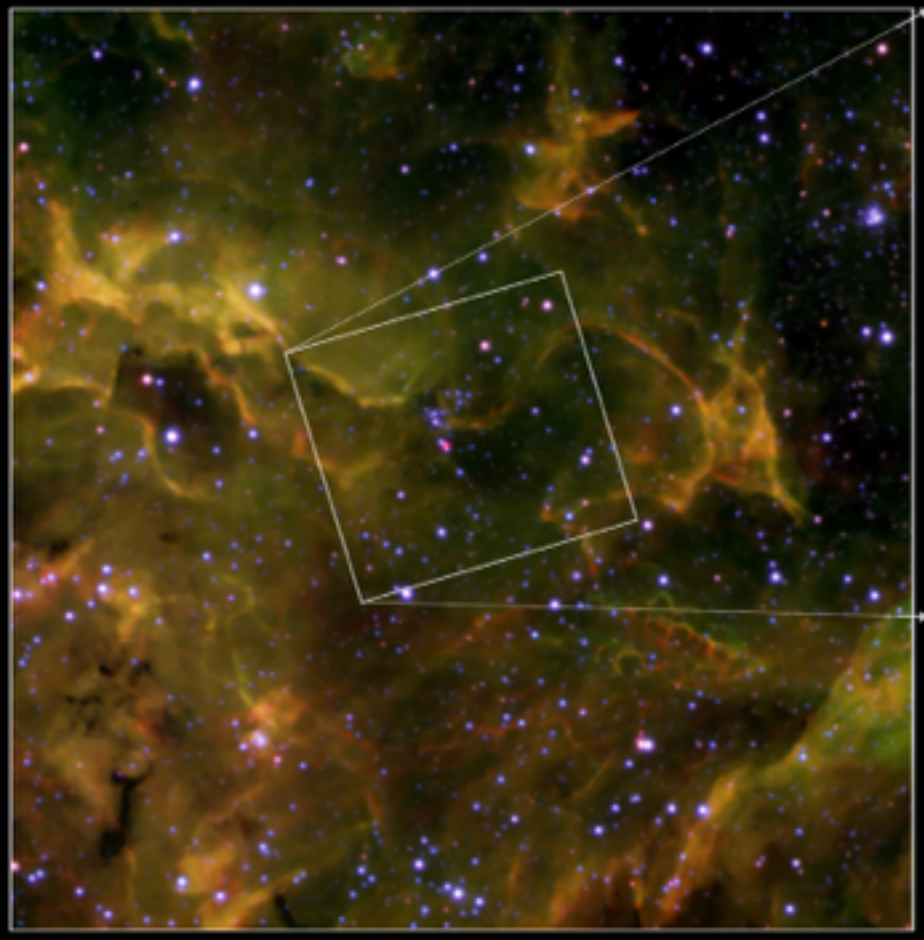
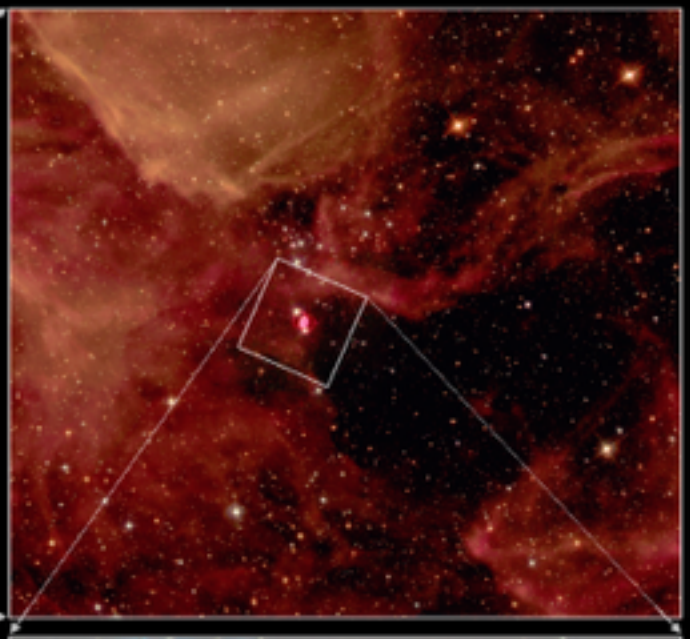
Centre for Astronomy





The neighborhood and the remnant of SN 1987A

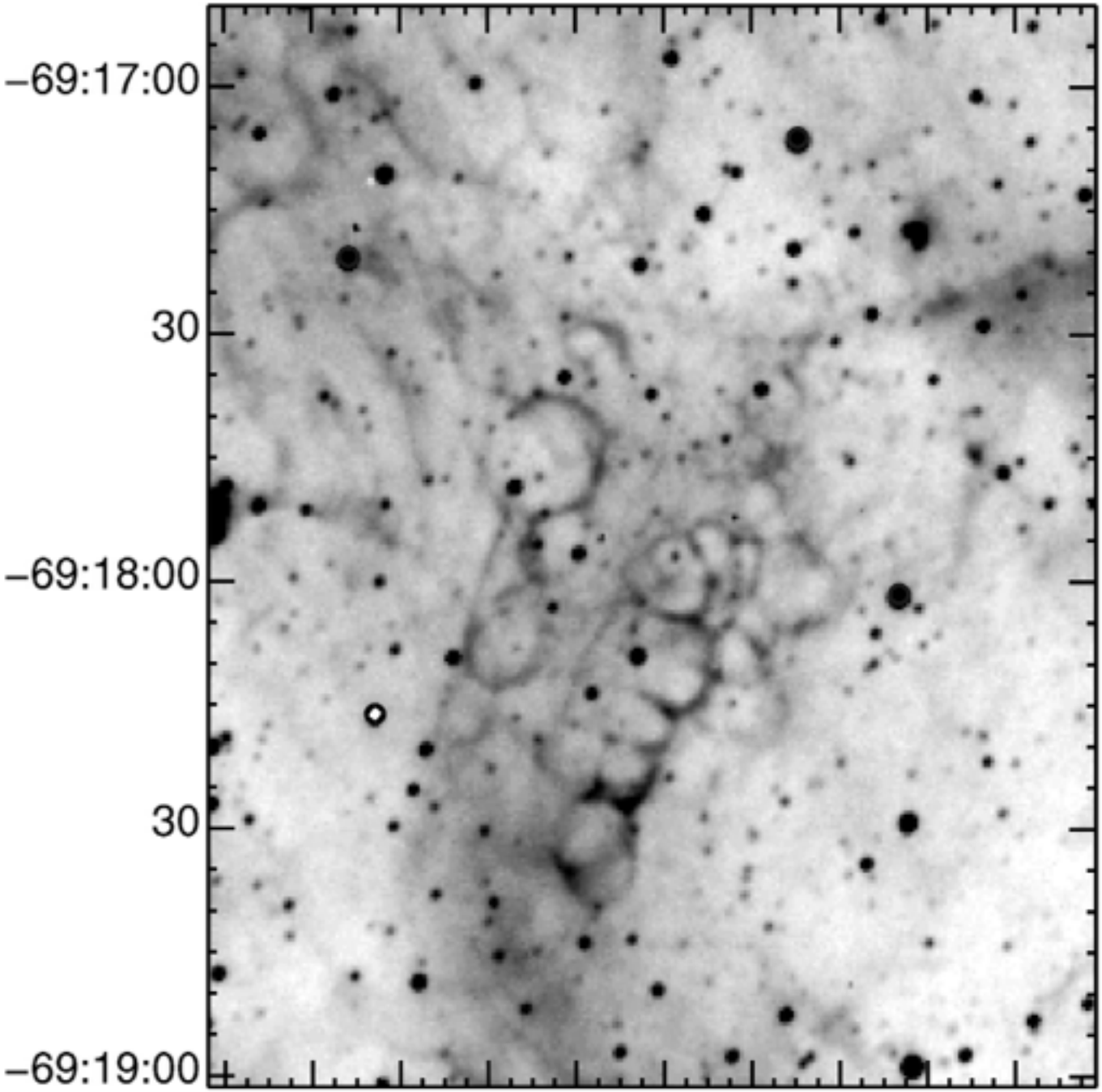




Left: New image around the remnant of SN 1987A in the Large Magellanic Cloud taken with the 3.9m Anglo-Australian Telescope.
Credit: Ángel R. López-Sánchez (AAO/MQU), Steve Lee, Robert Patterson, Robert Dean and Jennifer Riding (AAO) & Sarah Martel (UNSW / AAO).

Top right: Wide Hubble Space Telescope image of the central area, data collected between 1994 and 1997.
Credit: Hubble Heritage Team (AURA/STScI/NASA/ESA).

