

The EVLA Nova (ENova) Project: First Results

Miriam Krauss (NRAO)

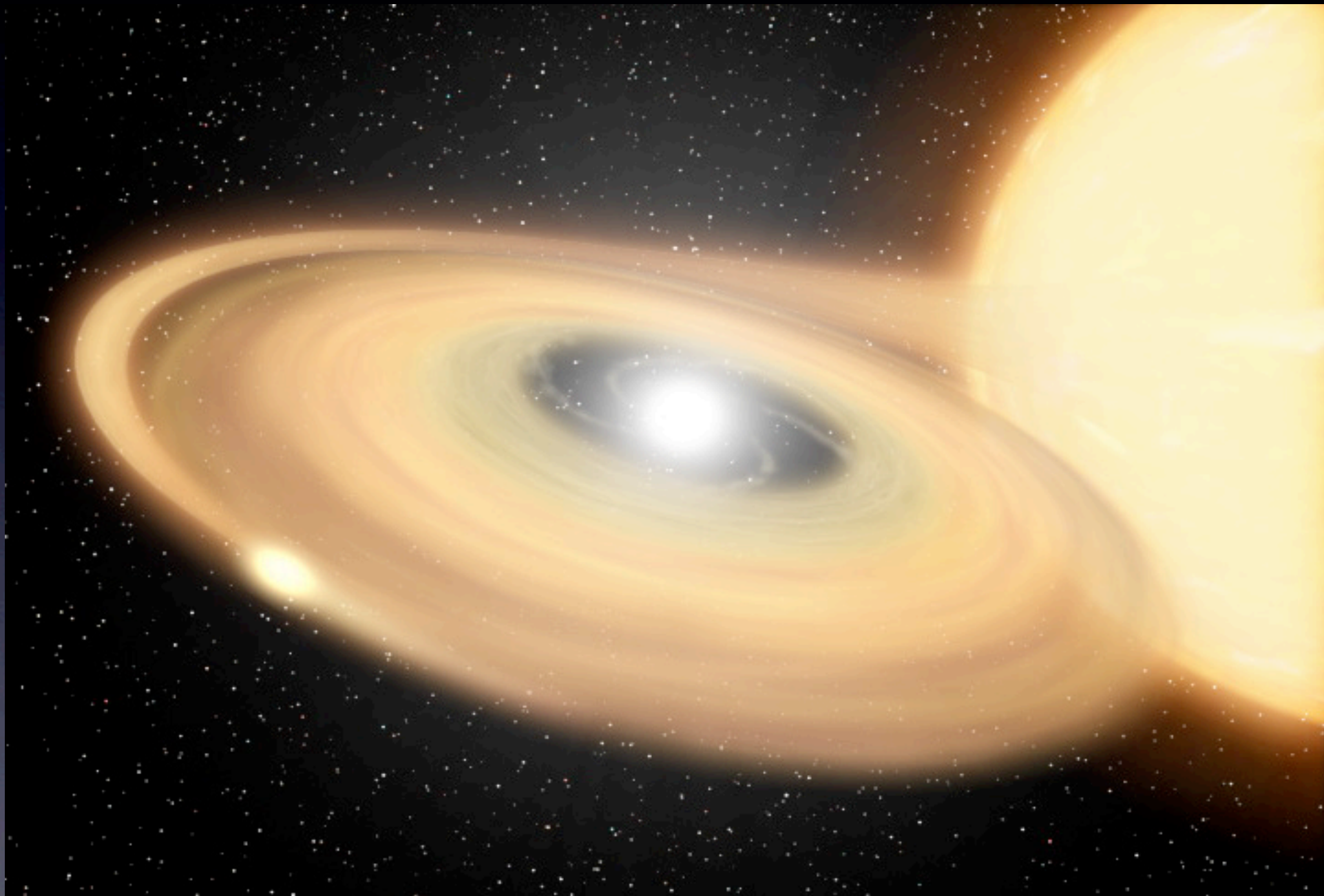
The ENova Team:

Laura Chomiuk (NRAO, CfA); Jennifer Sokoloski (Columbia); Michael Rupen, Nirupam Roy, Amy Mioduszewski (NRAO); Gregg Hallinan (National U. of Ireland, Galway); Tim O'Brien (U. of Manchester); Mike Bode (Liverpool John Moores U.); Jill Knapp (Princeton U.); Stewart Eyres (U. of Central Lancashire)



New Mexico Symposium
Nov. 5, 2010

Classical Novae: Introduction



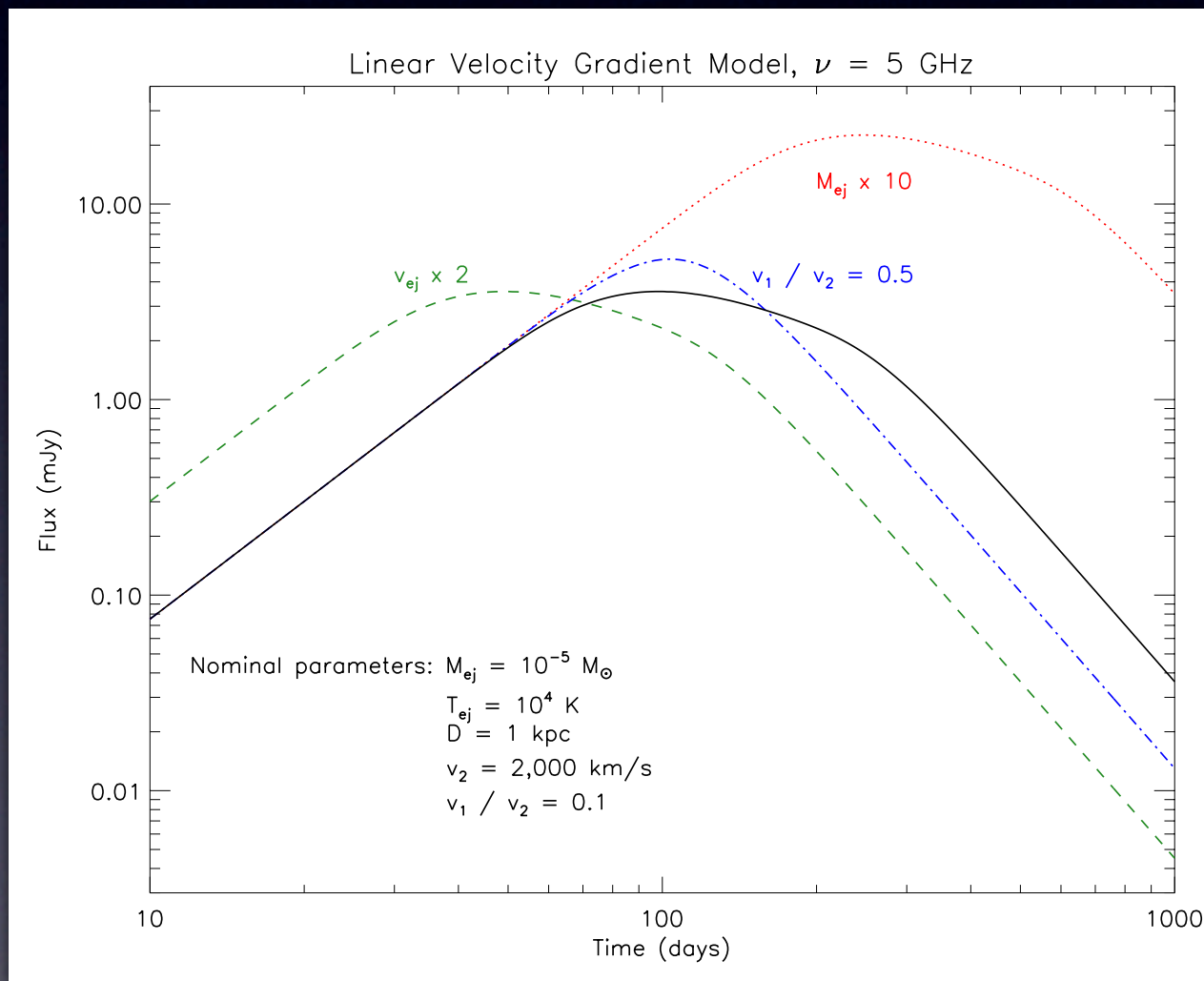
Z Camelopardalis (NASA/JPL-Caltech, GALEX)

