

Satellite Accretion and
Minor Merger
Events from the HI and
Stellar Perspectives

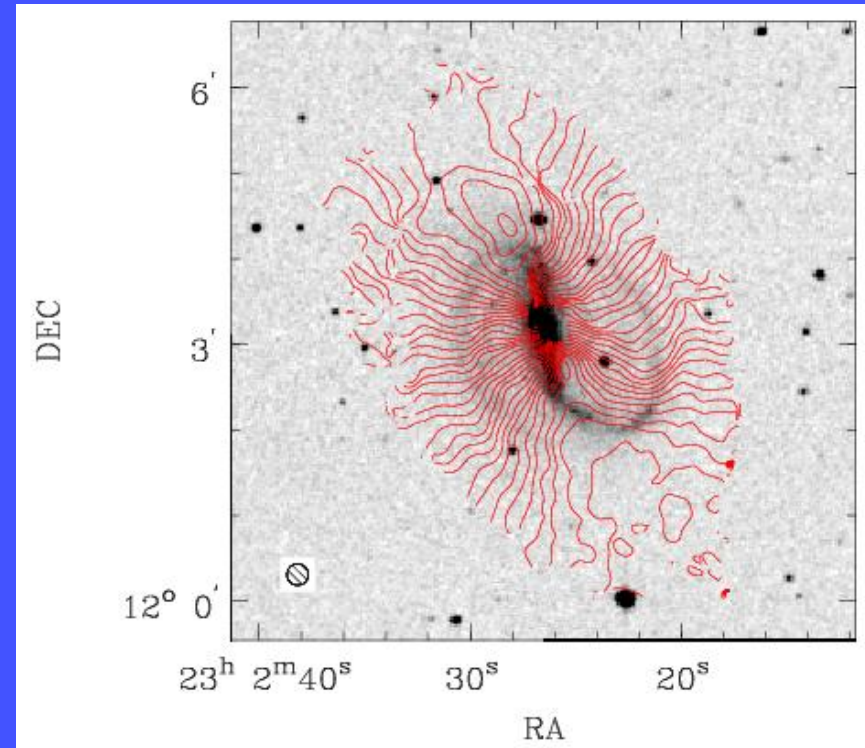
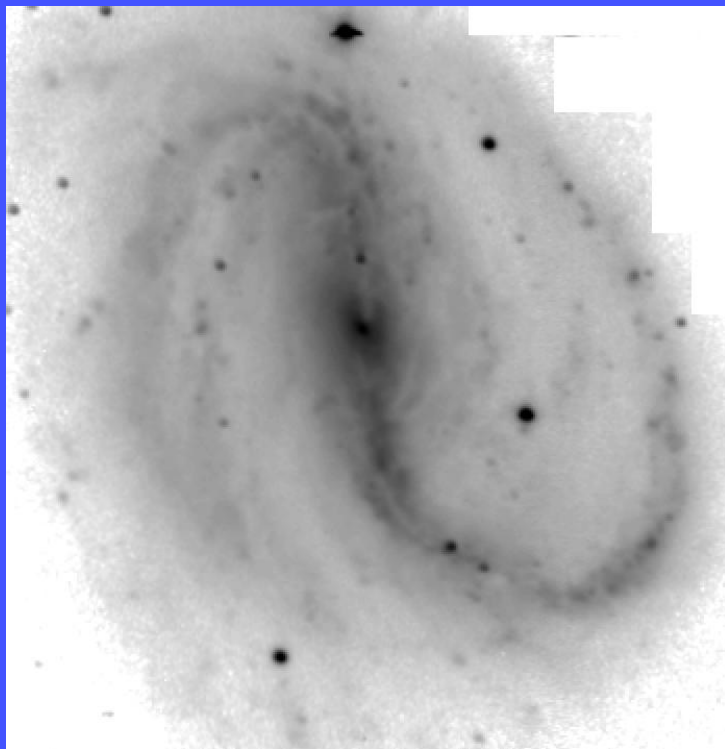
Seppo Laine, Spitzer Science Center, Caltech

Why Should We Care?