Bottom right: Deep Hubble Space Telescope image obtained in 2011 showing the asymmetric structure of the SN 1987A remnant. Credit: ESA/Hubble & NASA.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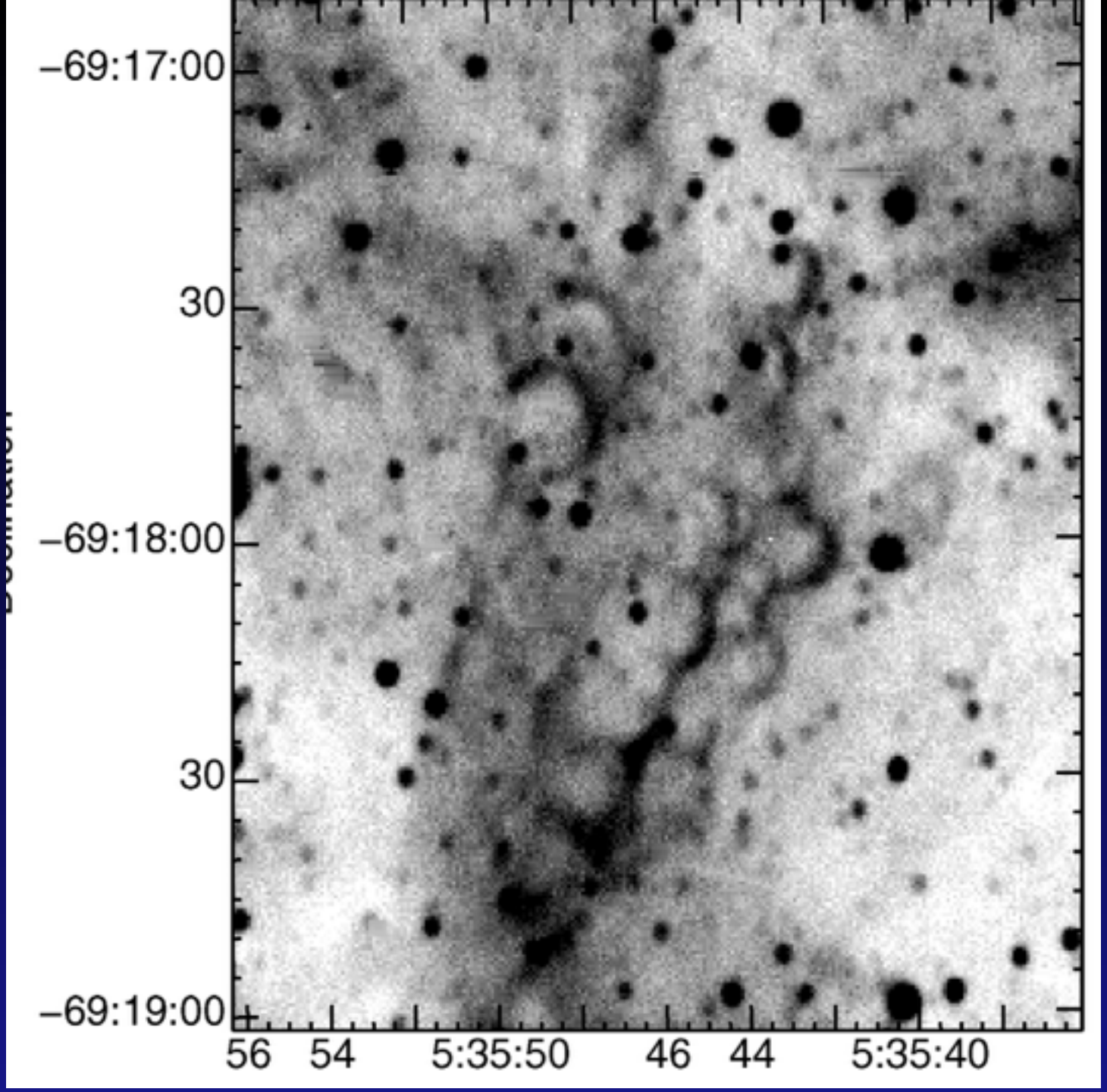
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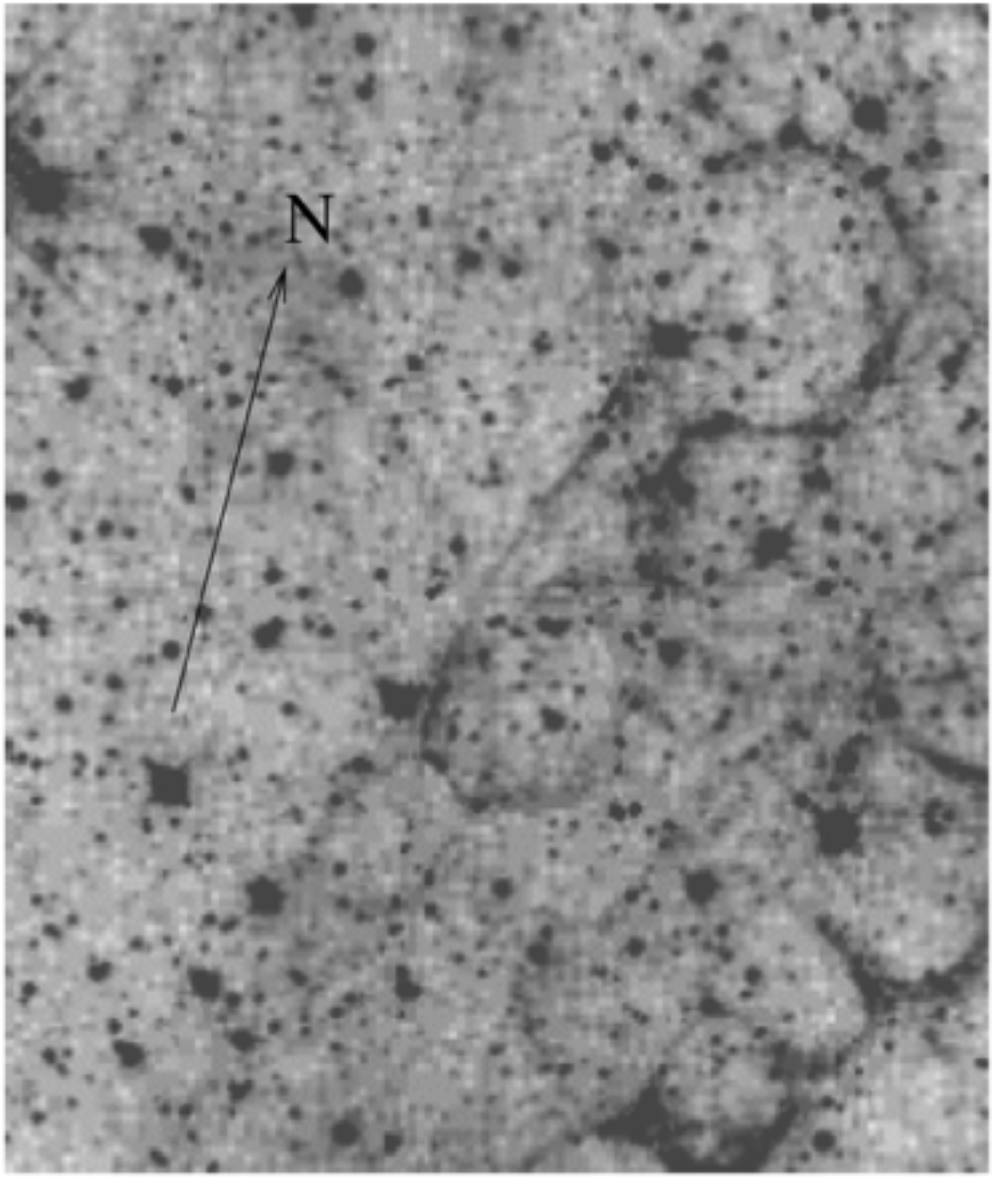
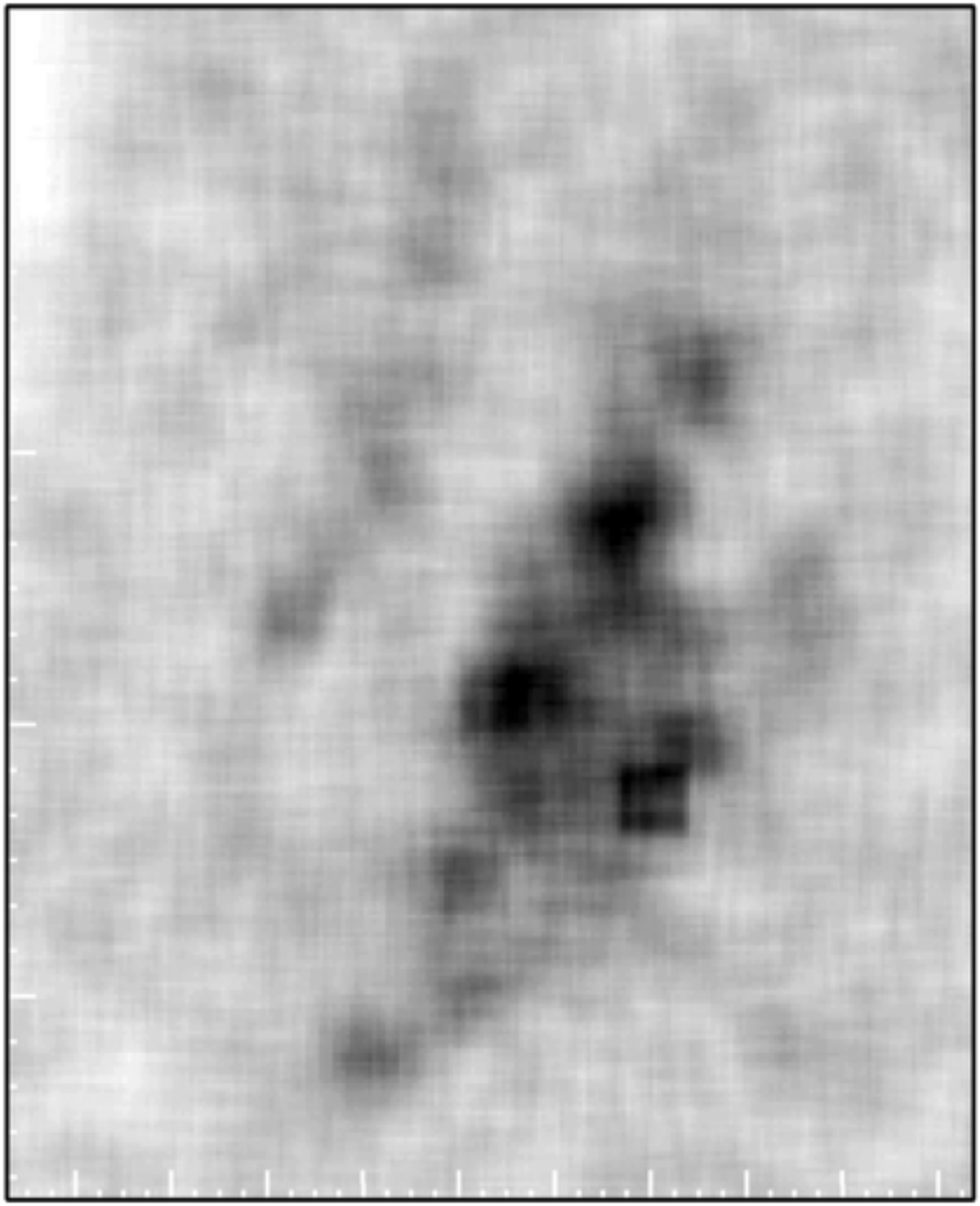