Radio emission from novae: Observational motivation

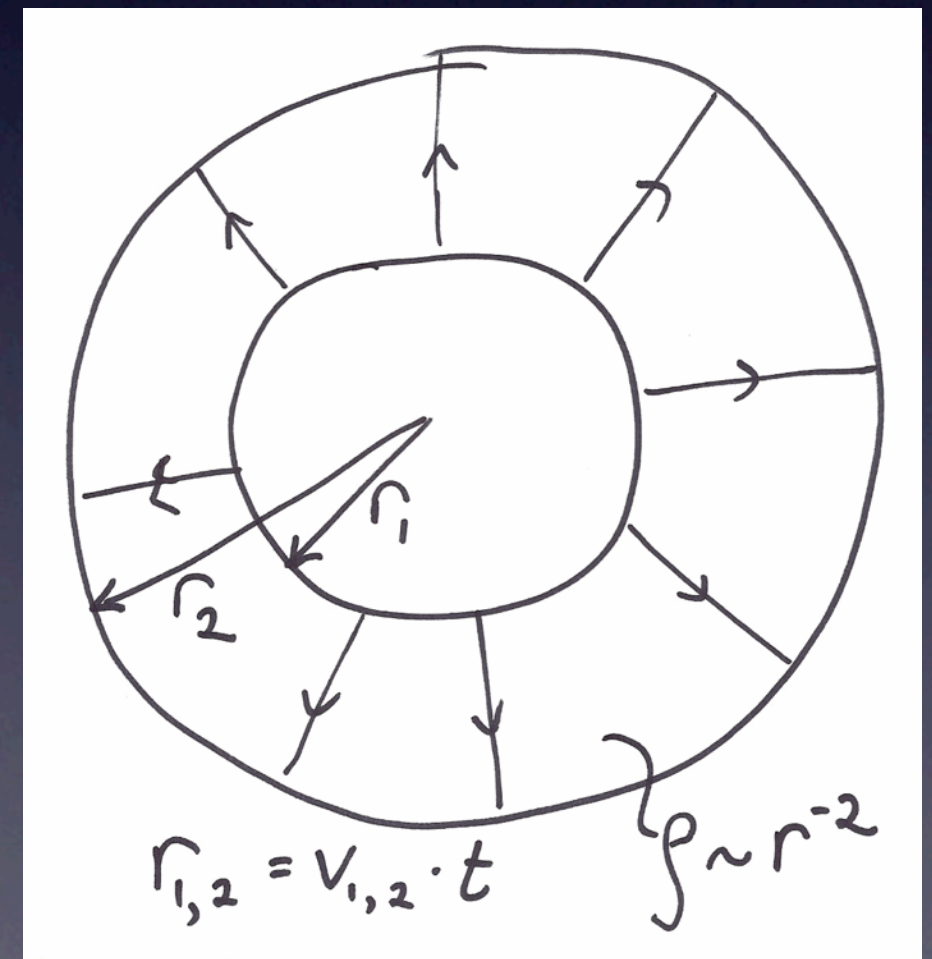
- Novae are nearby laboratories for accretion/ejection physics
- Long-lasting emission in radio; evolution is slower than at other frequencies
- Thermal bremsstrahlung easy to model; can derive physical parameters
- Ejected material is optically thick at much lower densities
- Can be used to get mass estimates – but don't agree with optical observations or theory