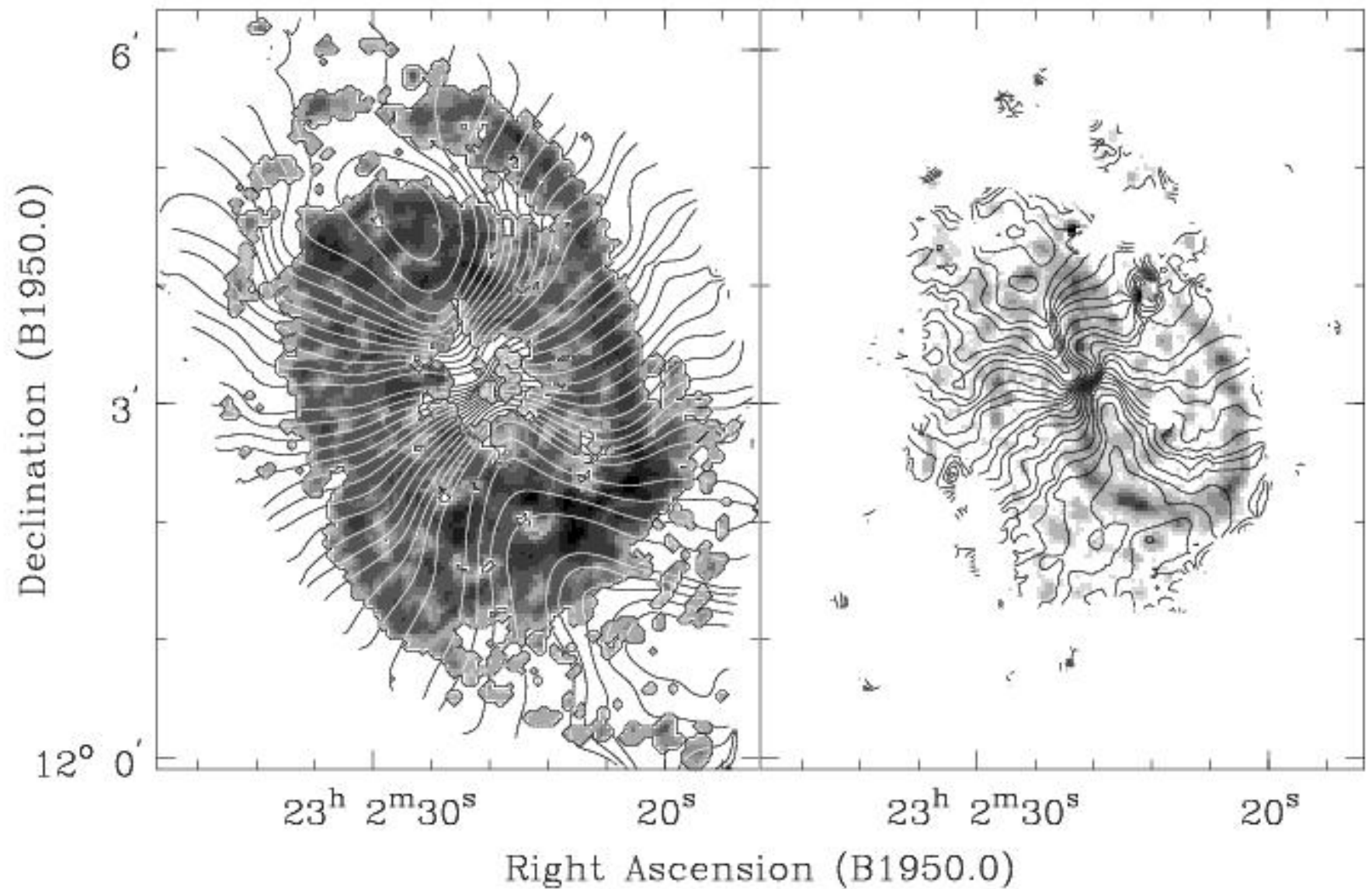
- The apparently steady rate of star formation in disk galaxies implies a source of continuous replenishment
- Galaxy evolution and internal dynamics may be largely driven by satellite accretion and minor mergers
- ASKAP/WALLABY will survey 75% of the sky to a decent depth with decent spatial and spectral resolutions and may allow the HI detection of mergers/accretions in yet unmapped (in HI) nearby galaxies/galaxy groups

