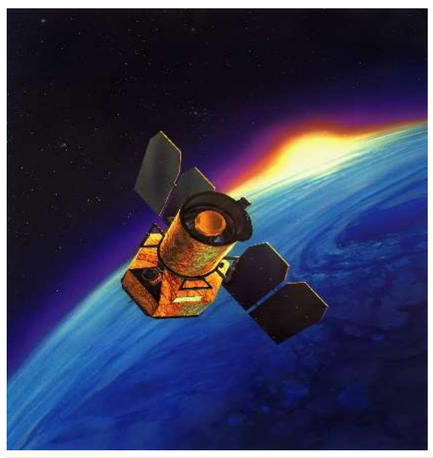

GALEX is a NASA Small Exploreer, launched April 2003, and developed in cooperation with the Centre National d'Etudes Spatiales of France and the Korean Ministry of Science and Technology.

UV Morphology and Star Formation in the Tidal Tails of NGC 4038/39

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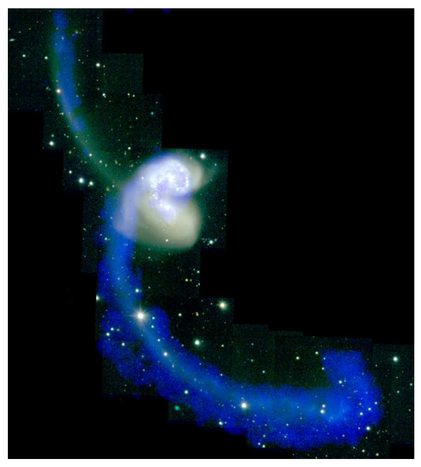
ABSTRACT: We present 4 orbits (2554 sec) of GALEX FUV (1530A) and NUV (2310A) observations of the archetypal merging system NGC4038/39, ``The Antennae". These data are compared to existing optical (CTIO 4m BVR imaging), radio (VLA C+D-array HI), and X-ray (Chandra) observations. UV-optical colors indicate that star formation has continued within the tidal features over that last few 100 Myrs, with the location of UV bright regions well correlated with HI density. Within the merging bodies, there is evidence that HI has been swept out of the disk of NGC4039 by a wind-blown X-ray superbubble.