Figure 7. The broad-band *HST* (675-nm) image of part of the field shown in Figs 1(a)–(c). The low-edge width to diameter ratio of the most prominent Honeycomb shell (top right) should be compared to its synthetic image in Fig. 6(a).



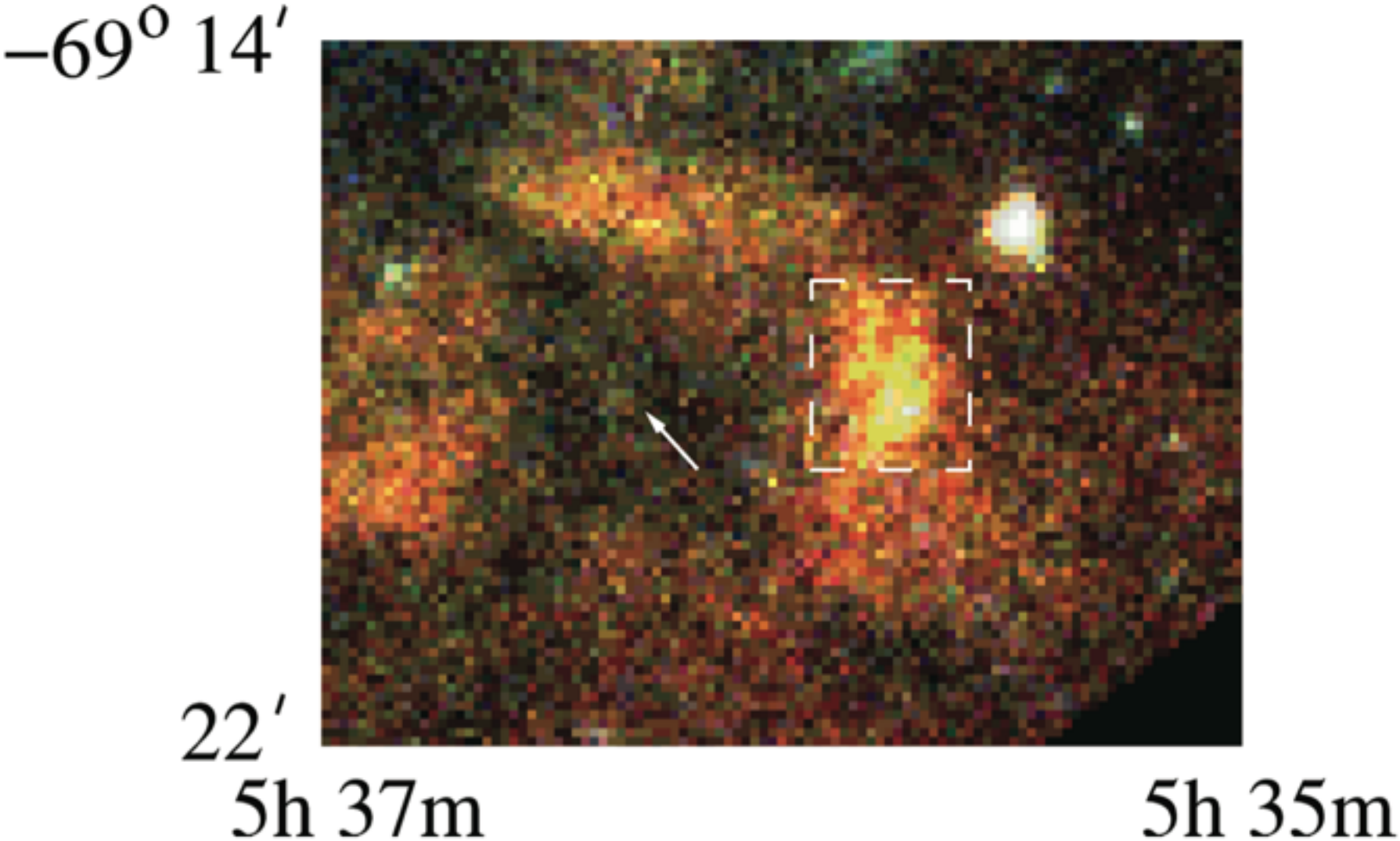
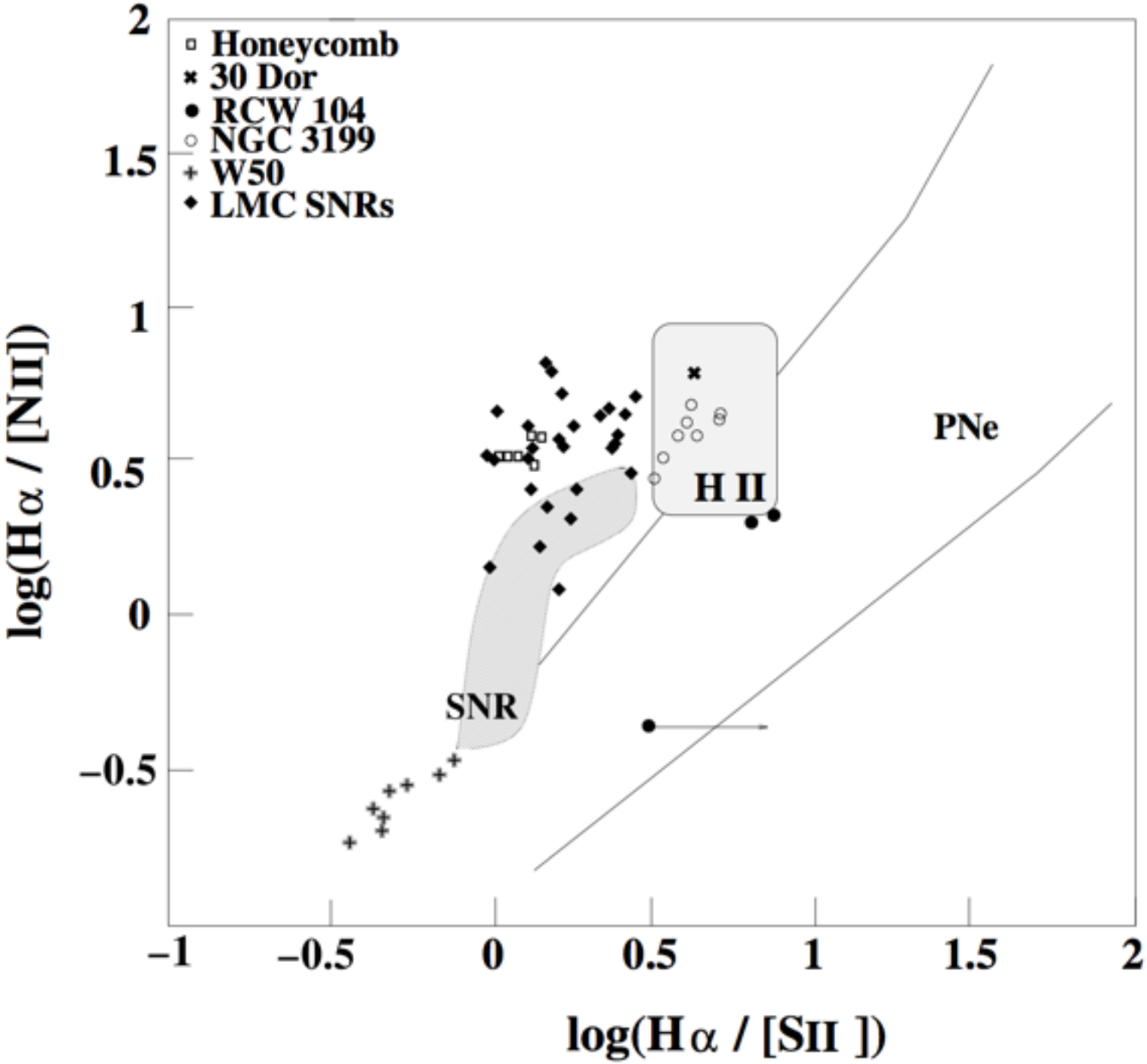


Figure 9. The area of Figs 1(a)–(c) is shown as a dashed box against a subset of the *XMM* X-ray image from Dennerl et al. (2001). Softer X-rays become orange in this presentation and harder ones blue. SN1987A is the bright source towards the top right and the point X-ray source number 1 of Haberl et al. (2001) is towards the top left (J2000 coordinates). An arrow points to a marginally detected point source which is more apparent in the original image of Dennerl et al. (2001).