An Example of a Minor Merger: NGC 7479

A nearby ($D=32$ Mpc) barred spiral galaxy with an asymmetric arm structure and other peculiarities



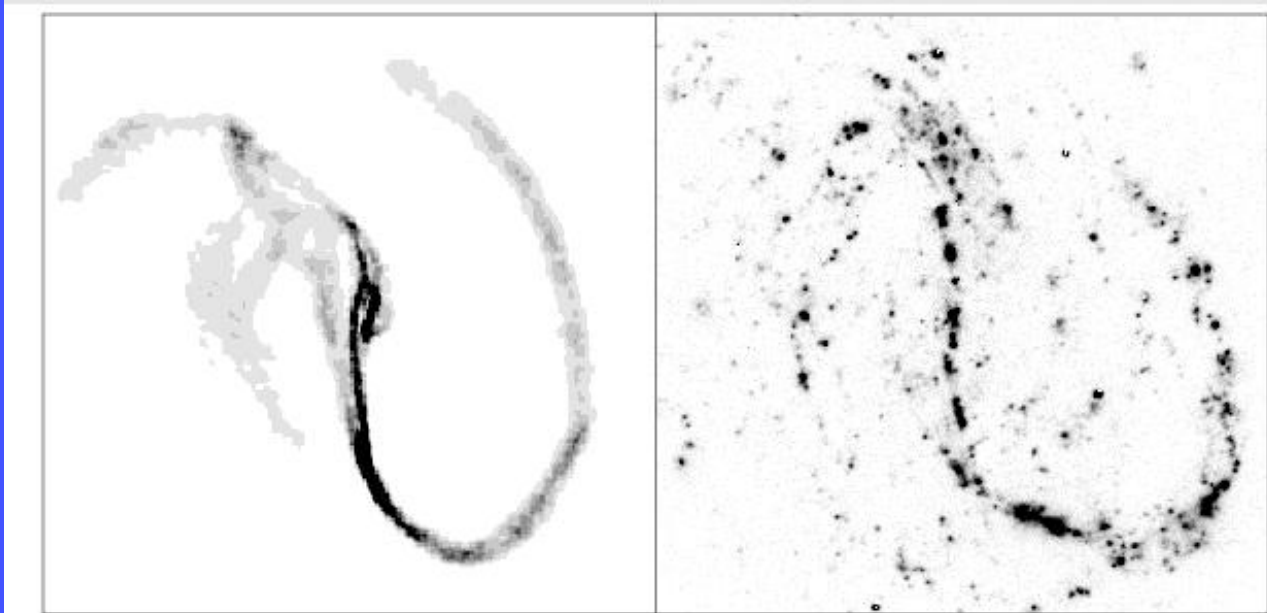
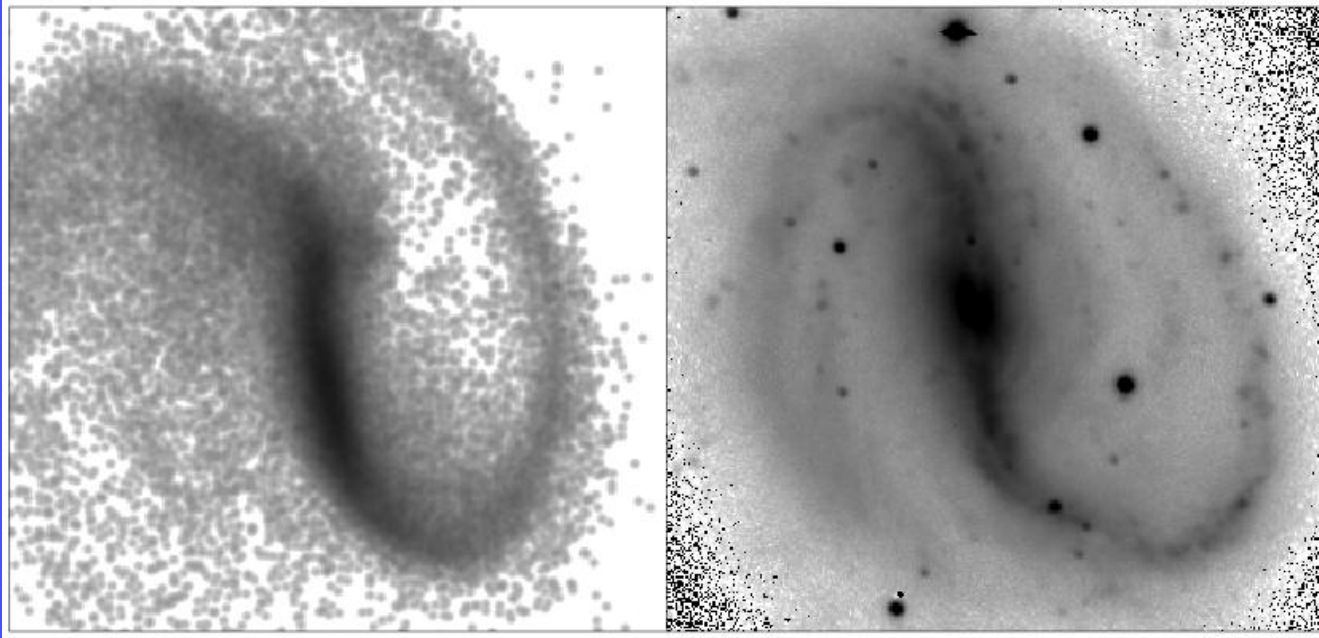
HI and H α Velocity Fields



