Sculptor and Cen A Groups: HI Detection in dSph Galaxies

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We made HI observations with the ATCA of 10 dwarf spheroidal (dSph) galaxies in the Sculptor and Cen A Groups. Our primary motivation was to detect or put limits on their HI content.

Our sample comes from Jerjen et al. (1998 ; 2000) and consists of the 5 optically brightest dSph/dS0 members of each group. These galaxies all have precise distance estimates from Surface Brightness Fluctuation measurements which confirm their group membership. Of these 10 galaxies, only 2 show enough HI to be detectable with a 12-hour observation using a 750-m configuration. These two detections (ESO384-016 and NGC 59) are the subject of this poster. Their properties are summarized in Table 1.

In summary, two of our ten early-type dwarf galaxies have small reservoirs of HI, at the 10^5 $M_\odot$ level, which may provide the fuel for future generations of low level star formation. We recall that many of the dSph galaxies in the Local Group show multiple generations of star formation, although only a few show evidence for gas from which future generations of stars might form.

Table 1. **GALAXY PROPERTIES**

	ESO384-016	NGC 59
Group	Cen A	Sculptor
Type	dS0/Im	dS0
R.A.	13 57 01	00 15 25.1
Decl.	−35 19 59	−21 26 38
R_T (mag)	13.90	11.90
$(B-R)^0_T$ (mag)	1.09	1.04
M_B (mag)	-13.1	-15.3
Dist (Mpc)	4.23	4.39
ATCA 750 (hr)	12	12
Beam (arcsec)	91 x 91	167 x 167
V_{opt} (km s^{-1})	561 ± 32	362 ± 10
V_{HI} (km s^{-1})	506 ± 5	359 ± 5
HI mass ($M_\odot$)	2.6×10^5	1.1×10^5
M_{HI}/L_B ($M_\odot/L_\odot$)	0.010	0.0006

Acknowledgement:

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Reference:

Côté, S. et al. 2000, AJ, 120, 3027
Jerjen, H. et al. 1998, AJ, 116, 2873
Jerjen, H. et al. 2000, AJ, 119, 166