Honeycomb
30 Dor
RCW 104
NGC 3199
W50
LMC SNRs
PNe
H II
SNR
log(Hα / [NII])
log(Hα / [SII])
2
1.5
1
0.5
0
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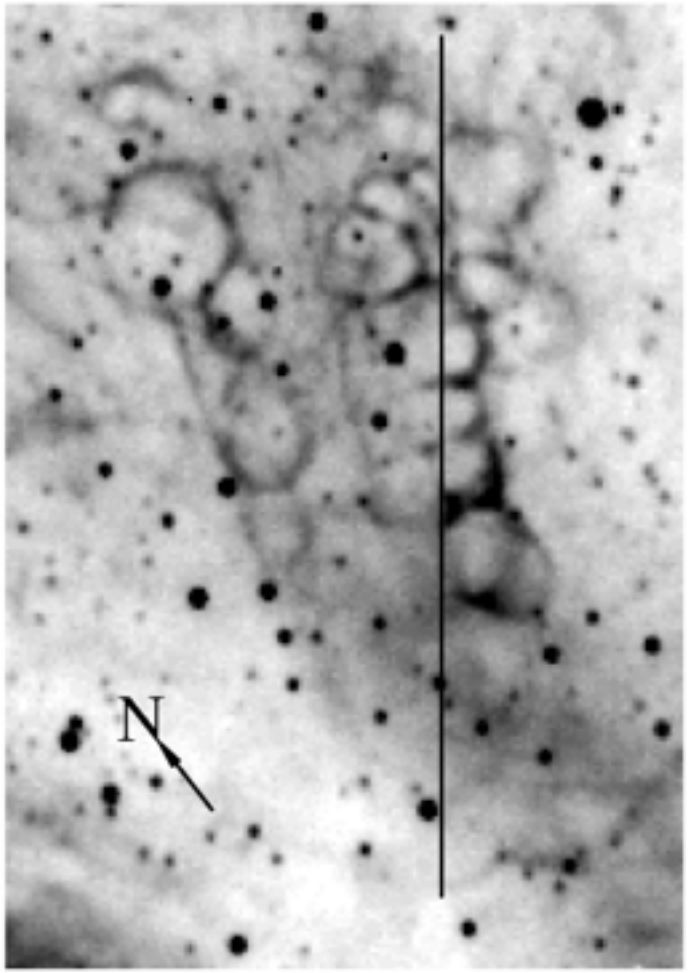
−1
−0.5
0
0.5
1
1.5
2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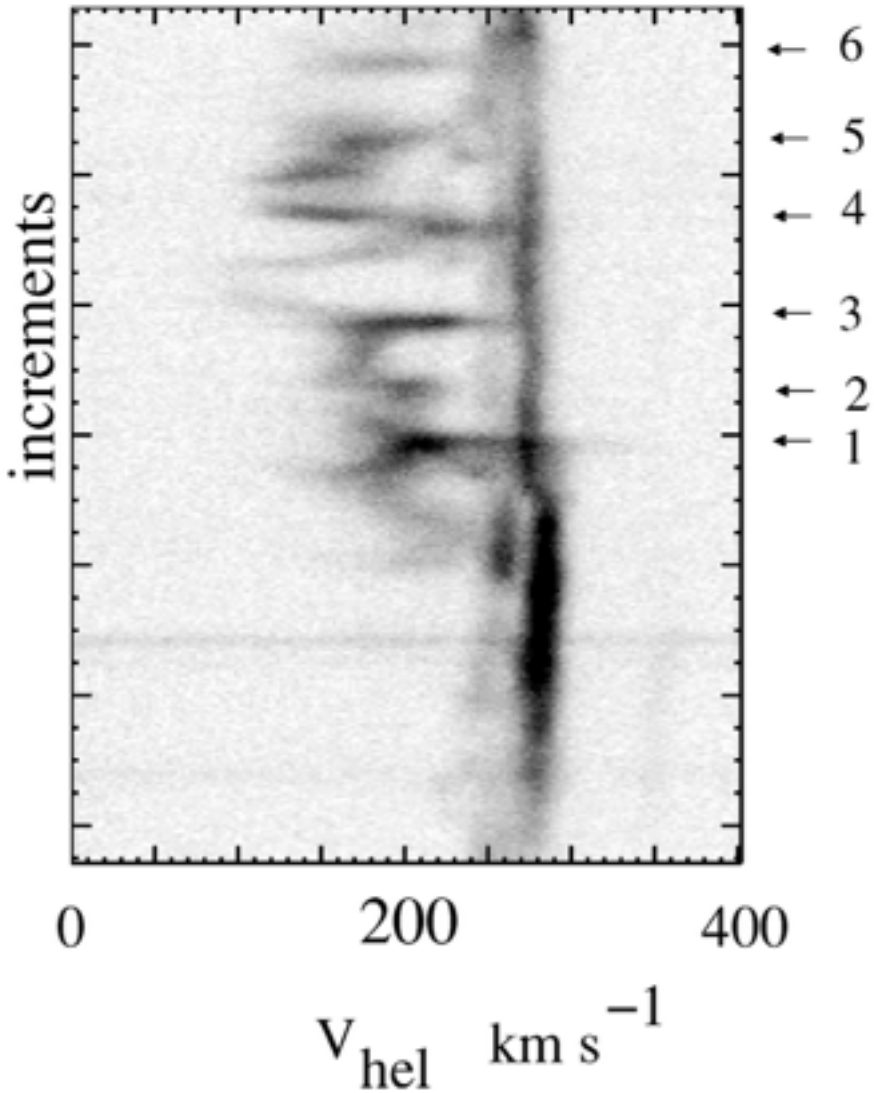
increments
6
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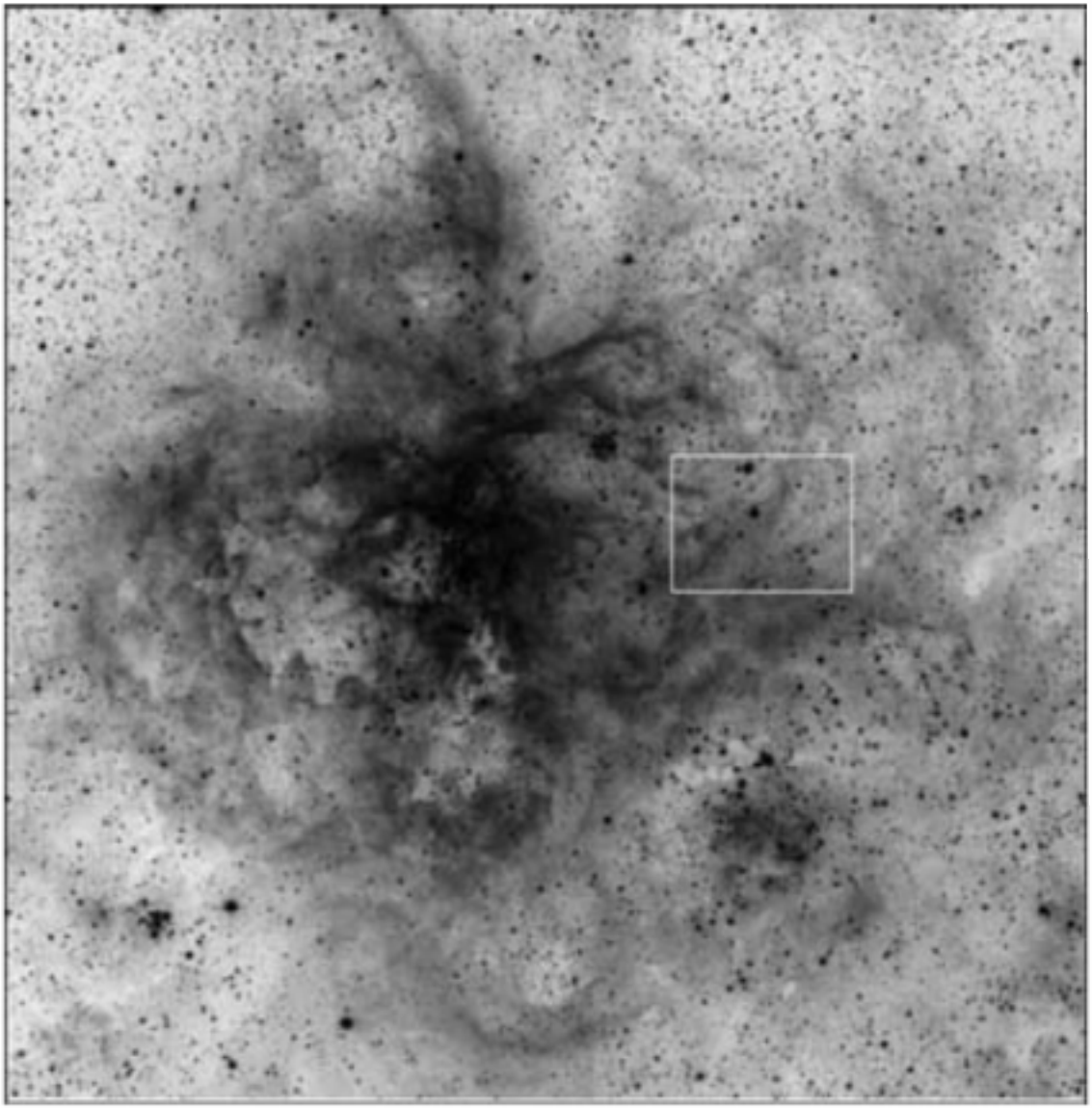
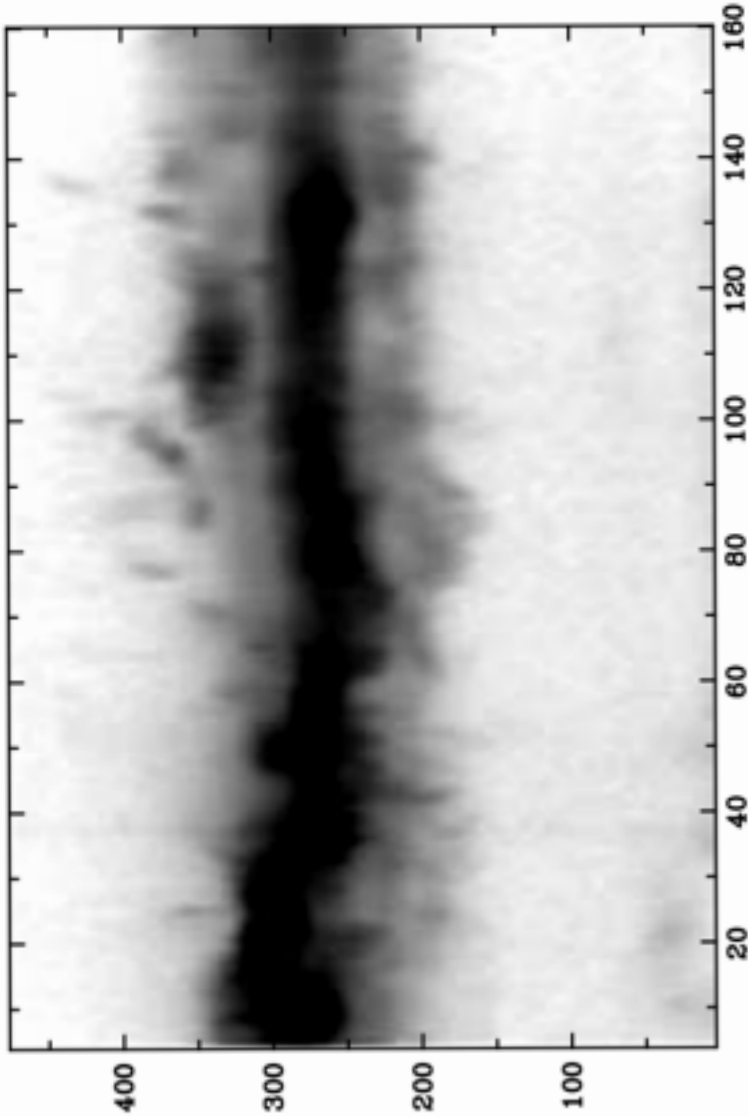
400
V_{hel} km s^{-1}