NGC 7479 radio jet



Minor Merger Model



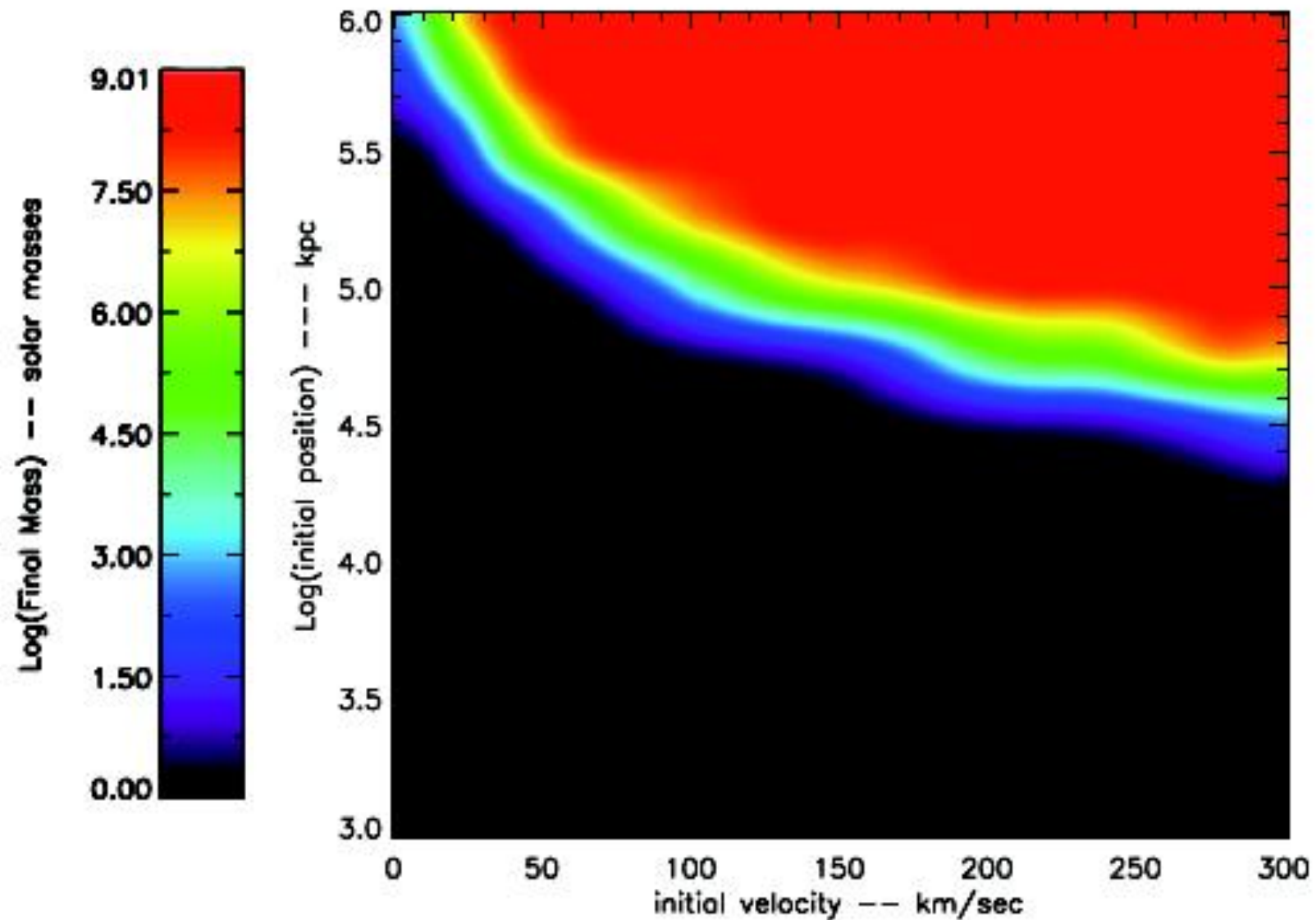
Signs of Minor Mergers in H I

- Asymmetries in gas distribution, including lopsidedness
- Peculiarities in velocity fields
- Minor tidal features