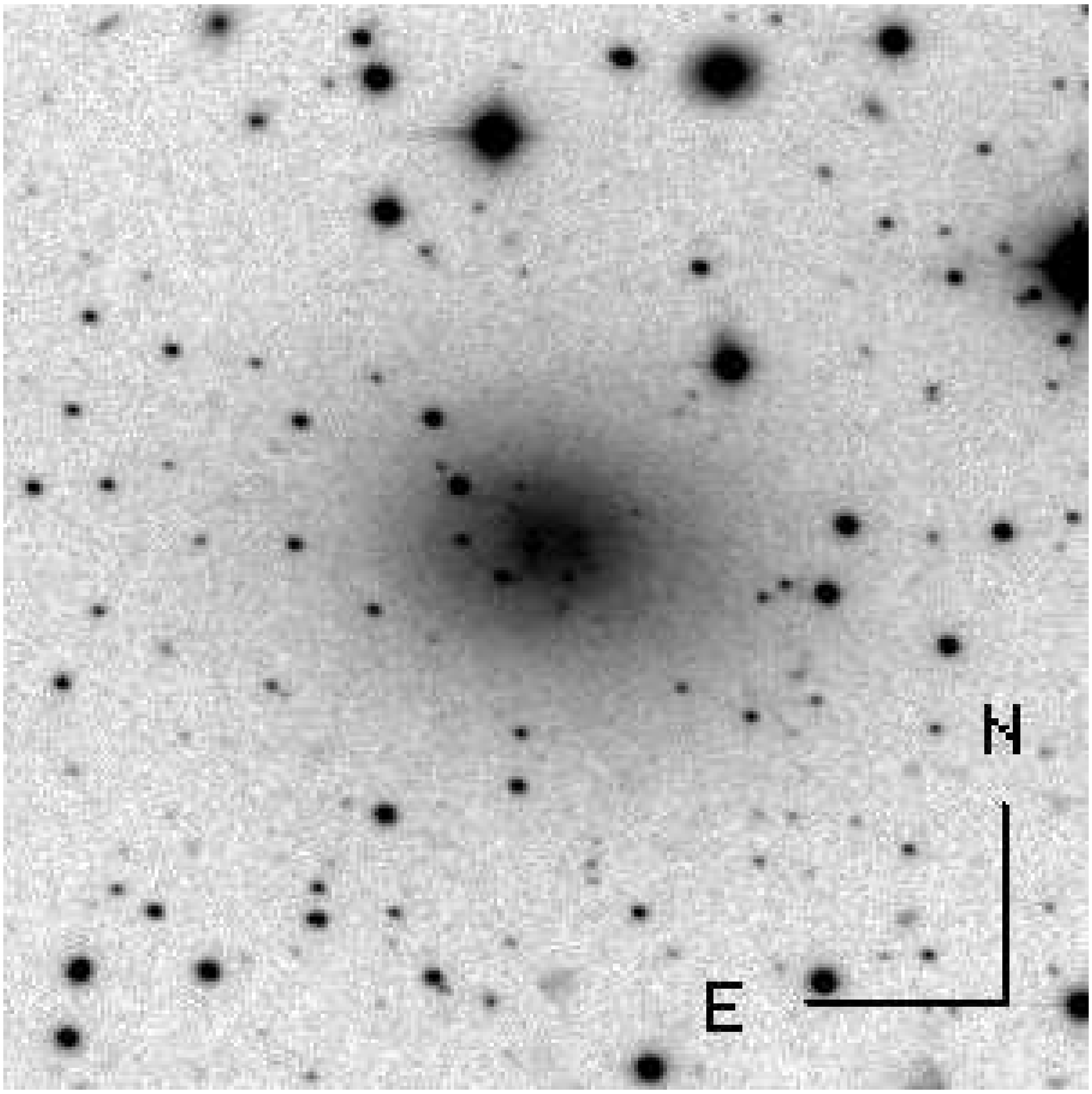

Figure 1. ES0384-016 Deep R-band CCD image taken from Jerjen et al. (AJ 2000, 119, 166). This system is classified as a transition dS0/Im galaxy.

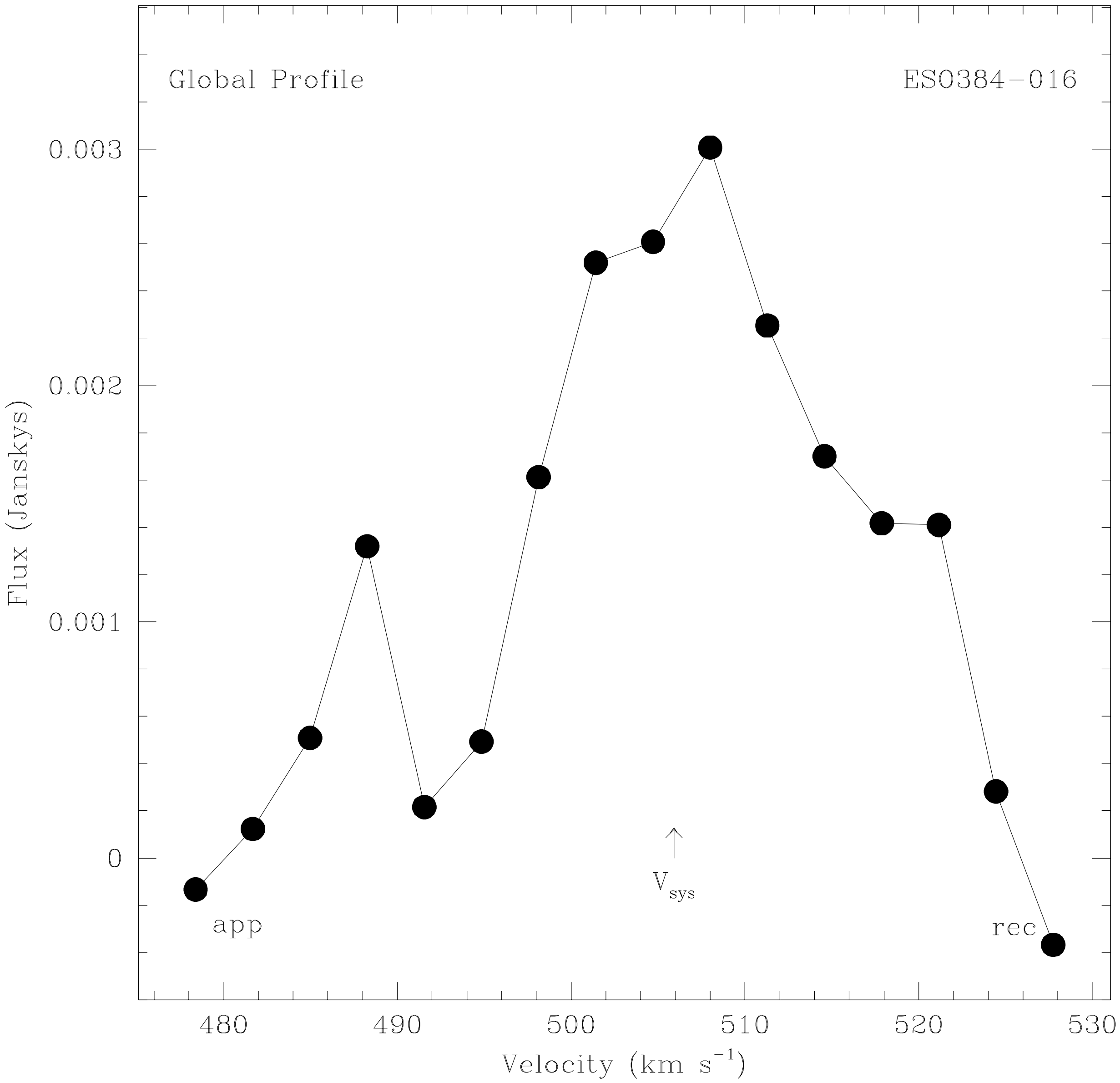

Figure 2. ESO384-016 HI Global Profile showing a systemic velocity of 506 km s^{-1}. For comparison, the optical velocity is 561 ± 32 km s^{-1}.