Radio emission from novae: Light curves and modeling

Linear velocity gradient (a.k.a.
“Hubble flow”) model

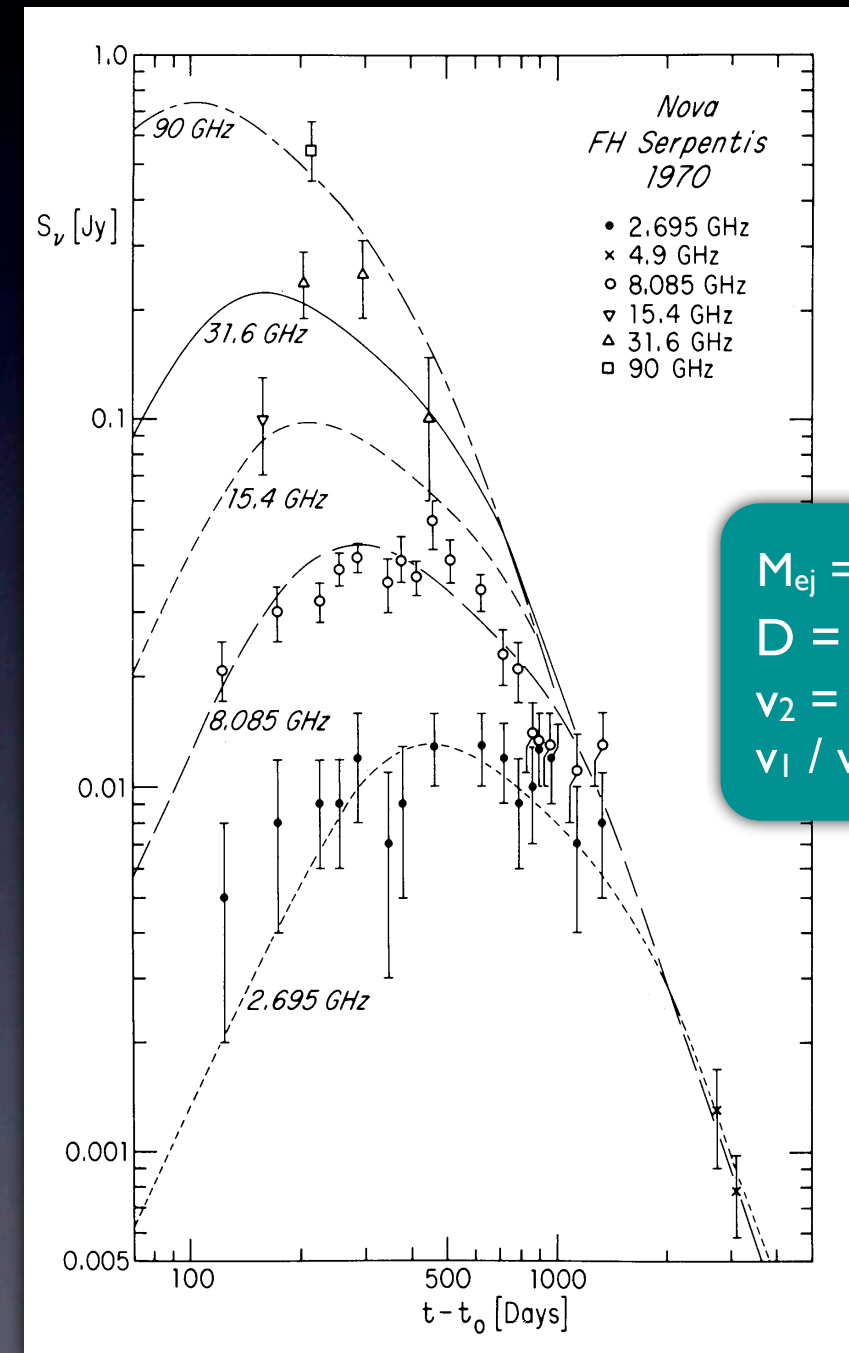
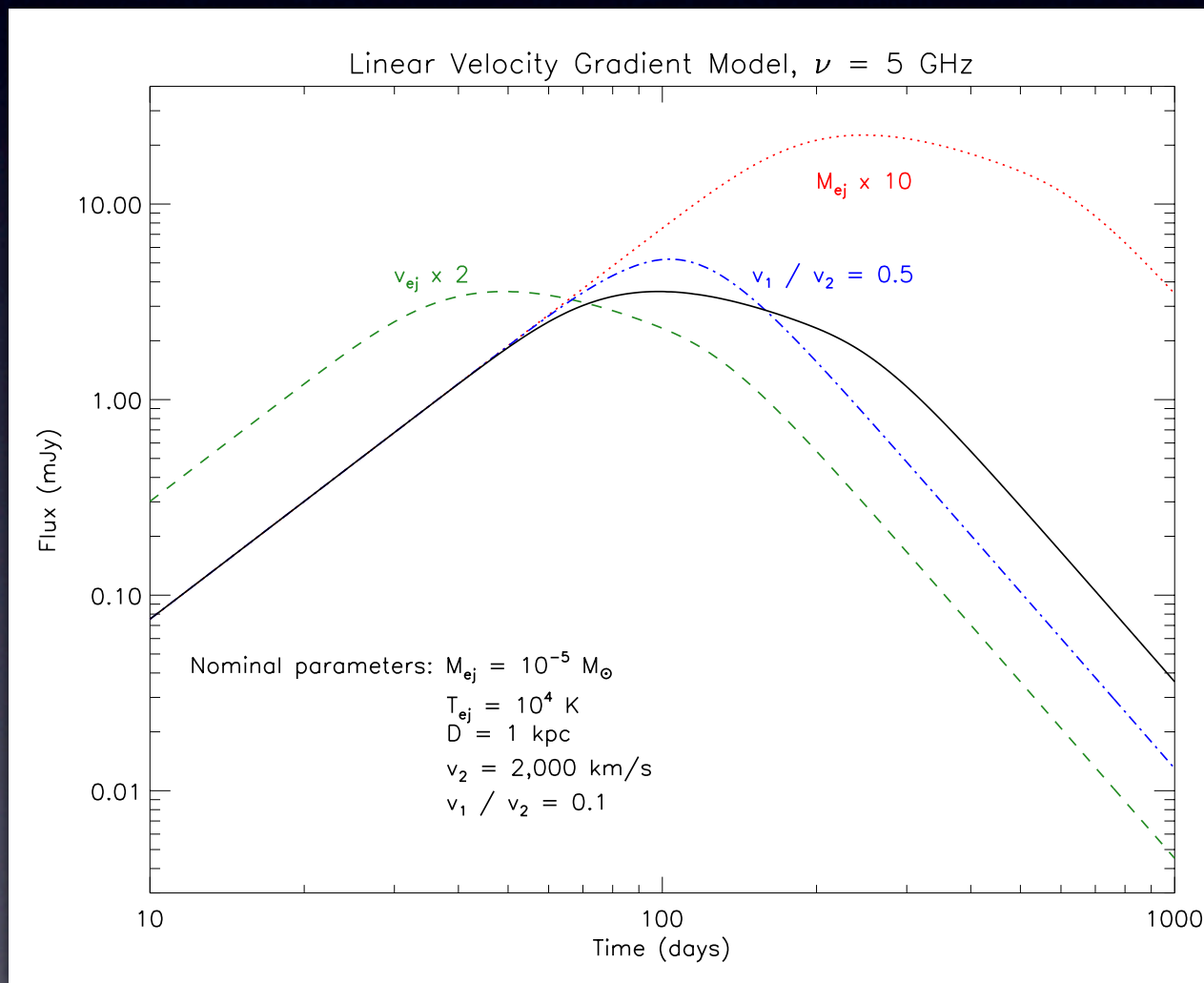


- Optically thick rise: $S_{\nu} \propto v^2$
- Freely expanding, isothermal shell



Radio emission from novae: Light curves and modeling

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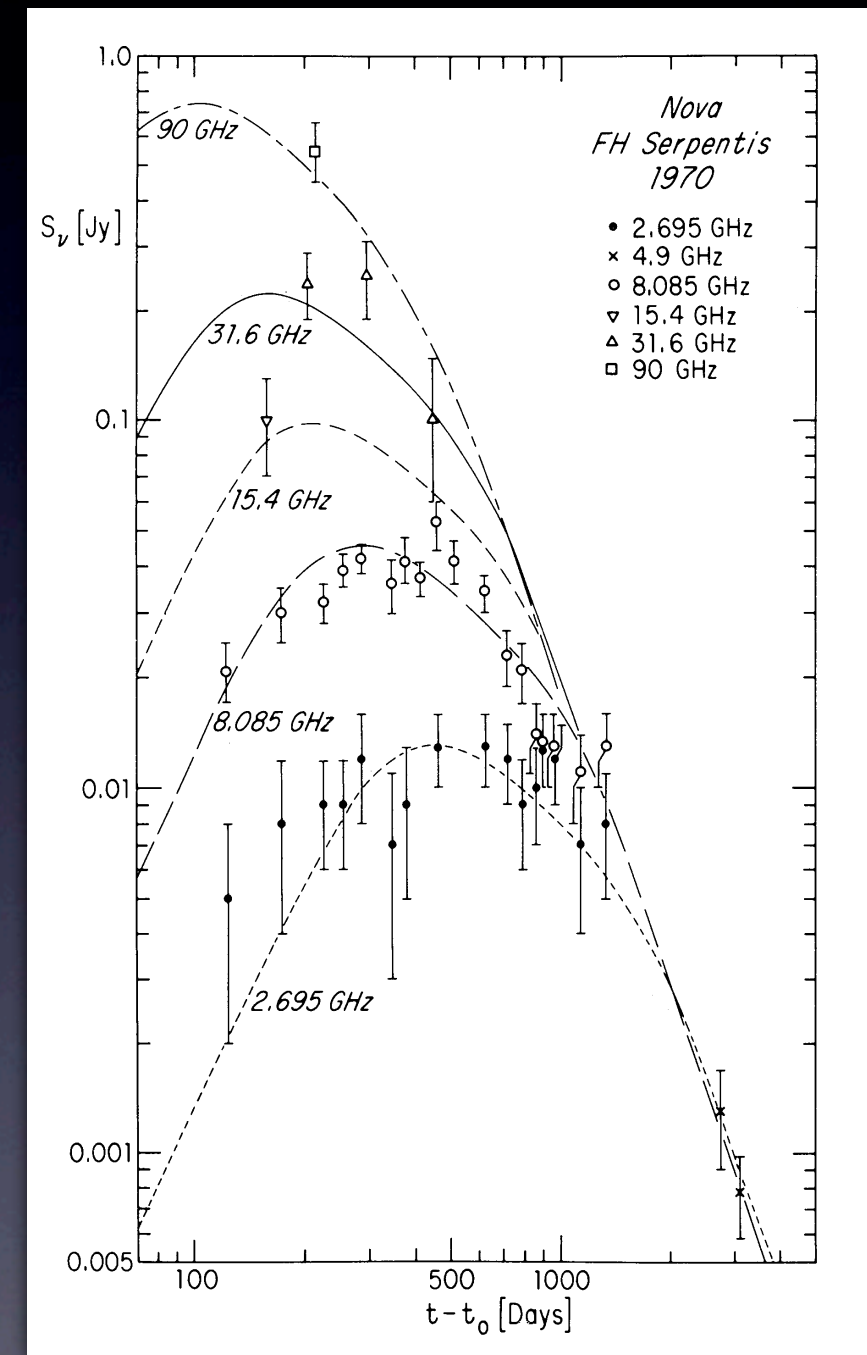