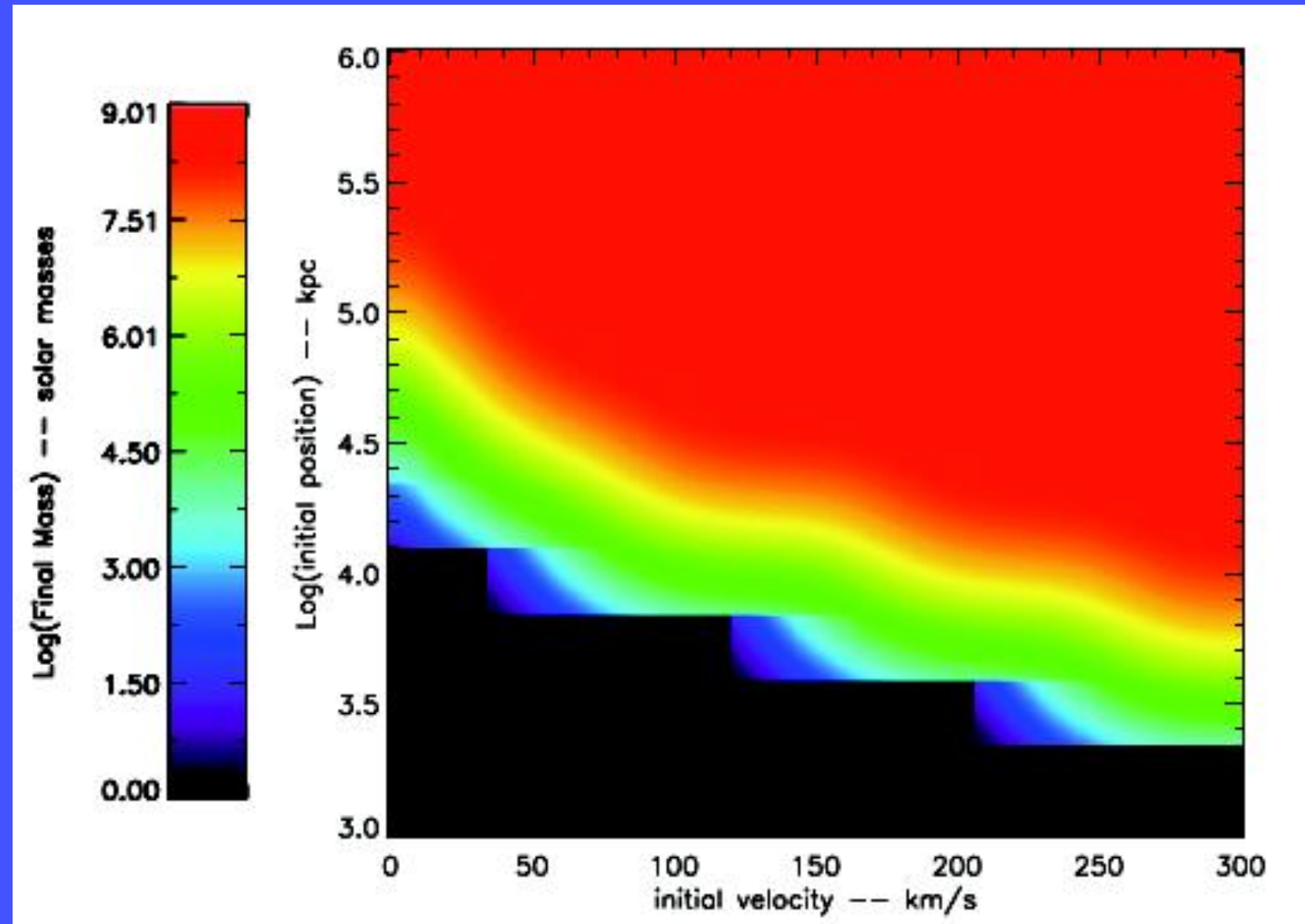
Studying Satellite Galaxy Disruption

1. I-band imaging of satellites from the sample of Zaritsky et al. (1997).
2. Fit 2D luminosity profiles with Sersic or exponential law.
3. Conversion to 3D profiles assuming axisymmetry.
4. 3D mass density conversion using M/L from Zaritsky et al. (2008), based on a scale radius and surface brightness.