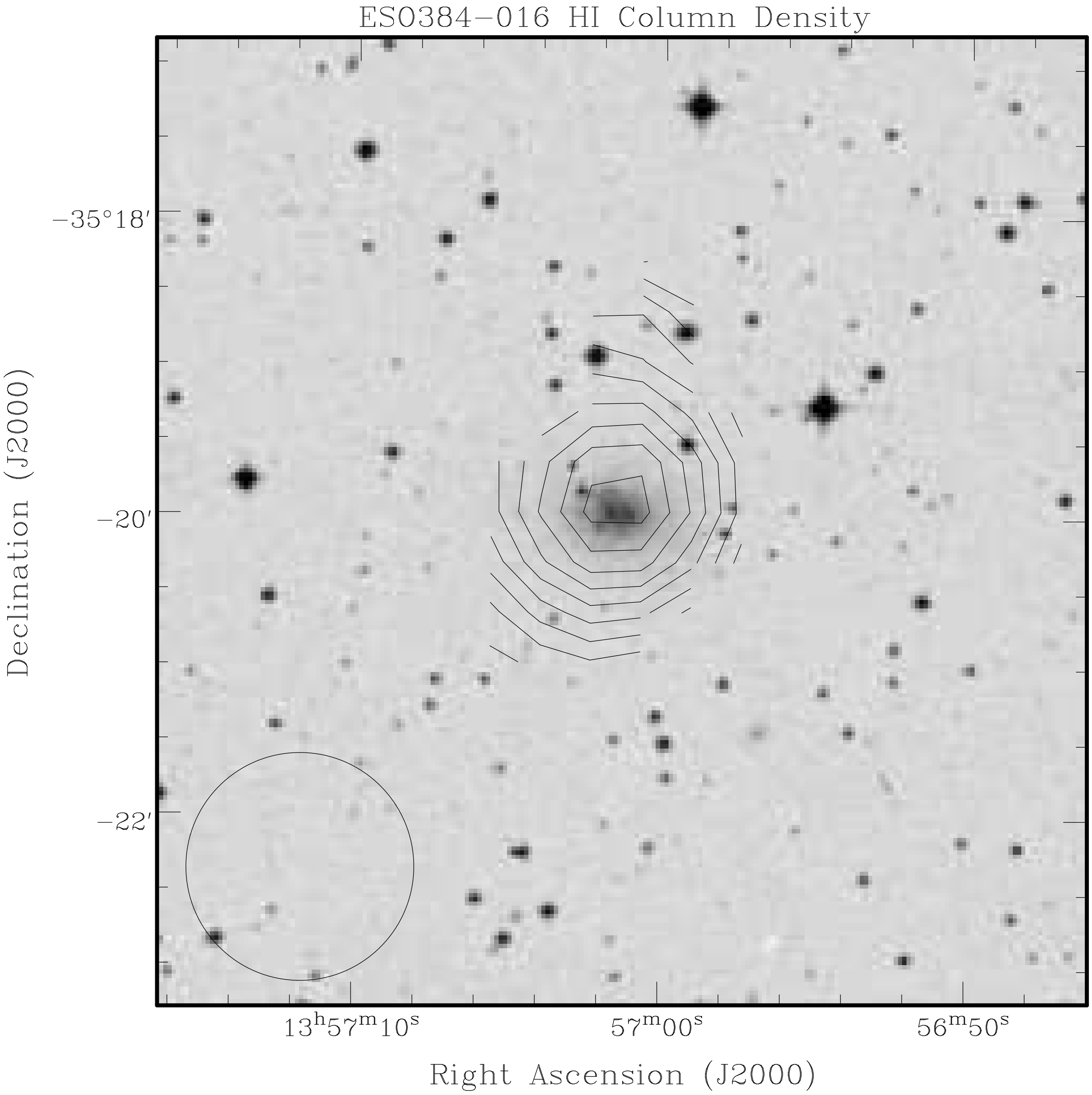

Figure 3. ESO384-016 HI Column Density distribution. The 91″ ATCA beam is shown at the lower left. The HI distribution is barely resolved. The 91″ FWHM beam, at a distance of 4.23 Mpc, corresponds to 1870 pc. The contour steps are 2×10^{18} cm^{-2} and the inner contour level is 2×10^{19} cm^{-2}. The total HI flux is 0.06 Jy km s^{-1}. We have also acquired an additional 12-hour observation using a 1.5-km configuration. This will improve the spatial resolution but has not yet been combined with the 750-m data cube.