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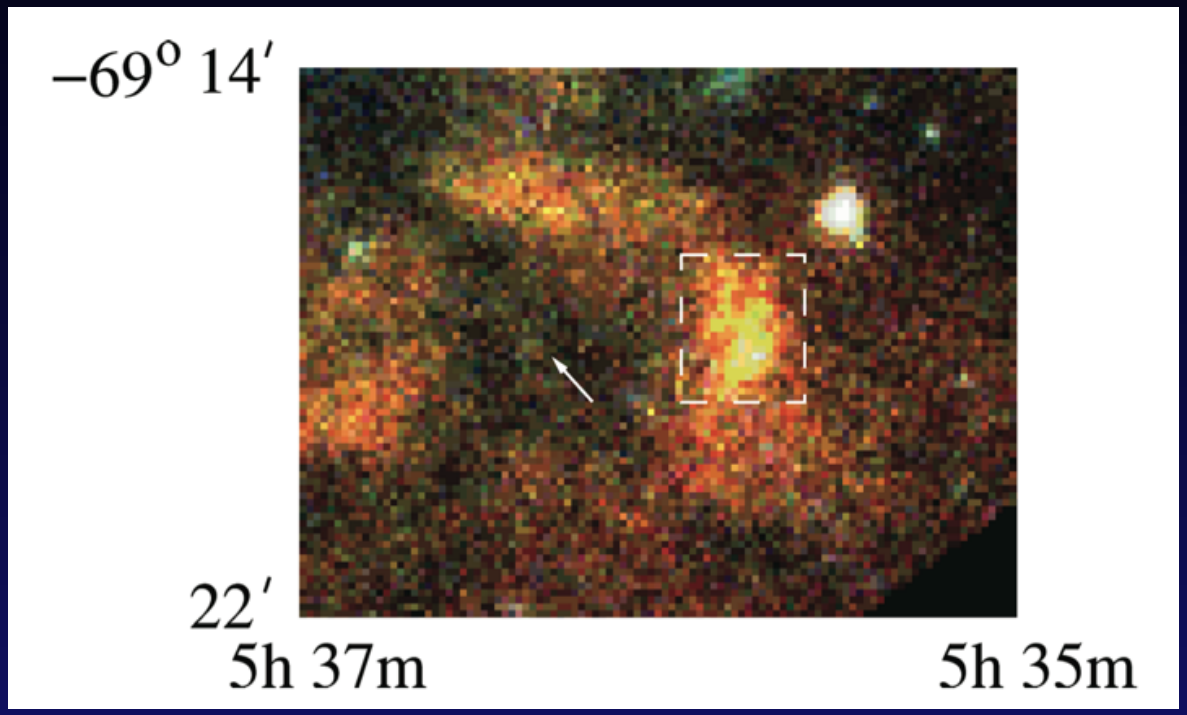
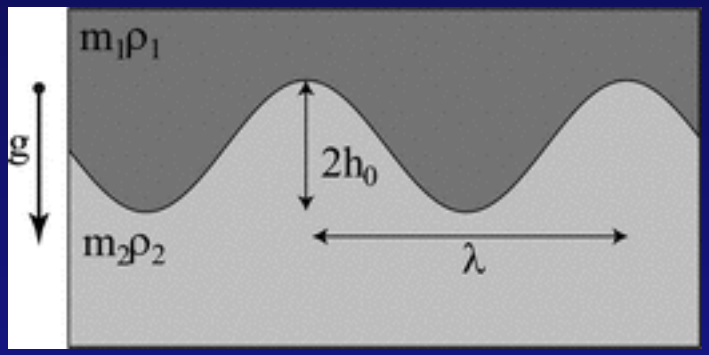
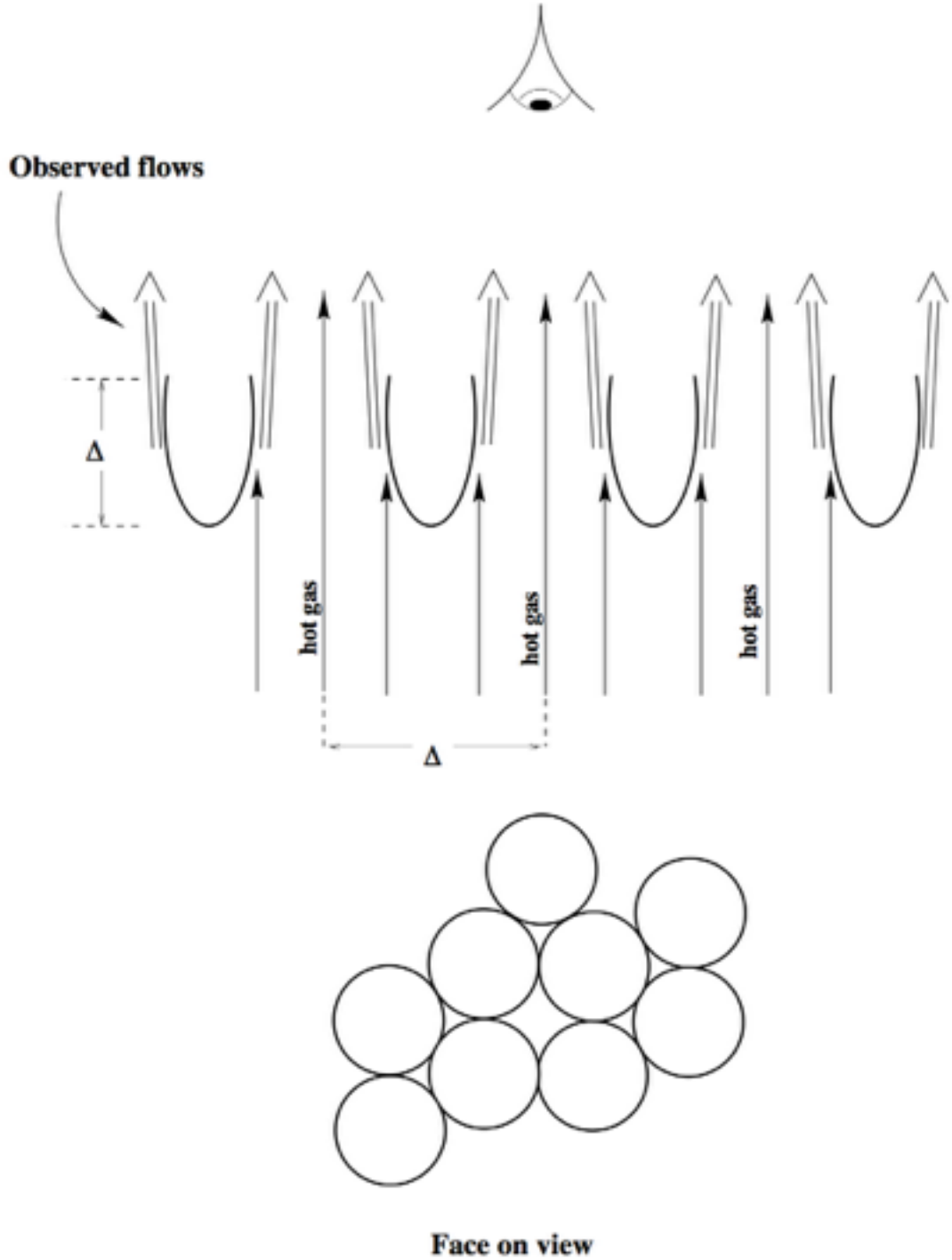


Model as due to the interaction of a young supernova remnant interacting with an older SNR or a giant shell.

