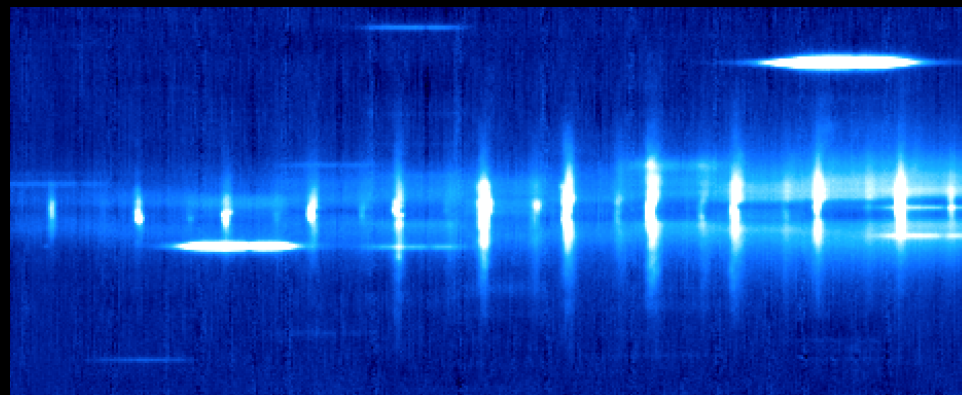
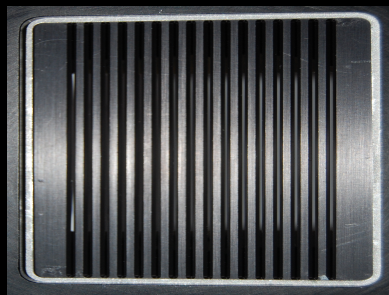


Multi-long-slit Spectroscopic Observations at APO



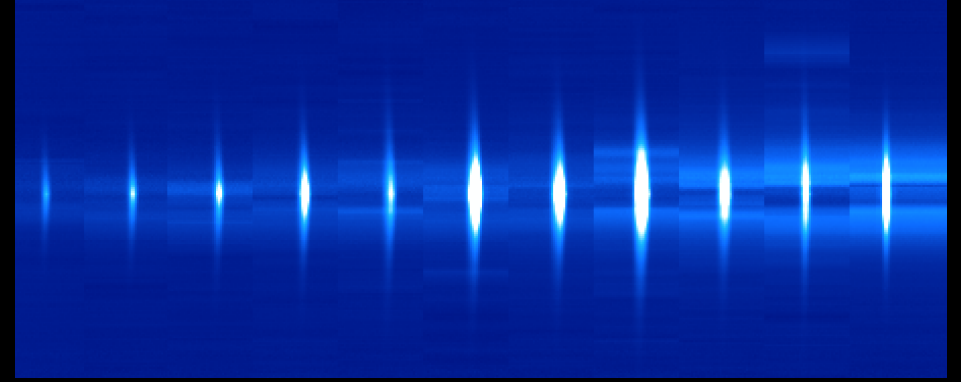
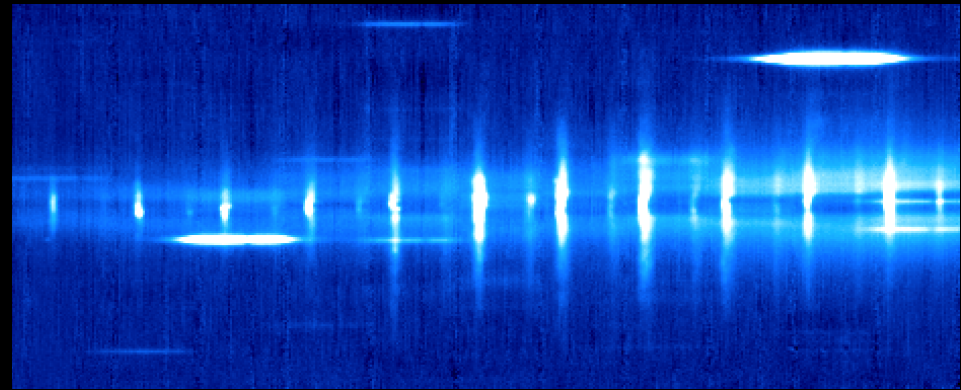
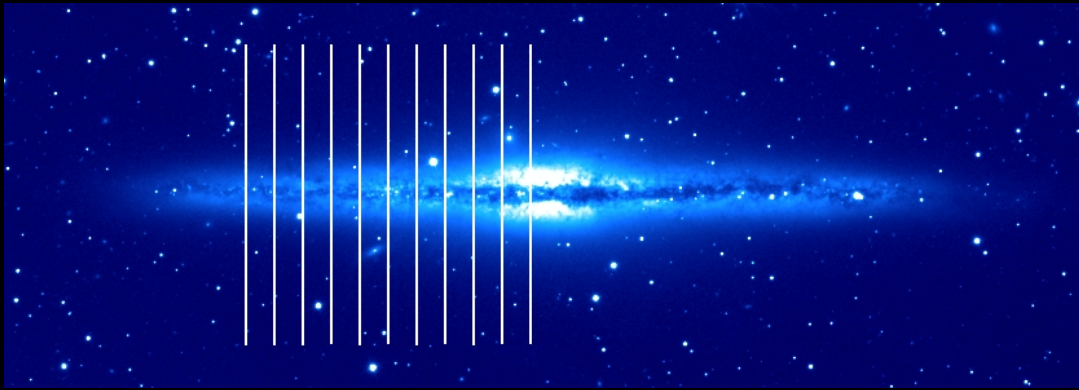
Study kinematics of ionized, extra-planar gas