PREPRINTS: http://www.nrao.edu/~jhibbard/n4038/GALEX/

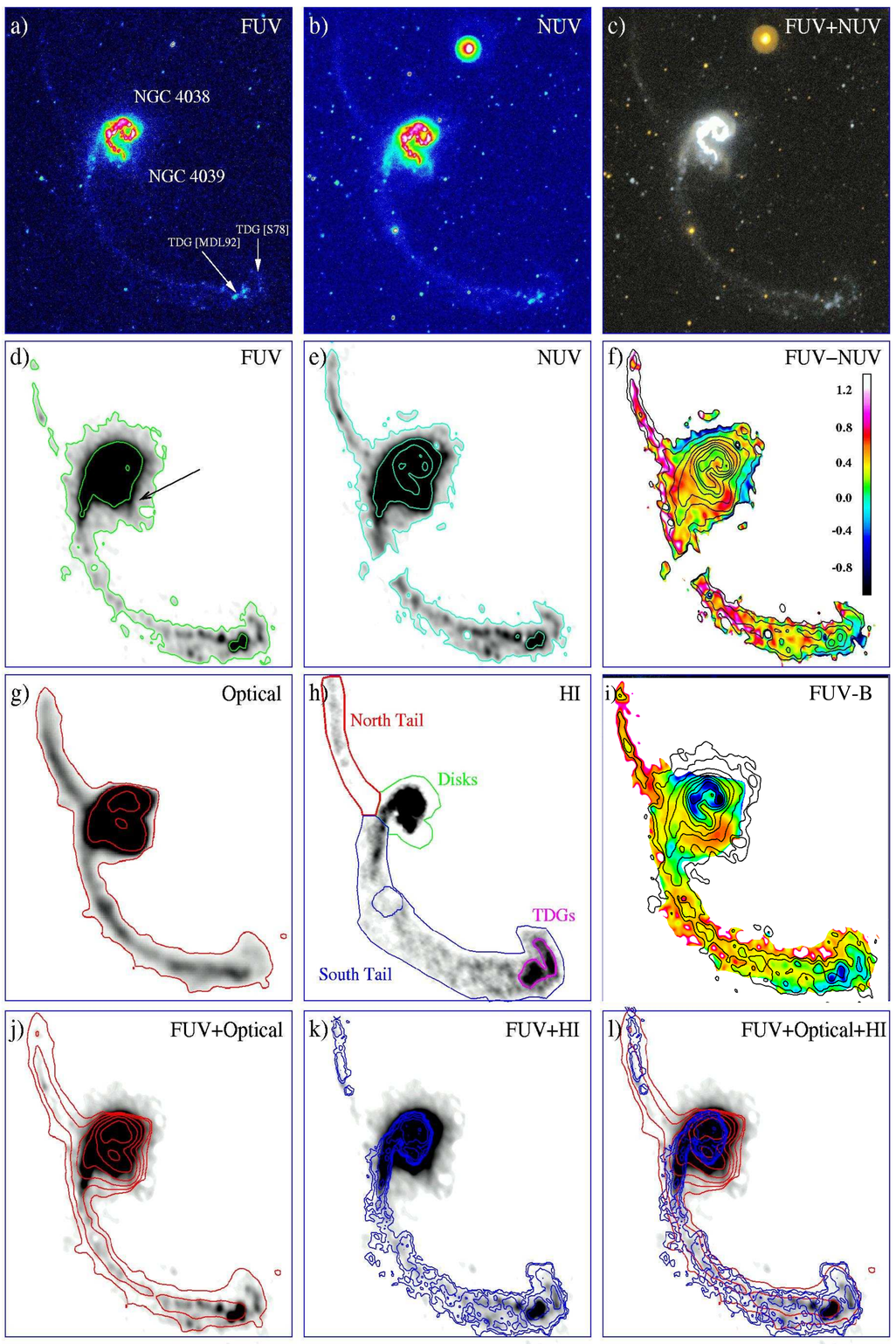


Figure 1: Montage of UV, optical and HI data, as labeled. HI and optical (B-band) data are from Hibbard et al. (2001, AJ, 122, 2969). In the first three panels, the Far-UV (FUV, 1530 Å) and Near-UV (NUV, 2310 Å) data are shown at full resolution (5″). In subsequent panels, the UV and optical data have been star subtracted and smoothed to the resolution of the HI (21″x15″). In panel (a), the location of the Tidal Dwarf galaxy candidates identified by Schweizer (1978, in IAU Symp. 77, p.279) and Mirabel, Dottori & Lutz (1992, A&A, 256, L19) are indicated. Panel (c) presents a "True color" FUV+NUV image, where blue indicates bluer FUV-NUV colors, and yellow represents redder FUV-NUV colors. The contours in panel (f) delineate the regions whose properties are tabulated in Table 1.
Contours are drawn to indicate the following surface brightness levels: FUV and NUV (green contours in panel d, cyan contours in panel e) μ_{UV}=29.5, 27, 24.5, 22 mag arcsec^{-2}. Optical B-band (red contours in panels g, j, l) μ_B=26.5, 24. 21.5 mag arcsec^{-2}. HI (blue contours in panels k&l) $N_{HI}=2^n x10^{20}$ atoms cm^{-2} (n=0,1,2...).

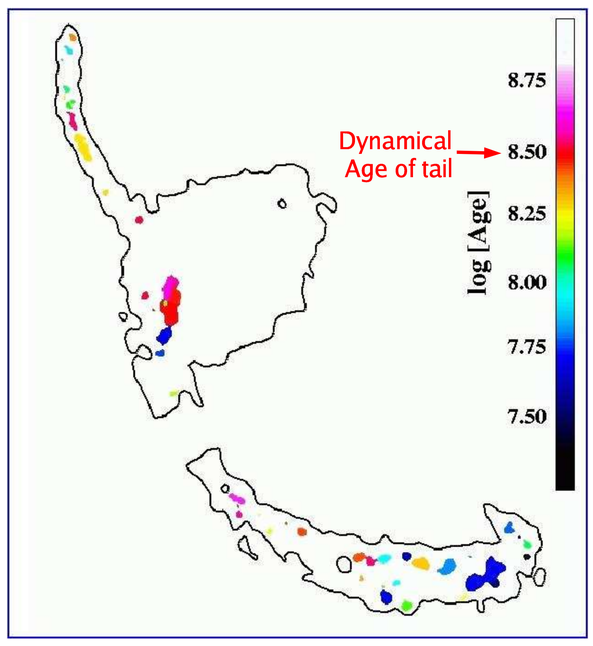


Figure 2: Luminosity-weighted Simple Stellar Population (SSP) ages of UV bright tidal regions. Ages are derived from (FUV-NUV) and (FUV-V) colors, assuming only Galactic extinction. The arrow on the color bar indicates the dynamical age of the tail from Barnes (1988, ApJ, 331, 699). This figure indicates that there has been wide-spread in-situ tidal star formation, not just at the location of the TDG candidates.