Studying Disruption Parameter Space



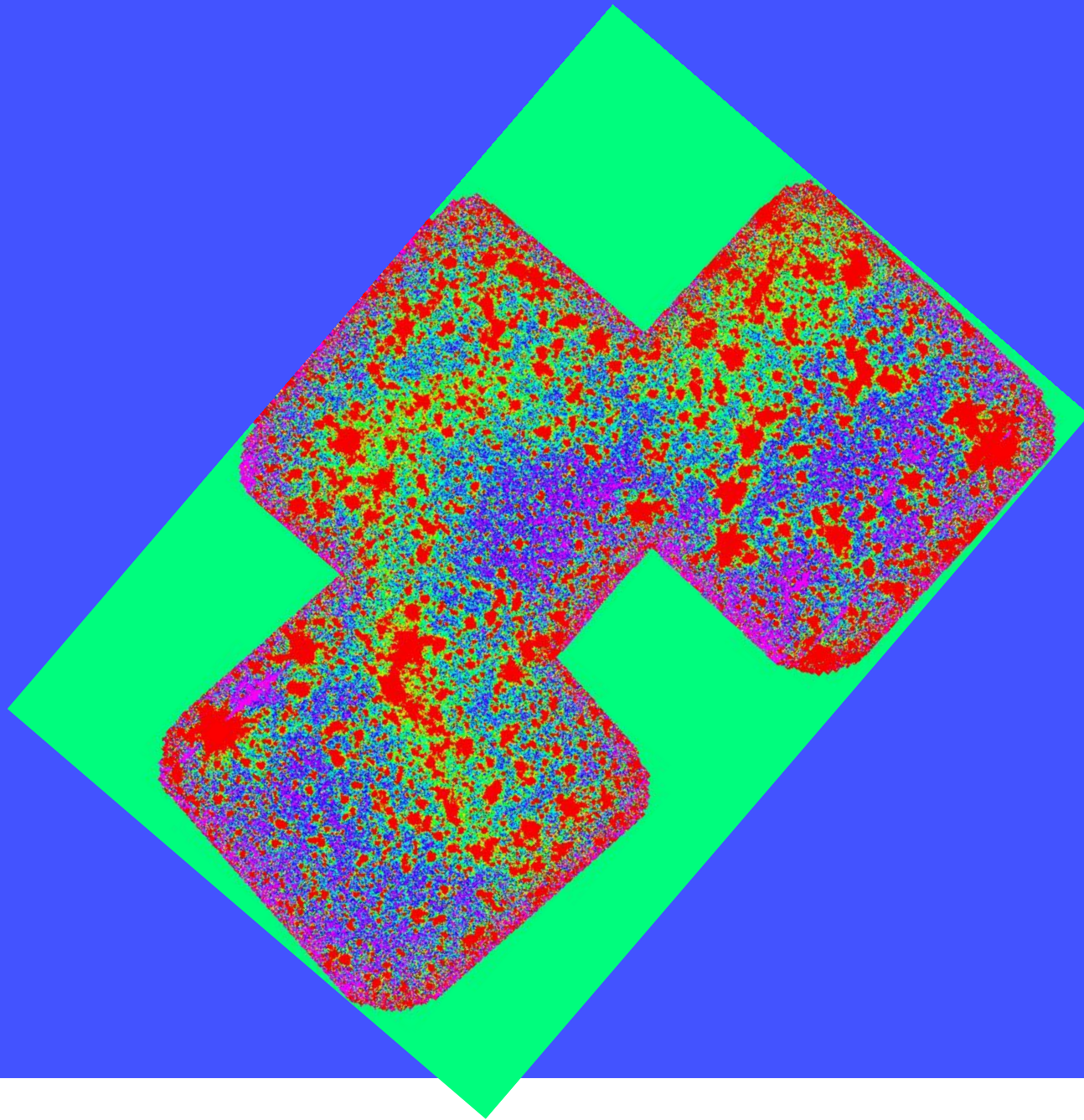
Studying Disruption Parameter Space



Stellar Stream in NGC 5907



NGC 5907 stream at 3.6 μm



Other Stellar Streams Etc.