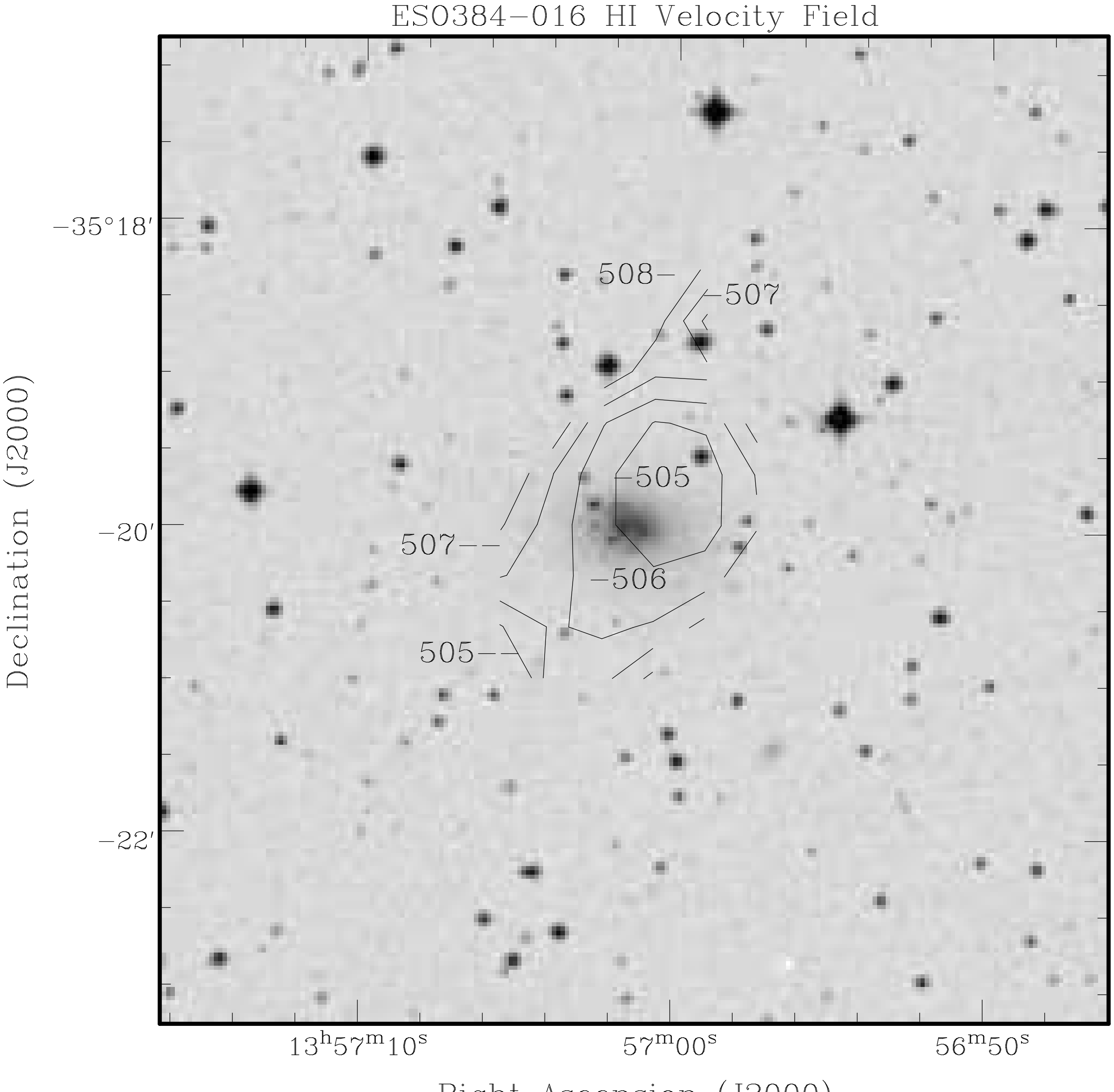

Figure 4. ESO384-016 HI Velocity Field shows very little, if any, velocity structure. The labels show the contour levels in km s^{-1}.