$M_{ej} = 4.5 \times 10^{-5} M_{\odot}$
 $D = 0.65$ kpc
 $v_2 = 990$ km/s
 $v_1 / v_2 = 0.05$

The ENova Project:

A new era of observations

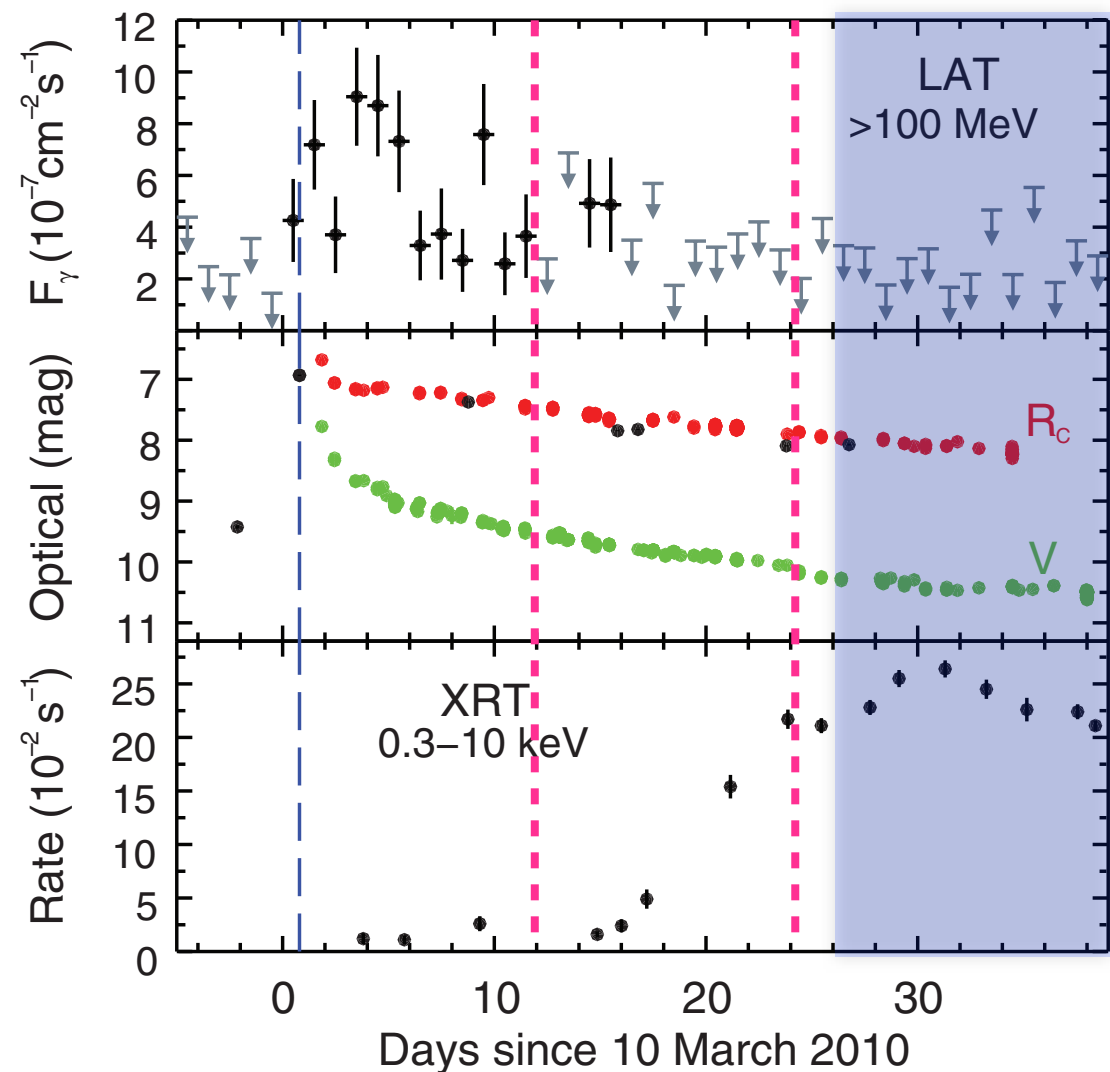
- EVLA + eMERLIN + VLBI: all galactic novae
- Monitoring of new, nearby (< 3 kpc) novae (currently underway)
 - improved sensitivity
 - broad frequency coverage
 - fast response
- Imaging of recent novae (proposed observations)
 - morphology and spectral properties of radio remnants
 - will tie to interpretation of light curves