Model as due to the interaction of a young supernova remnant interacting with an older SNR or a giant shell.

As the existing shell is accelerated, a RT instability develops with characteristic scale of order the shell thickness.





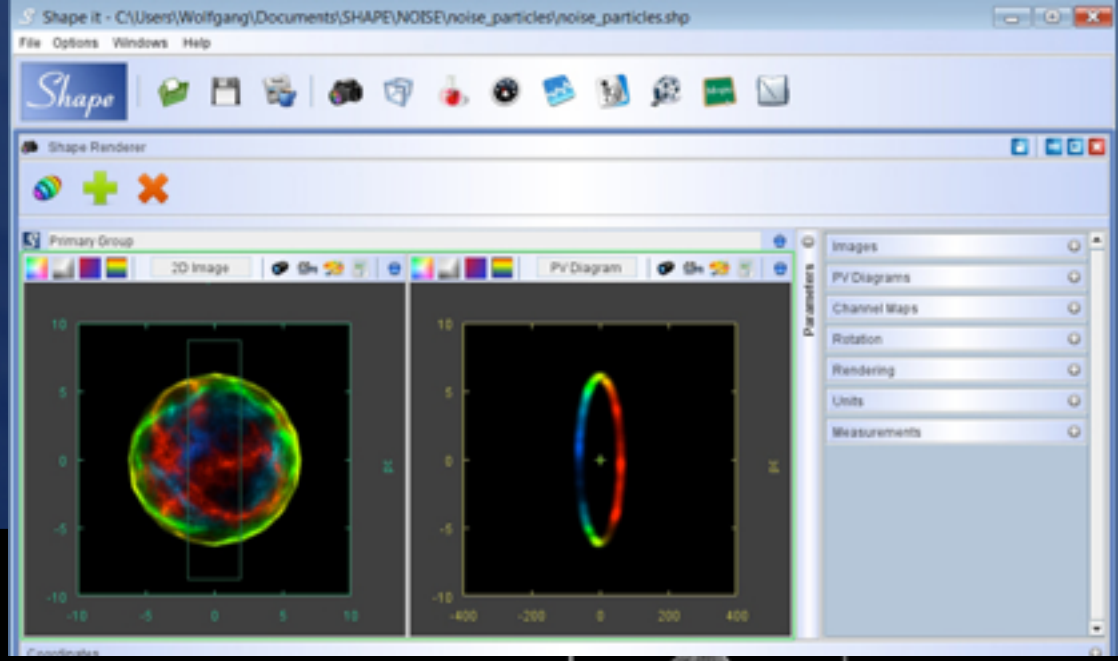
Model as due to the interaction of a young supernova remnant interacting with an older SNR or a giant shell.

As the existing shell is accelerated, a RT instability develops with characteristic scale of order the shell thickness.

The boundary layer between the hot gas and cooler shell is being viewed end-on.

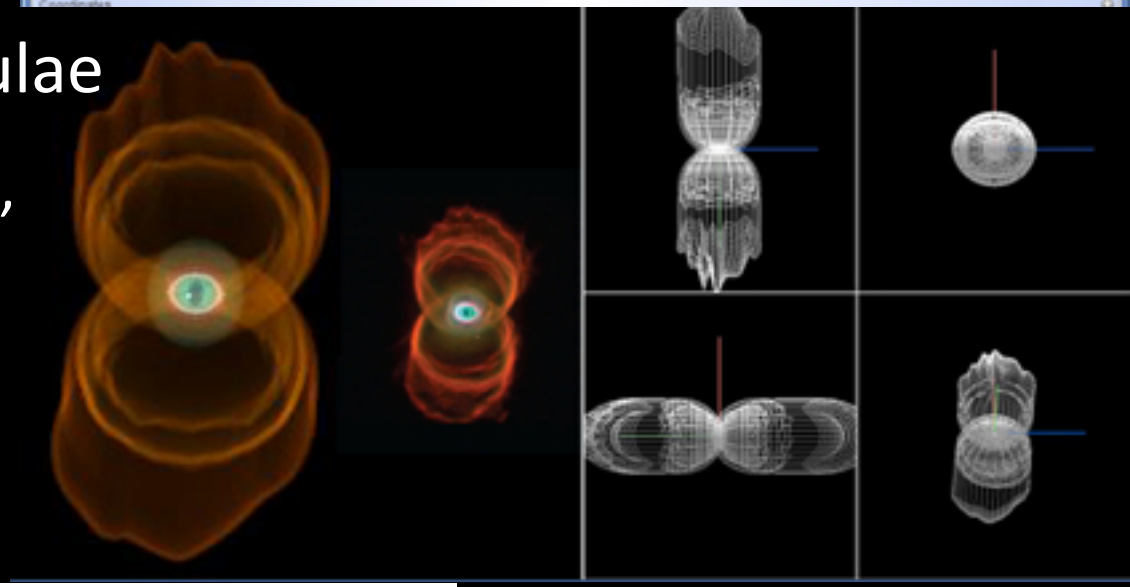
SHAPE
v 5.0

Get your science in Shape!



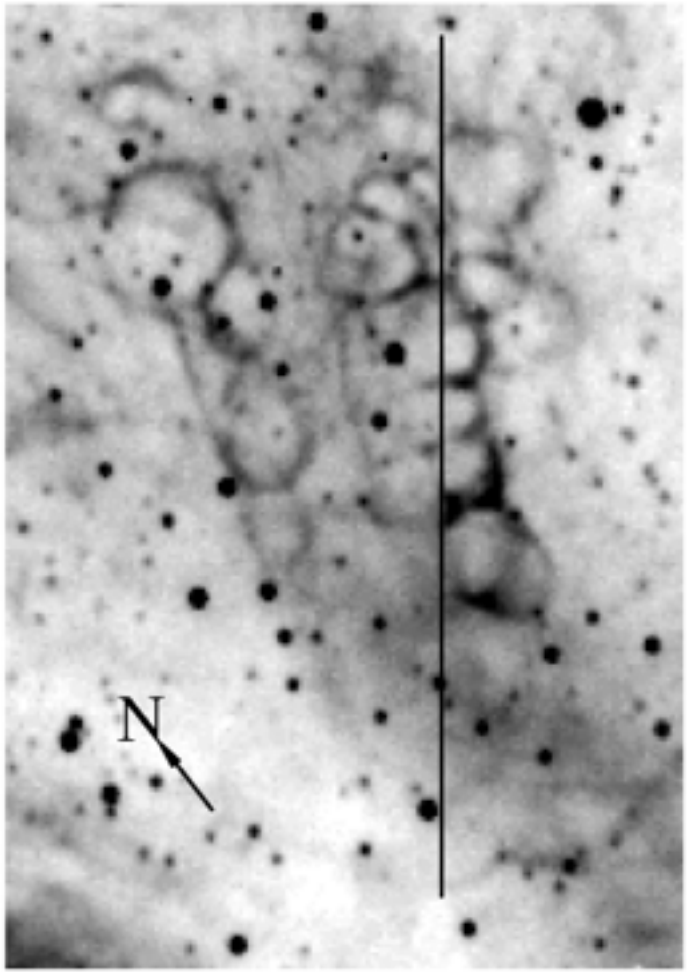
Model 3D shape and velocity structure of nebulae

Resultant model a 'snapshop' of a nebula at a given time in a specific emission line



Steffen, W., Koning, N., & et al. 2011, IEEE Transactions on Visualization and Computer Graphics, 17, 454