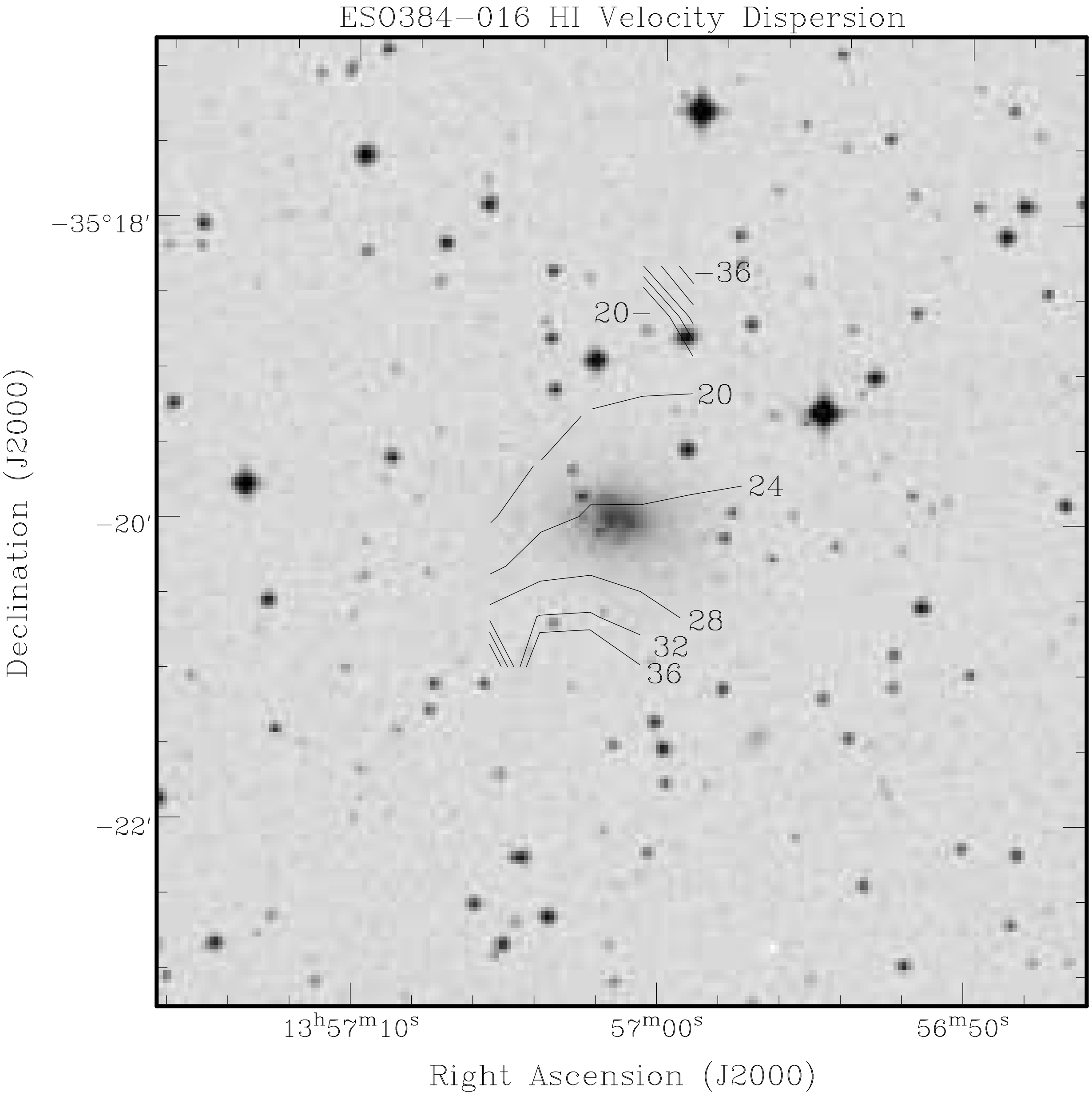

Figure 5. ESO384-016 HI Velocity Dispersion is unexpectedly high: if the HI distribution is really marginally resolved by the beam, we would expect a line-of-sight velocity dispersion of about 10 km s^{-1}. Also, the velocity dispersion shows a hint of a radial gradient which may indicate that the HI is not yet in equilibrium.