Hjellming et al. 1979

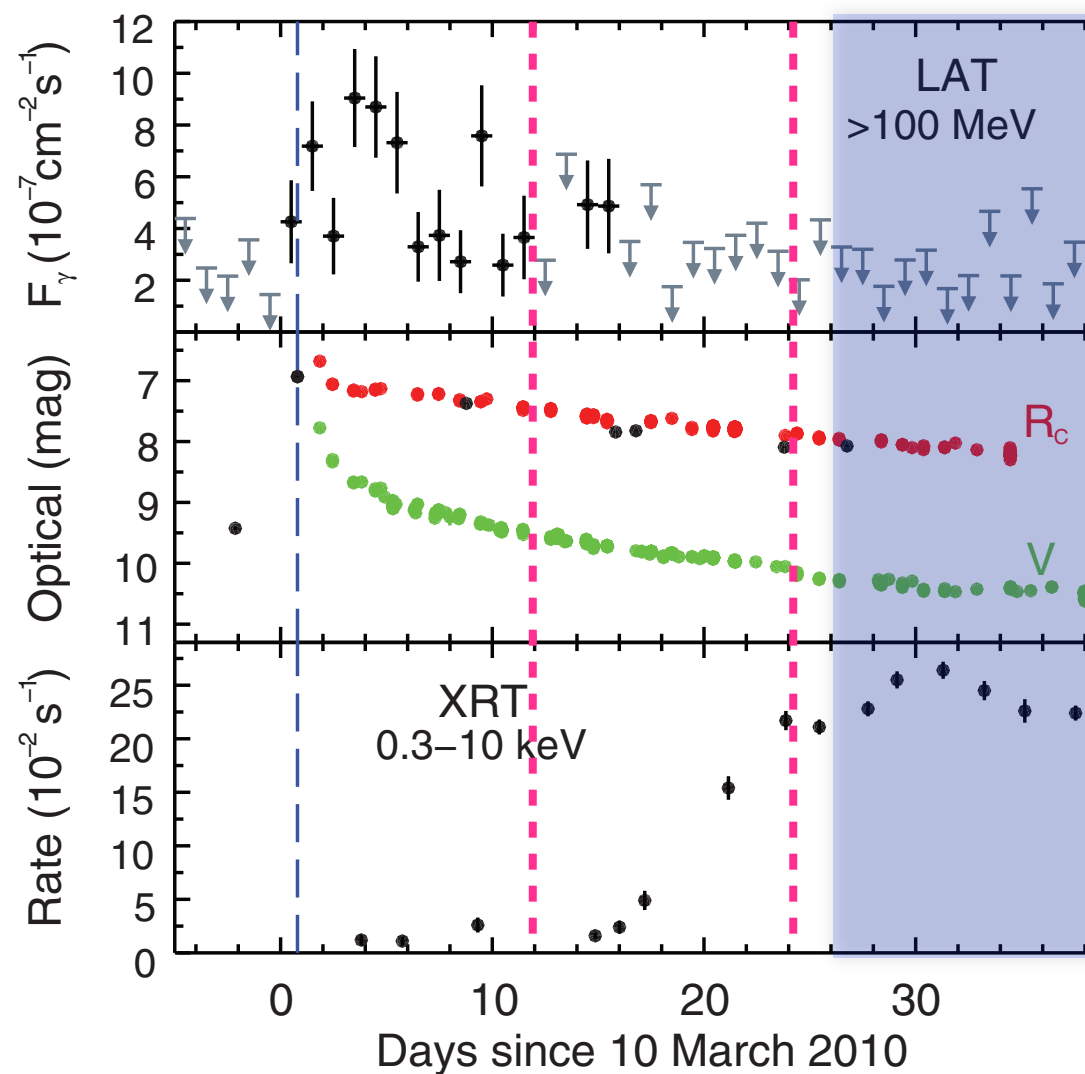
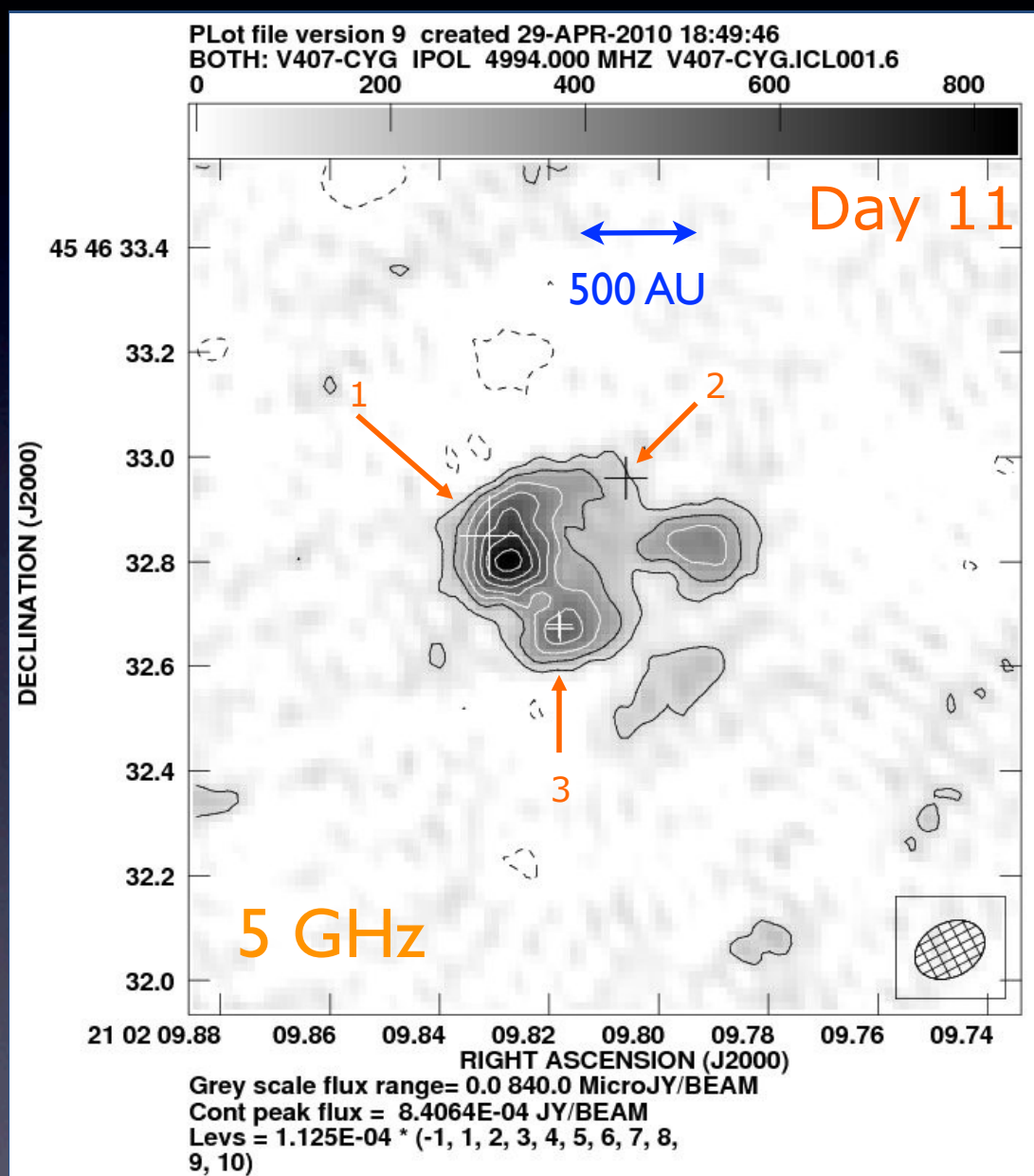
The ENova Project: V407 Cyg

- Symbiotic system with Mira secondary – dense circumbinary medium
- $D \approx 2.7$ kpc
- First nova with detected gamma-ray emission
- Early Merlin observations show resolved shell
- VLBI detections