Website: http://bufadora.astrosen.unam.mx/shape/index.html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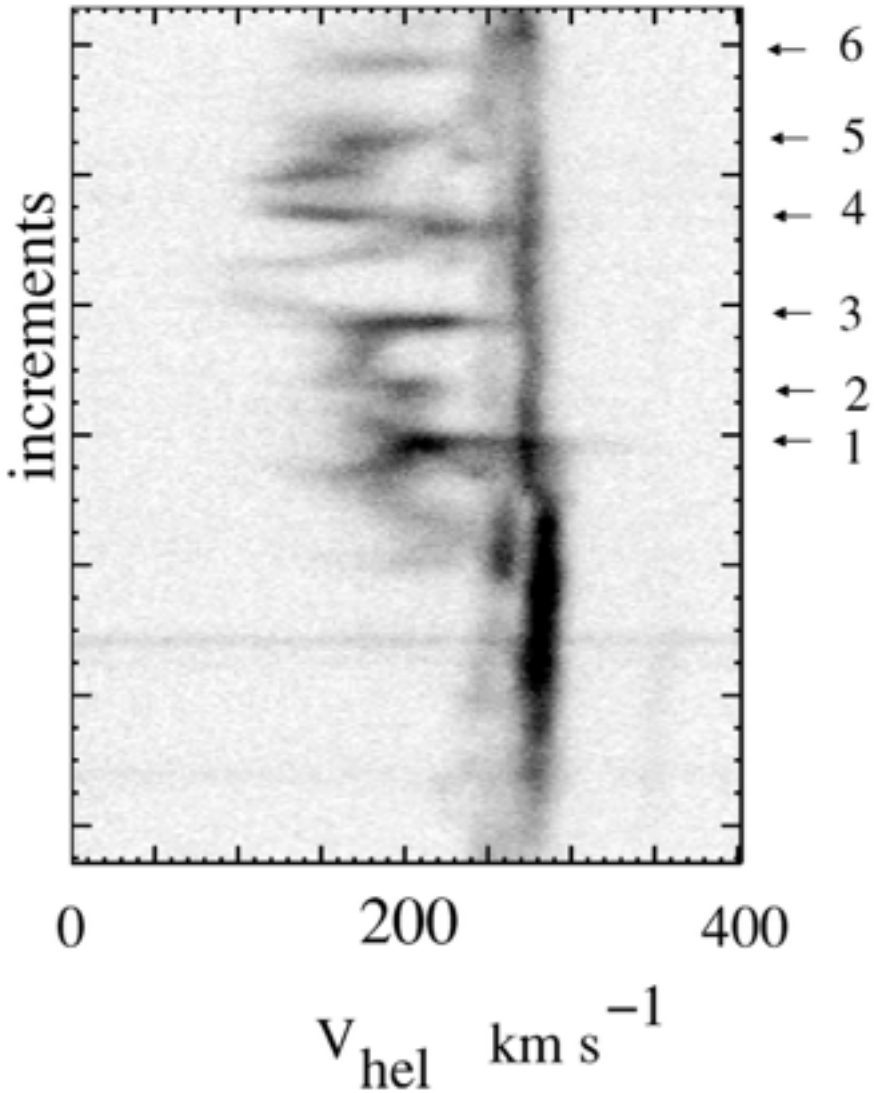
increments
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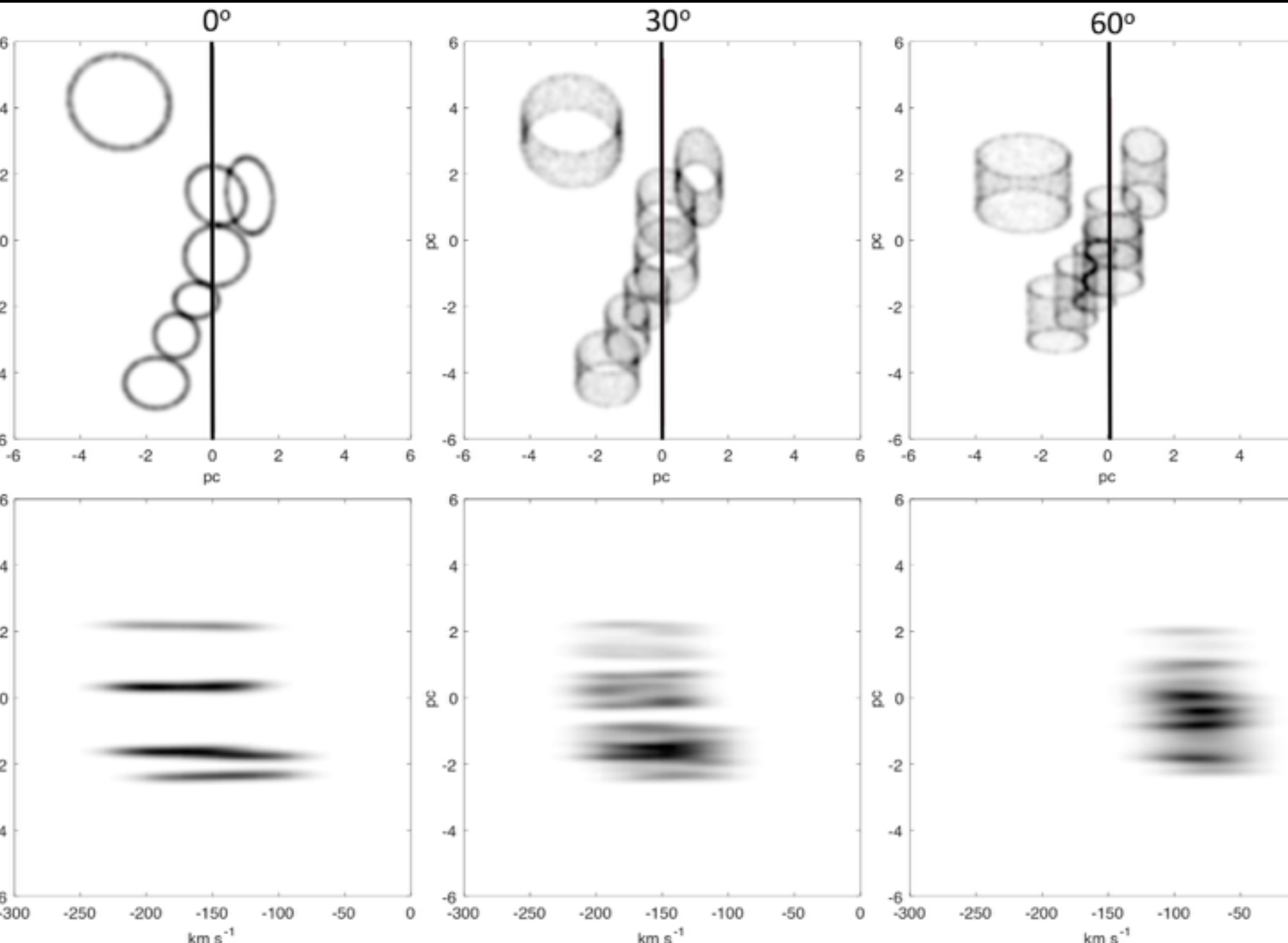
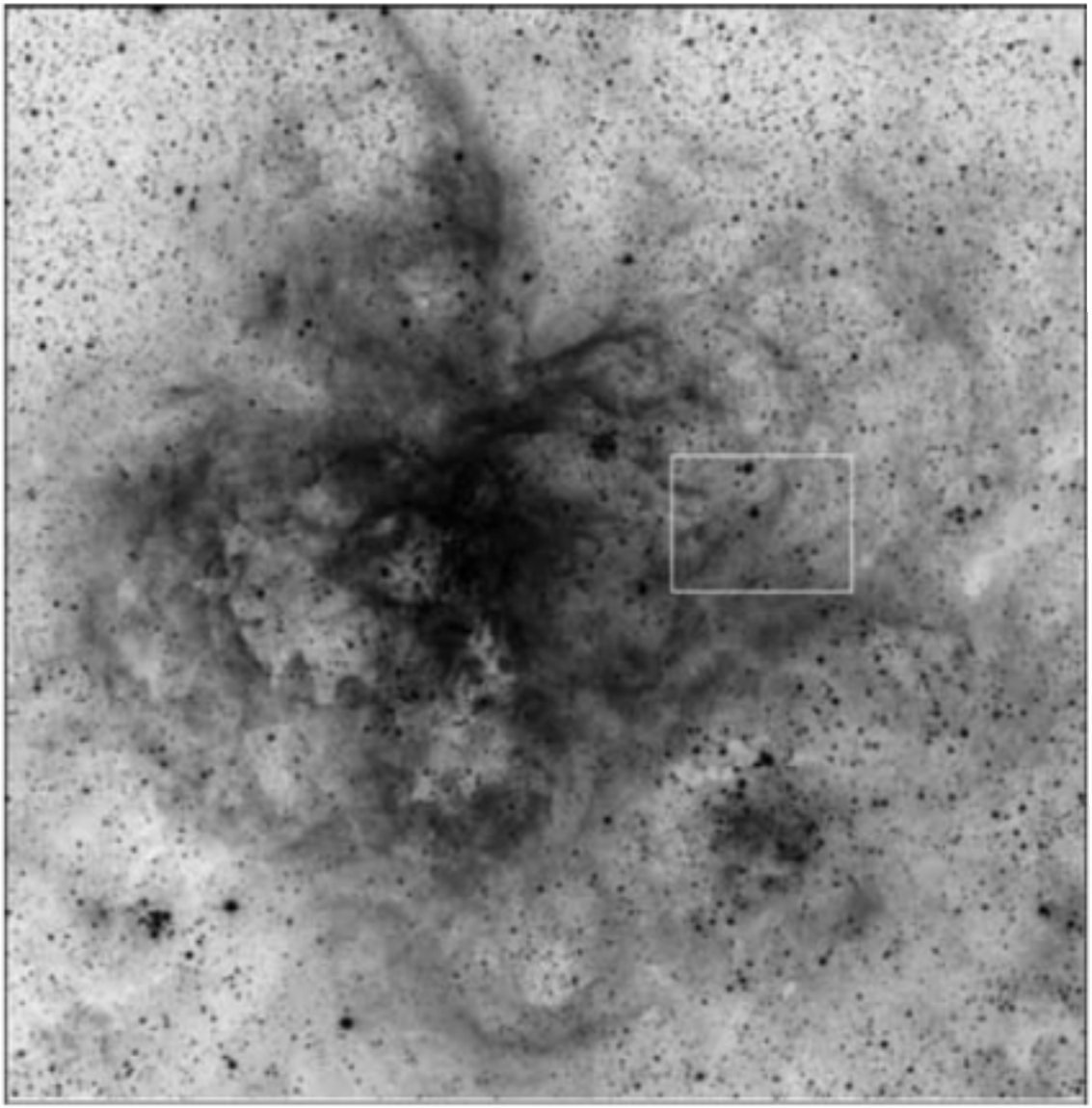
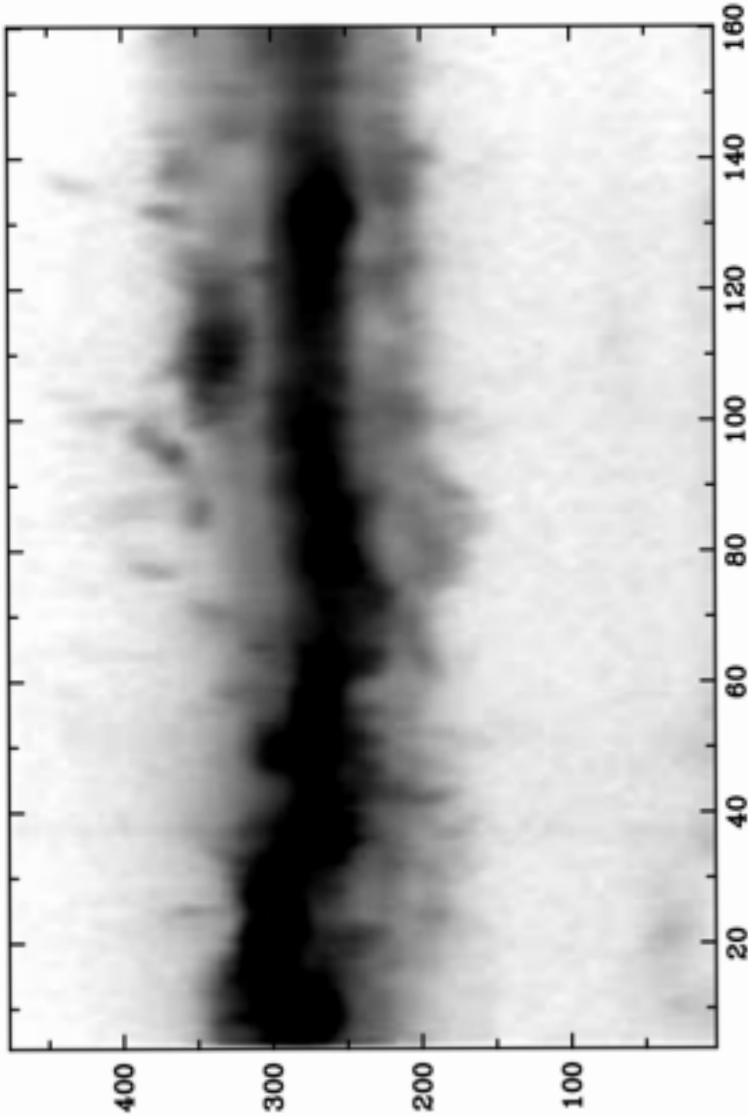
V_{hel} km s^{-1}