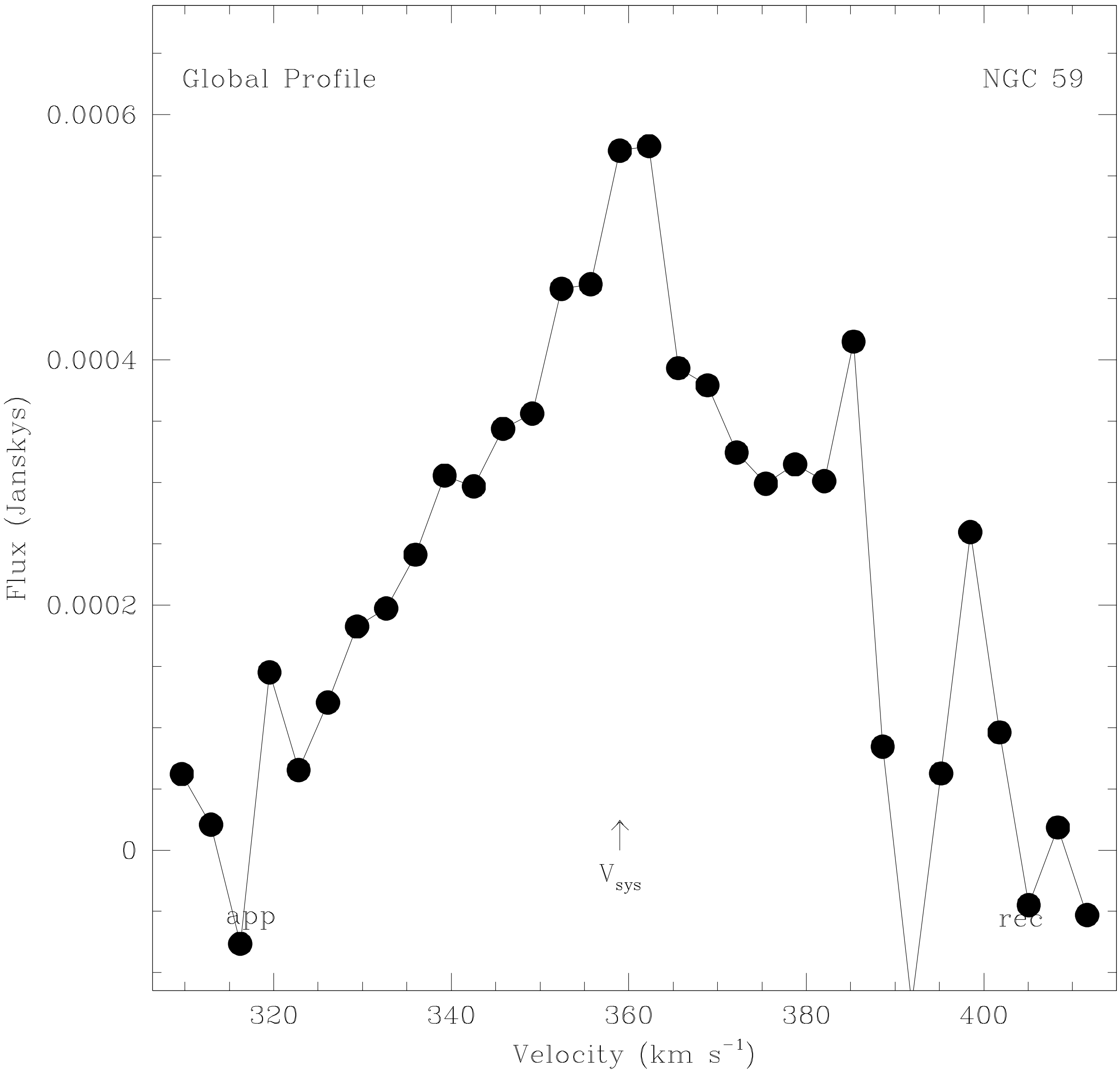

Figure 6. NGC 59 HI Global Profile showing a systemic velocity of 359 km s^{-1}. For NGC 59, the HI and optical velocities are in excellent agreement.