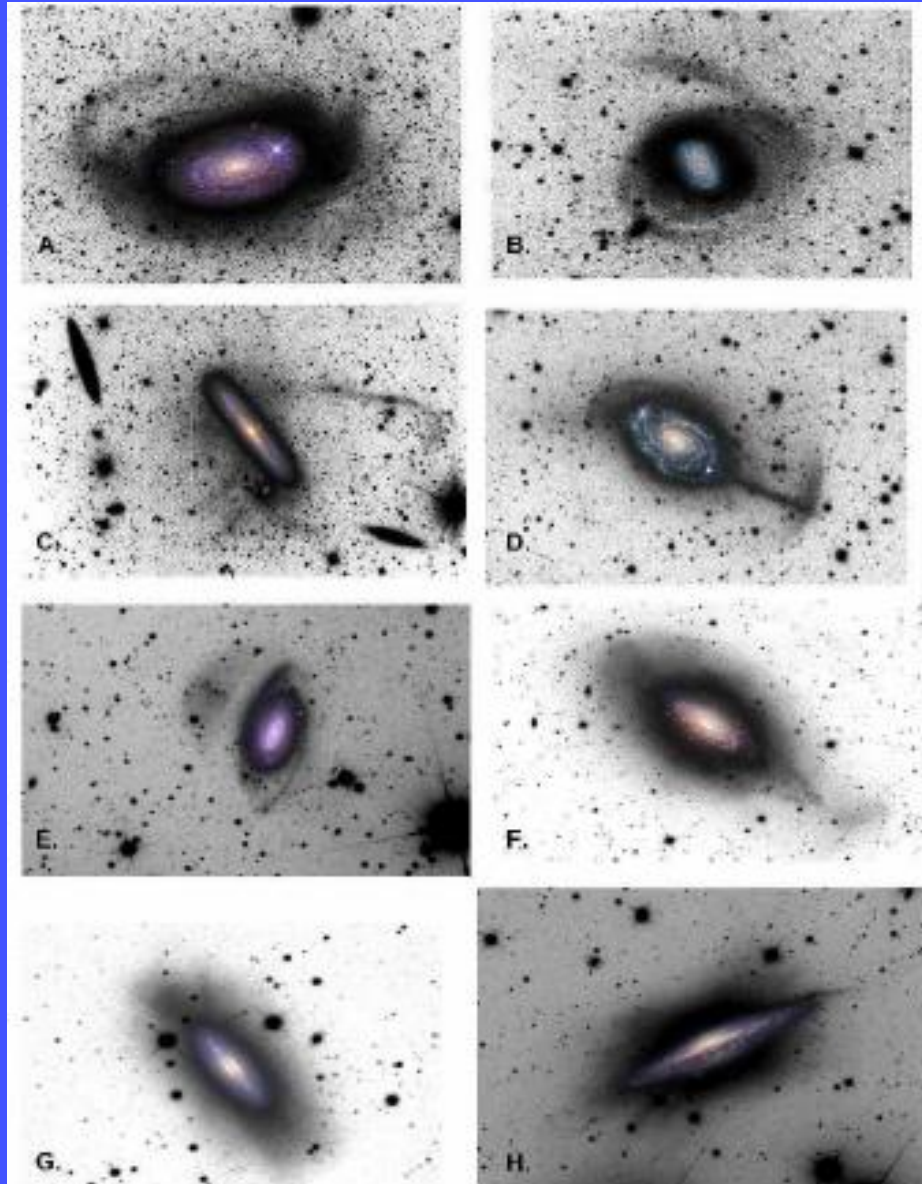
M63

From Martínez-
Delgado et al.
(2010)

NGC 4216

NGC 7531

NGC 5866



NGC 1084

NGC 4651

NGC 3521

NGC 1055

What Can We Learn by Studying Satellite Galaxy Accretion and Minor mergers?

- ✓ What is the recent merger history
- ✓ How do minor mergers and accretion events drive galaxy evolution:
 - can they build bulges/halos
 - thicken disks
 - generate bars/nuclear starbursts
 - form shells
 - form counter-rotating cores

What Can We Learn... (Continued)

- ✓ Calculate satellite masses and infer their stellar populations
- ✓ Learn more about the halo's gravitational potential
- ✓ Test alternative gravity theories (e.g., puffing up of satellites)
- ✓ Gas detections could give important kinematic constraints

How Can ASKAP/WALLABY Help?

- Using the ASKAP PSF simulator
- 30'' beam, 8 hour integration
- 18.5 kHz channel width
- natural weighting, 10'' tapering
- noise is about 1.5 – 2 mJy/beam
- $\sigma(N_{\text{H}}) \approx 5\text{-}10 \times 10^{19}$ atoms/cm² (20 km/s velocity width)
- 60'' beam would give sensitivity down to $\approx 3 \times 10^{19}$ atoms/cm²
- 90'' beam to 2×10^{19} atoms/cm²

Some Final Questions

- Reasonable to go only out to Virgo distance?
- So far gas AND stars only detected in the MW Sagittarius stream?
- Will it be possible to detect more HI clouds such as the one near NGC 4388 and M86 in the Virgo Cluster (Oosterloo & van Gorkom 2005)?
- Can we identify more minor merger candidates by their HI features?