The Fermi-LAT Collaboration, 2010

The ENova Project: V407 Cyg

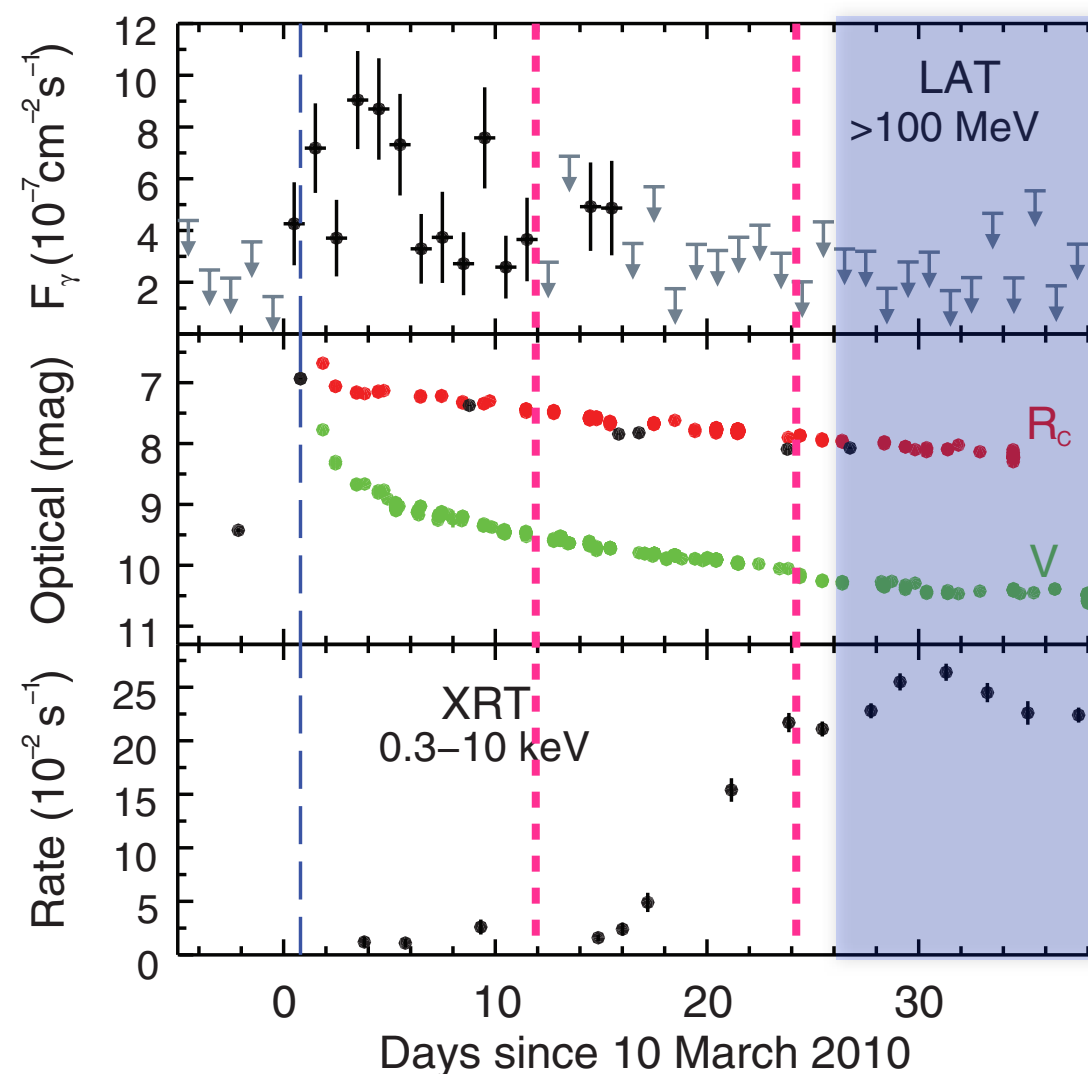
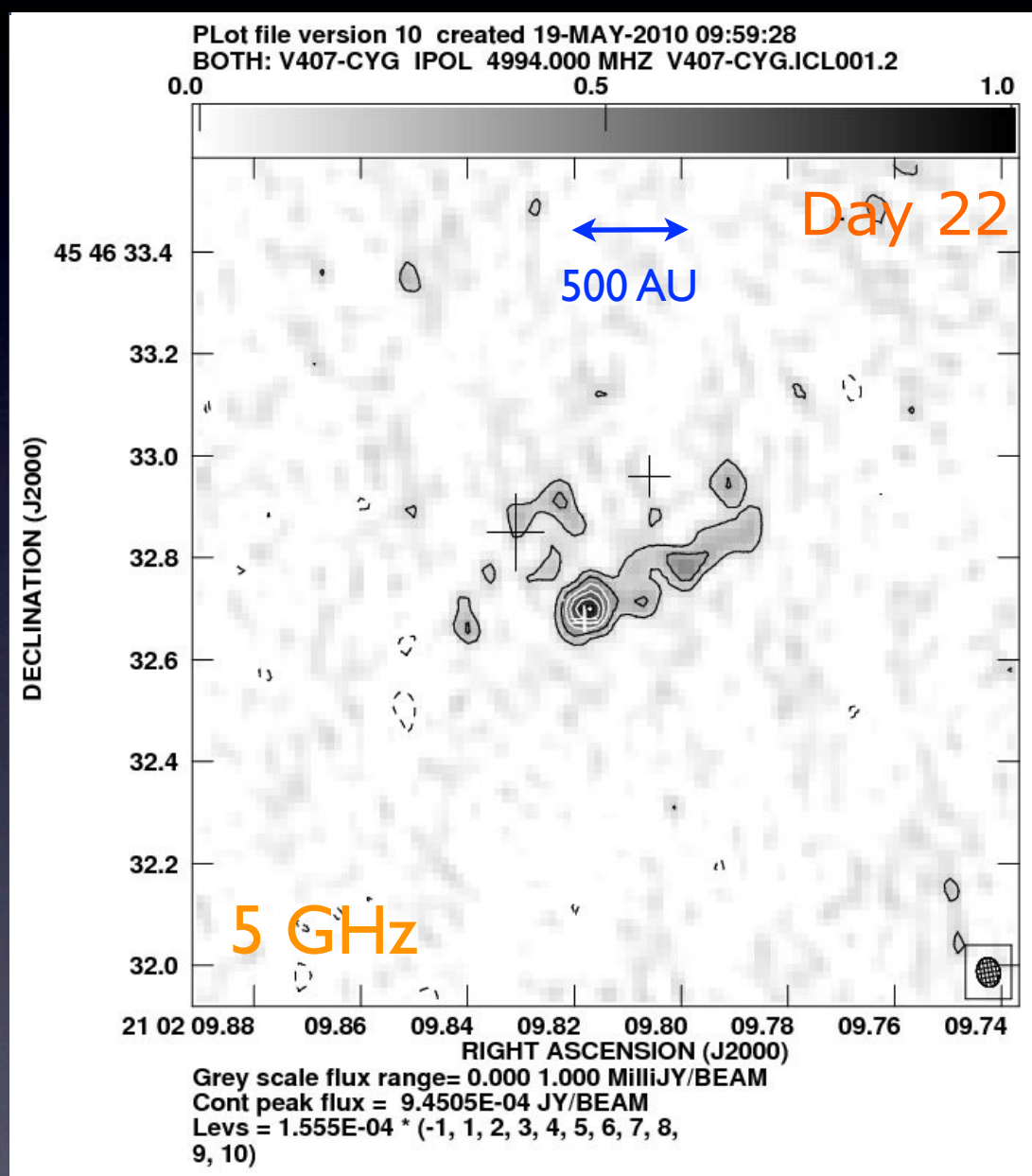