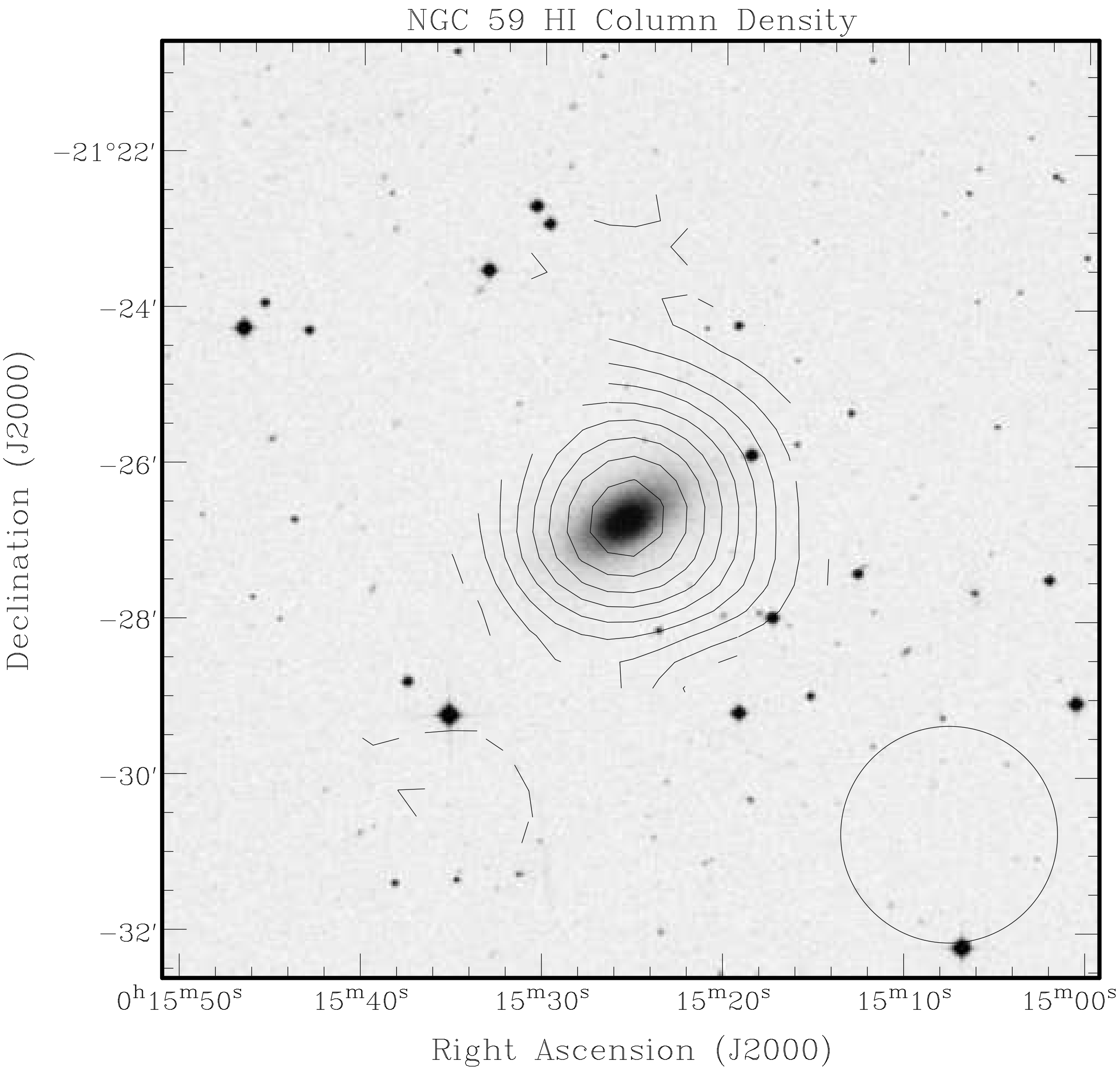

Figure 7. NGC 59 HI Column Density distribution. The 167″ ATCA beam is shown at the lower right. The HI distribution is marginally resolved. The 167″ FWHM beam, at a distance of 4.39 Mpc, corresponds to 3550 pc. The contour steps are $2\times~10^{17}$ cm^{-2} and the inner contour level is $2\times~10^{18}$ cm^{-2}. The total HI flux is 0.02 Jy km s^{-1}.