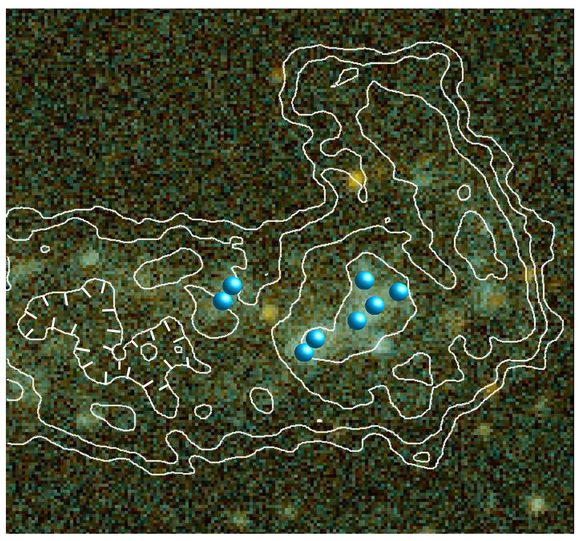


Figure 3: Close up of the candidate tidal dwarf region. False-color FUV+NUV with HI contours superimposed at levels of 1,2,4,8,16 M_o pc^{-2}. The eight young stellar associations identified in the HST WFPC observations of Saviane, Hibbard & Rich (2001, 2004, AJ, 127, 660) are indicated by 's. Here and throughout the tidal tail, the UV morphology more closely follows that of the HI than the optical light. Especially we note a bifurcated tidal morphology in the UV and HI, but not in the optical (compare Fig.1d,e,g,h,j,k,&l).

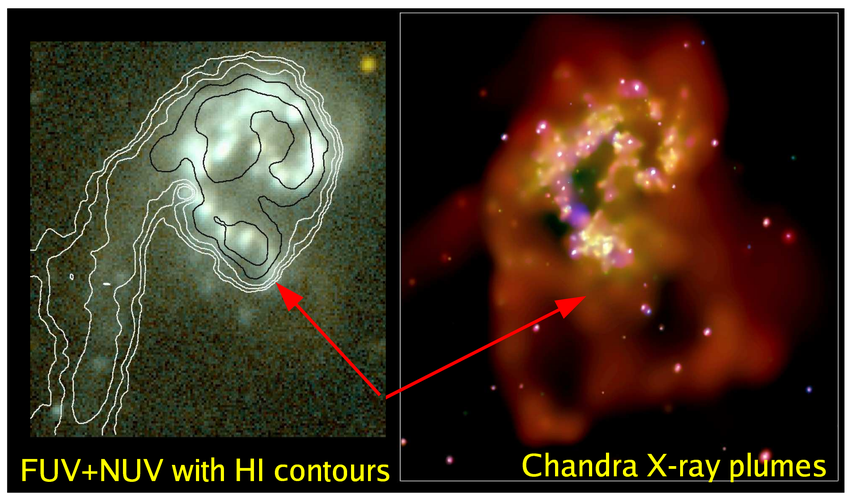


Figure 4: Comparison of Chandra X-ray observations (Fabbiano et al. 2004, ApJ, 605, L21) with UV and HI within the inner disks of NGC 4038/9. The HI gas in NGC 4039 is abruptly truncated to the south. A similar truncation is seen in the GALEX FUV (see arrow in Fig.1b) but not in the NUV observations. This indicates that the cold gas has been removed from this region in the last few 10 Myrs. The Chandra observations suggest that a wind-blown super-bubble (orange-red colors in right panel) is responsible for removing the atomic gas from this disk and subsequently truncating the star formation.

TABLE 1
Global Properties for NGC 4038/39

Quantity	Disks	South Tail	North Tail	TDG
m(FUV)	12.95	16.38	18.89	17.71
m(NUV)	12.62	15.94	17.66	17.66
m(V)	10.39	12.87	13.93	15.55
FUV-NUV	0.33	0.45	1.24	0.05
FUV-V	2.56	3.52	4.96	2.16
Log (Age)	8.34	8.49	8.71	8.08

TABLE NOTES: Colors and magnitudes are on the AB system. TDG denotes the region encompassing Tidal Dwarf Candidates TDG[S78] and TDG[MDL92]. Ages listed are for single burst model, assuming only foreground Galactic reddening of E(B-V)=0.046 (NED).

UPCOMING WORK: Our work on the Antennae will be extended by considering more realistic star formation histories for the UV-bright sources located within the tidal tails. The present analysis only compared the photometric data against instantaneous burst and continuous star formation models. GALAXEV (Bruzual & Charlot 2003, MNRAS, 344, 1000) will be used to compute synthetic predictions for parameterized burst scenarios of prolonged duration and/or declining SFR. Additionally, a GALEX Cycle 1 proposal to deeply image other interacting / merging galaxies was accepted. Further relevant observations are part of the GALEX Nearby Galaxy Survey. Well-known targets in the sample are Arp 141, 157, 236, 295, and 314. Some of these are discussed by Neff et al. (2004, ApJL, in press). An important piece of our upcoming analysis will be to develop or refine dynamical models for each system, to compare with the observed patterns of star formation in tidal structures.