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The ENova Project: V407 Cyg

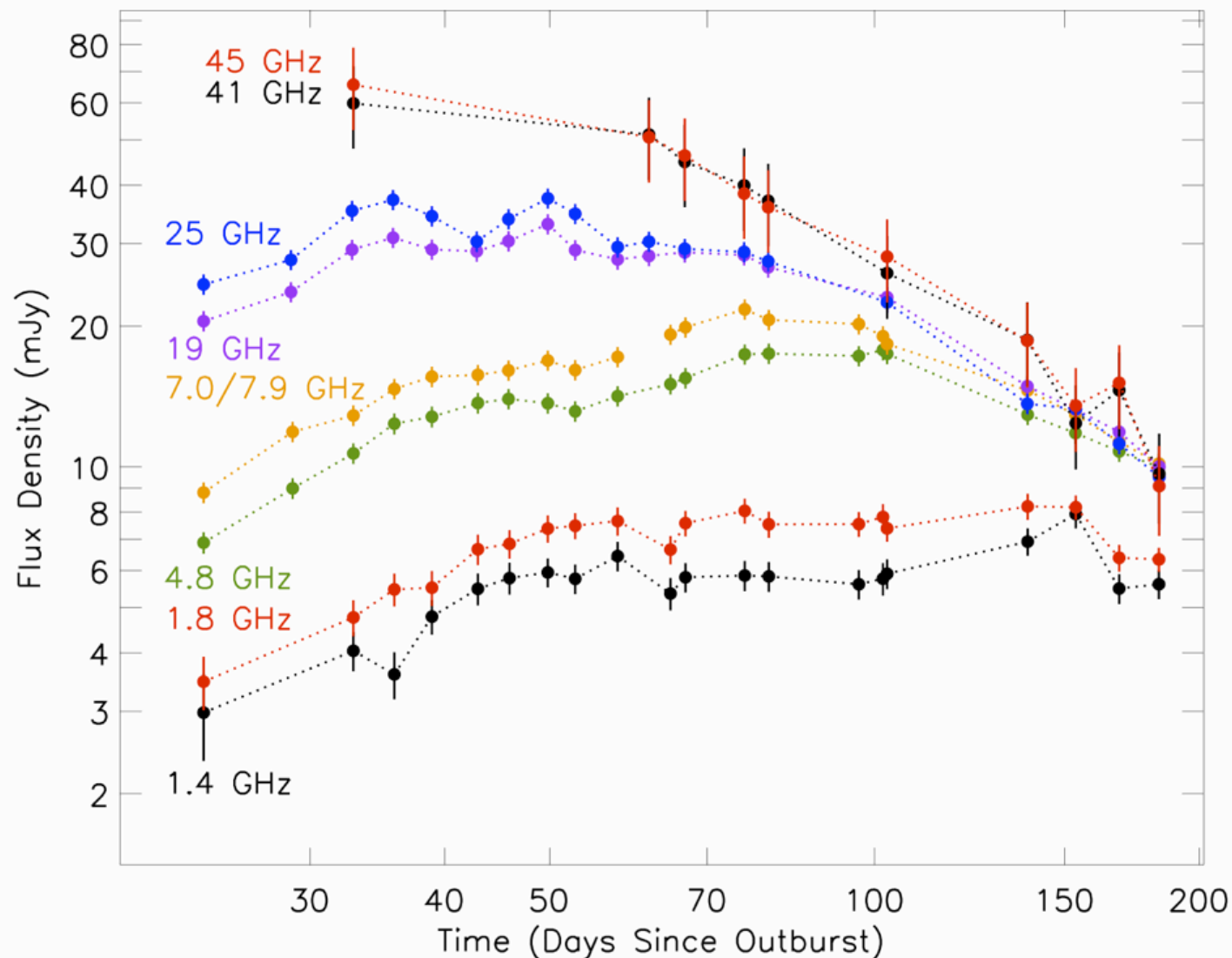


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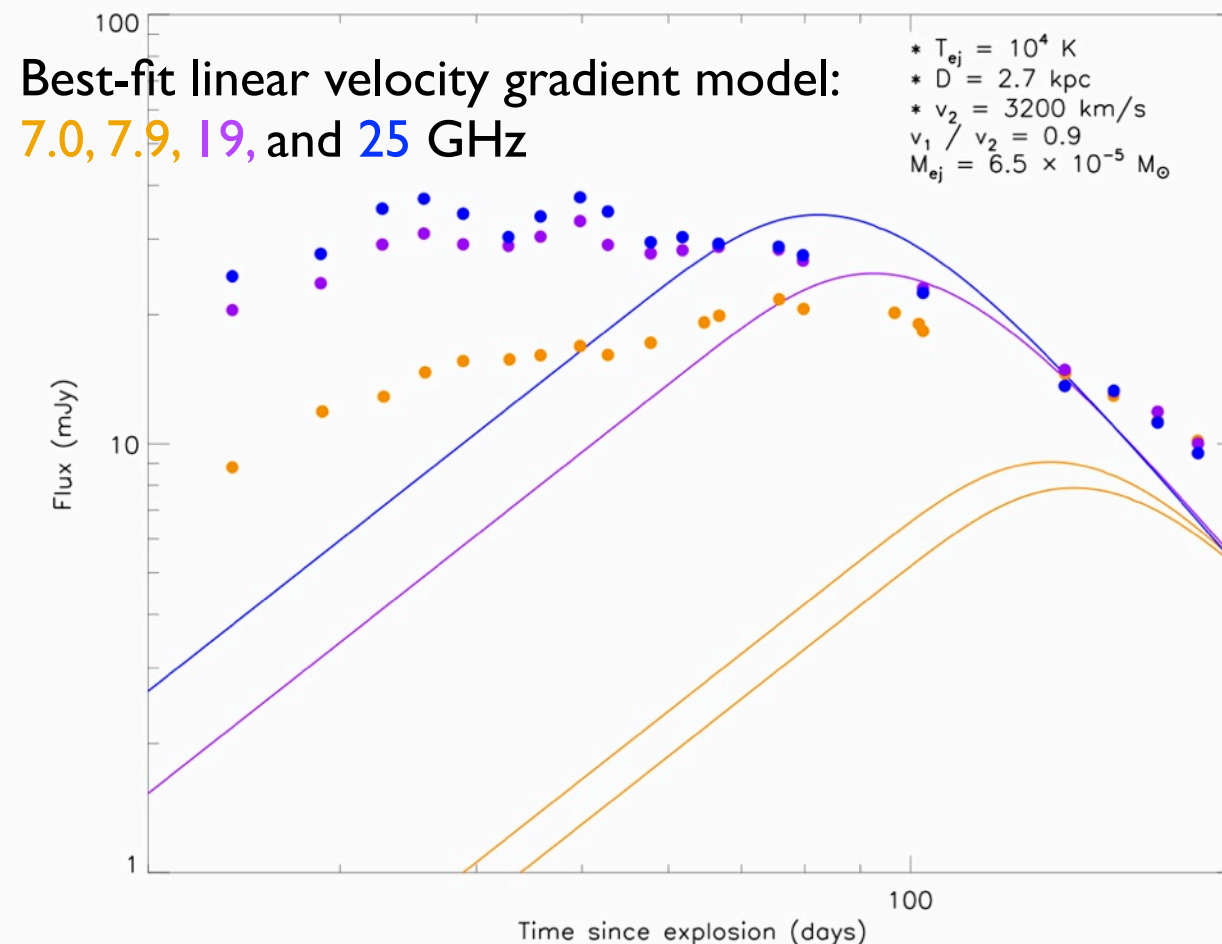
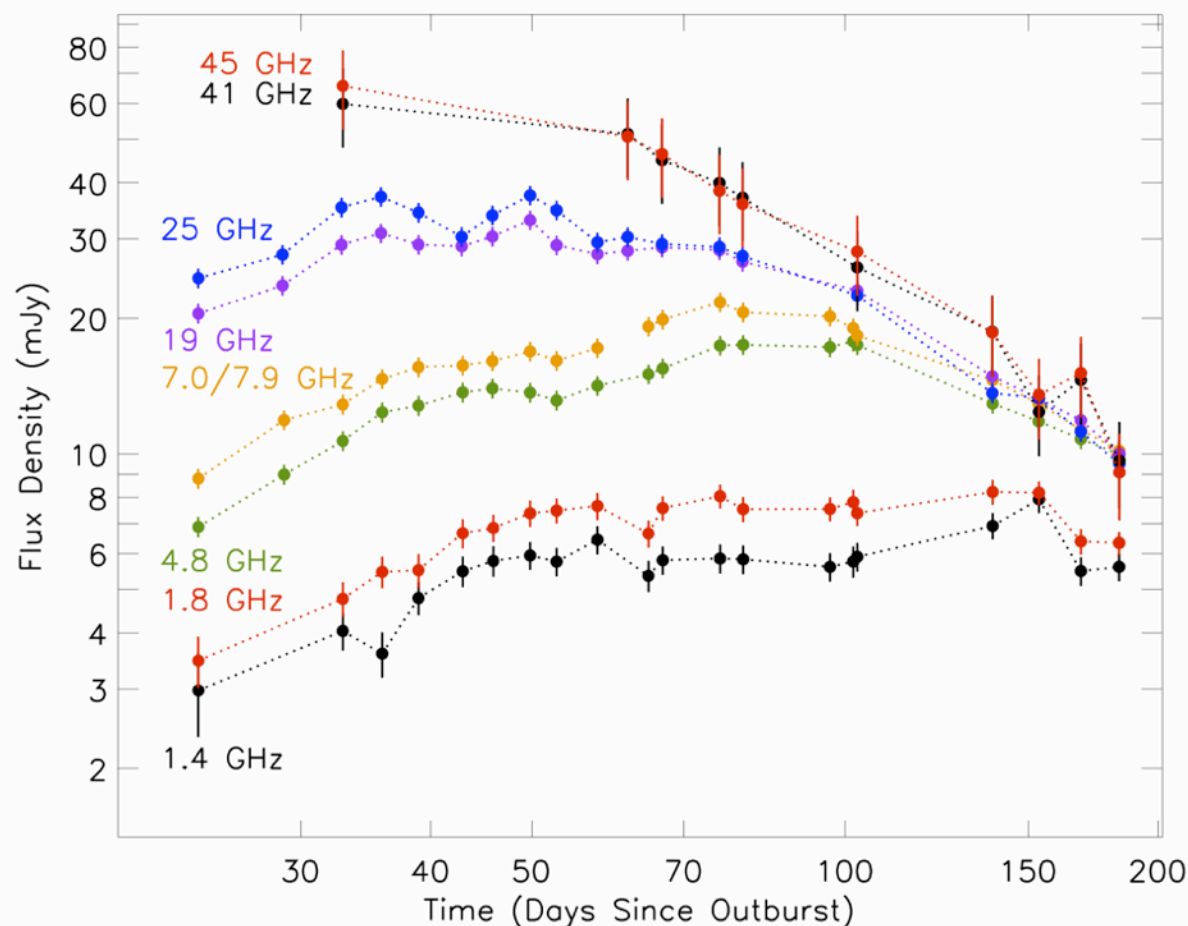
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The ENova Project: V407 Cyg – EVLA observations/modeling