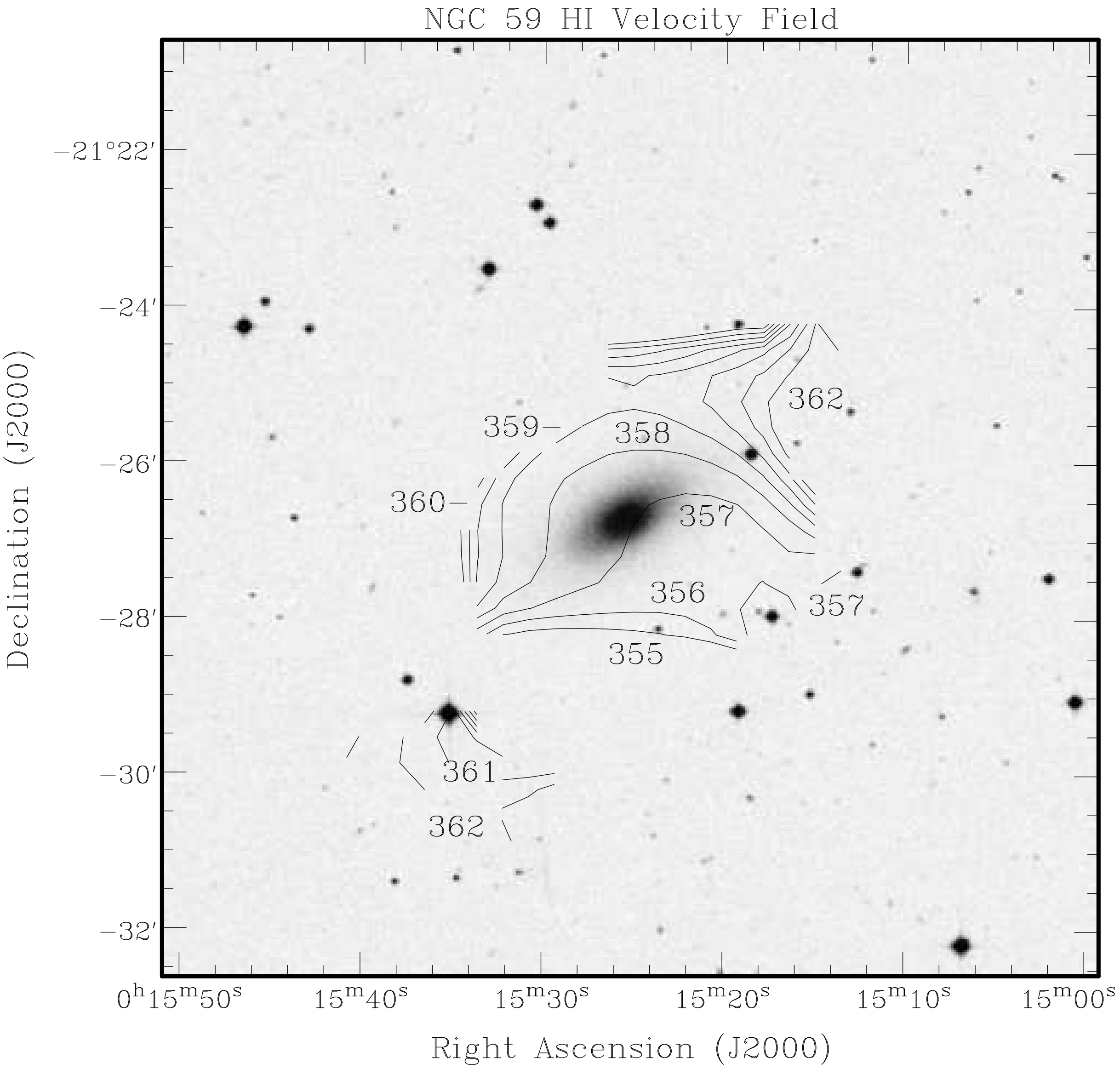

Figure 8. NGC 59 HI Velocity Field shows a low level of "rolling sausage" kinematics (c.f. NGC 625: Côté et al. 2000). The labels show the contour levels in km s^{-1}.

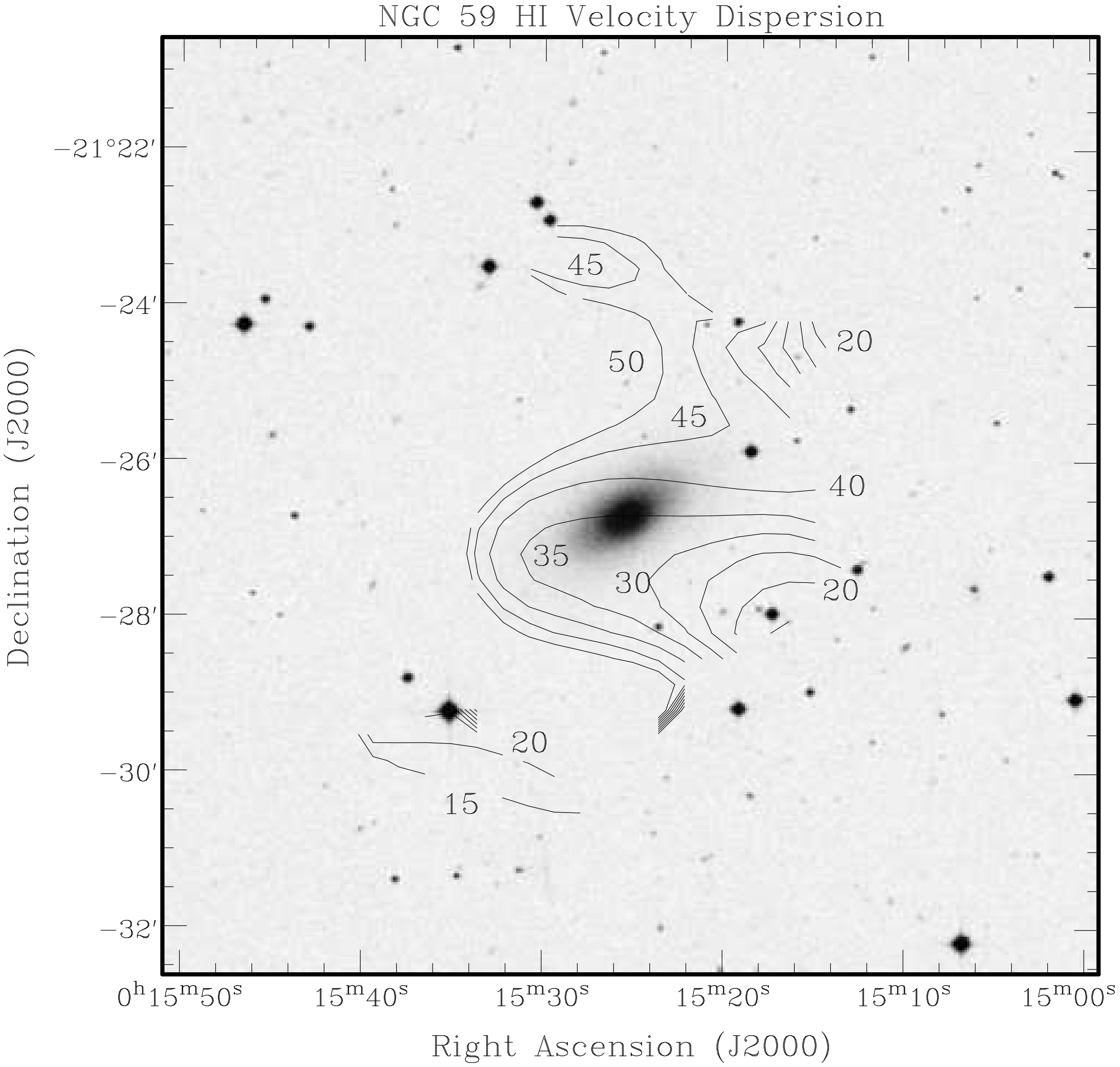

Figure 9. NGC 59 HI Velocity Dispersion is again relatively high, and shows evidence for a significant gradient from SW to NE. This may again indicate that the HI is not yet in equilibrium.