0°
30°
60°
pc
km s^{-1}

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Cloudy & Associates

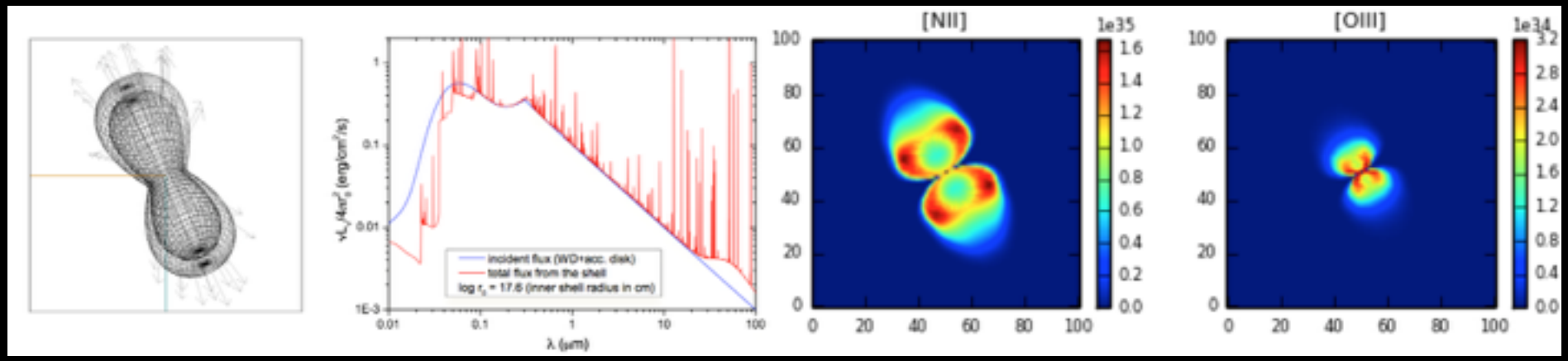
Photoionization Simulations for the Discriminating Astrophysicist Since 1978

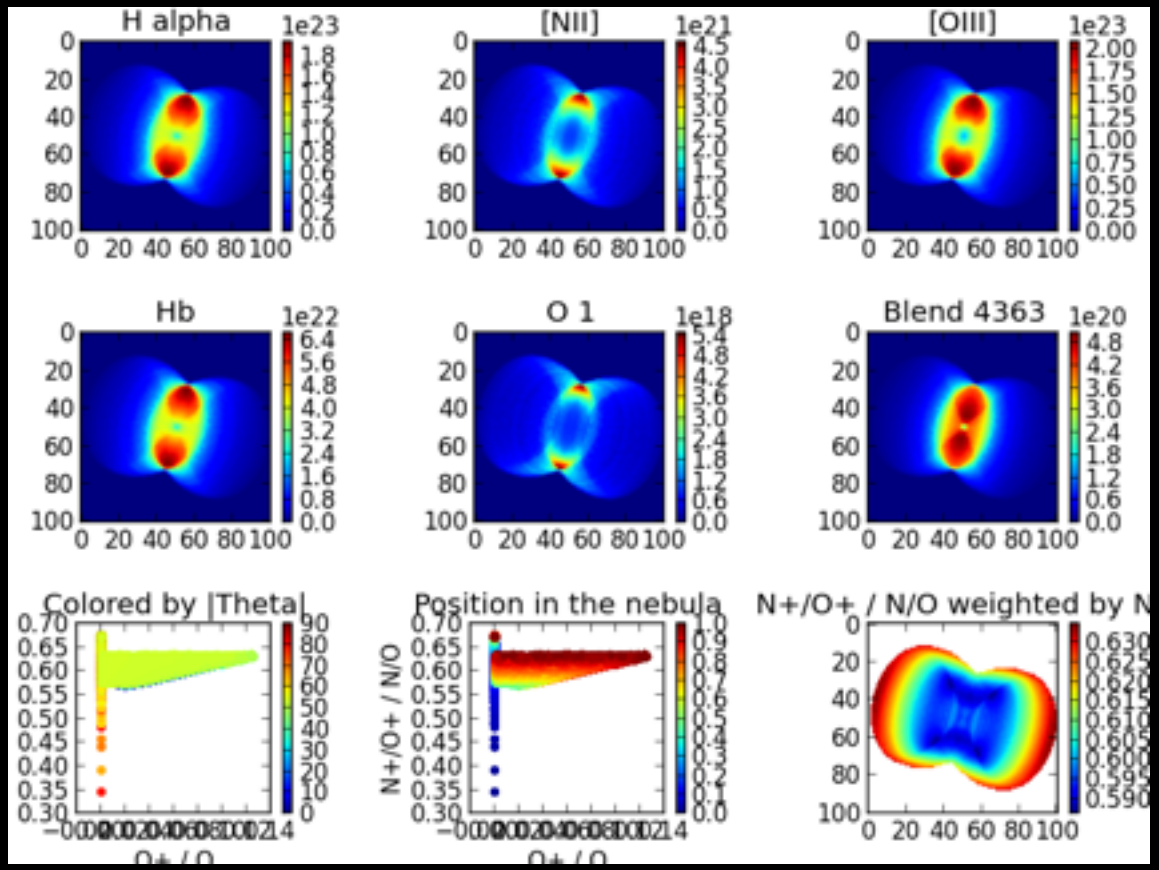
Plasma simulation code

-Models ionization, chemical and thermal state of material.
-Predicts observables such as emission & absorption spectra.
-Works in terms of elementary processes.

Ferland, Porter, van Hoof et al. (2013)
Revista Mexicana de Astronomıa y Astrofisica, 49, 137–163 (2013)

SHAPE x (py)Cloudy = pyCross





A Python interface between SHAPE and Cloudy
(Eamonn Harvey and Karol Fitzgerald)

The Honeycomb nebula is likely due to the interaction of a young supernova remnant interacting with an older SNR or a giant shell.

As the existing shell is accelerated, a RT instability develops with characteristic scale of order the shell thickness.

An interesting source for hydrodynamical (PION?) and photoionisation (Cloudy) modelling.