- Observations at 1.5, 1.8, 4.8, 7.9, 19, 25, 41, 45 GHz
- “OSROI” mode observing (2 × 128 MHz spectral windows per band)
- Light curves: 20–200 days
- Spectral index: 0.8 at earliest epochs; ~ 0.1 at latest

The ENova Project: V407 Cyg – EVLA observations/modeling

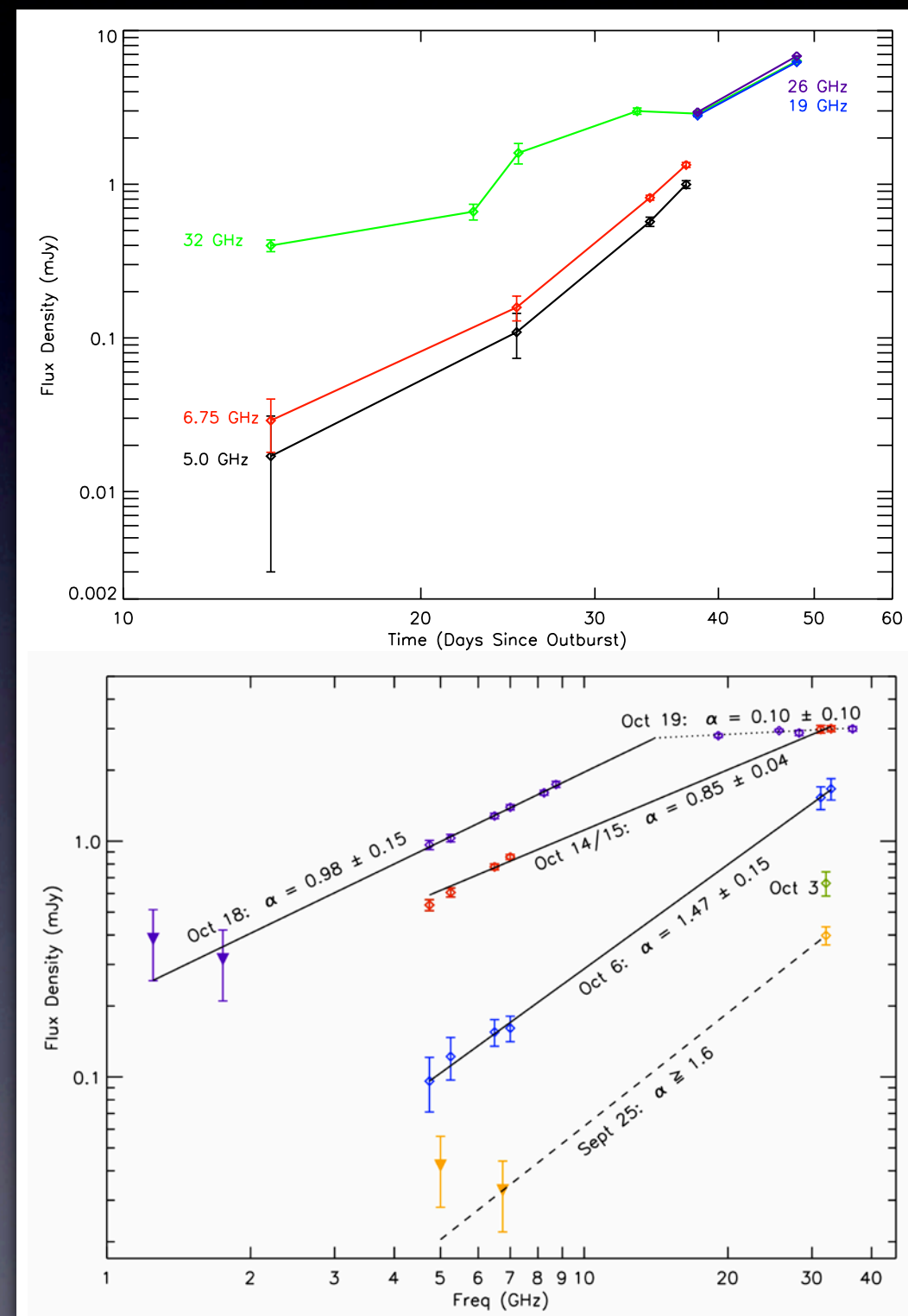


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- Observations at 1.5, 1.8, 4.8, 7.9, 19, 25, 41, 45 GHz

Ultimately, very complex system –
must consider multi-wavelength data

The ENova Project: V1723 Aql – a simpler source?

- Discovered Sept. 11; EVLA observations began Sept. 25
- 2 GHz bandwidth
- Highly extinguished; source not previously known
- Early EVLA data: rising flux; $\alpha < 2$
- $D \approx 3$ kpc ($v_{ej} = 1500$ km/s, optically thick at 30 GHz)
- Swift X-ray detection on day 40
- Continued observations: how will radio source develop?



The ENova Project: Conclusions & future prospects

- First complete, rapid-response, multifrequency radio monitoring of Galactic novae
- Already, data are challenging “standard” models
- Imaging will be very important!
- Will provide some of the highest-quality radio data ever gathered
- An exciting time for theory and interpretation!