- detect an extraplanar lagging component
- detect possible outflows via line widths

Sample of 14 nearby, edge-on galaxies

Multi-long-slit observations:

- 11 parallel slits, 1.5" wide, spaced 22.5" apart
- field of view: 3.75' wide, 4' tall
- 0.58 Å/pix dispersion → 65 km/s resolution
with centroid fitting → 5 km/s



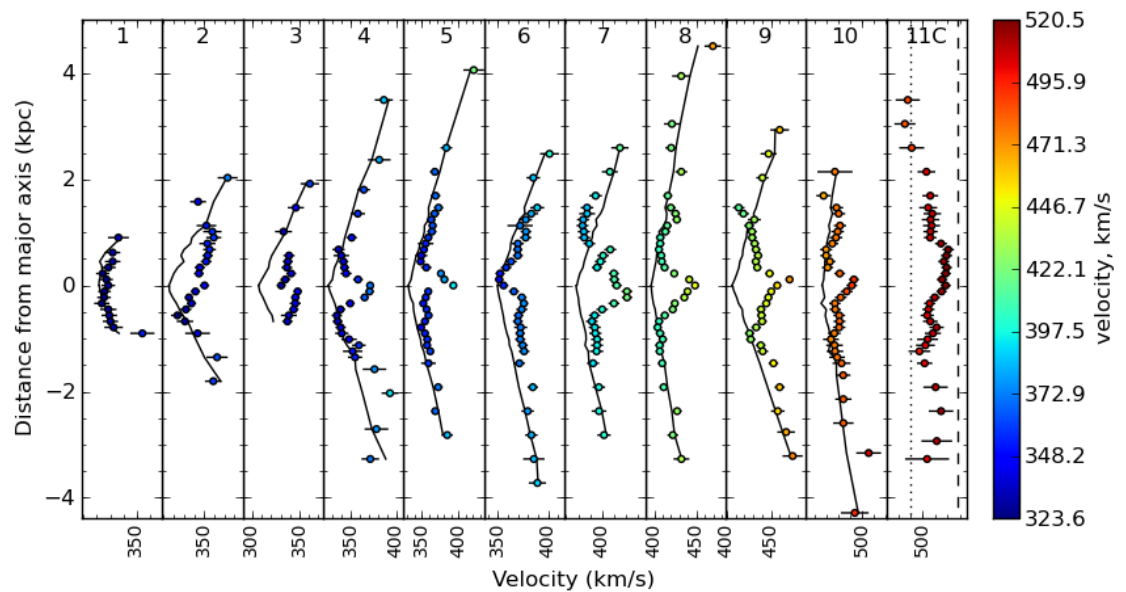
NGC 891

- Sb galaxy, v_{sys} 528 km/s
- 88-90° inclination
- $D = 9.5$ Mpc
- moderate to high star formation rate

Top: 12.9 hour exposure
North approaching side
Emission extends +/- 4 kpc

Bottom: model spectrum

NGC 891



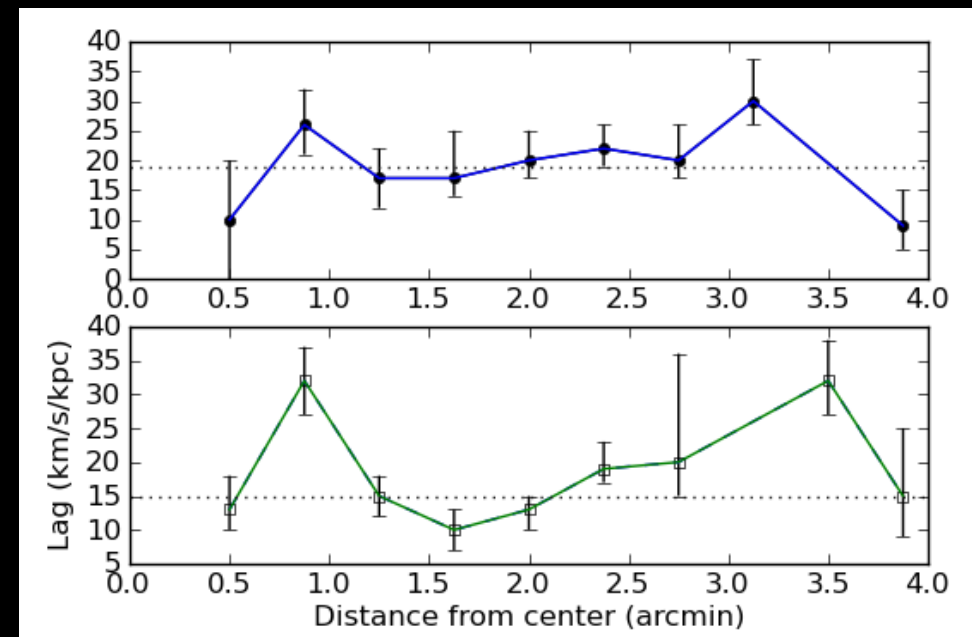
Circles: data centroids

Solid line: model centroids

Lagging component seen
+/- 1 kpc and farther from
midplane

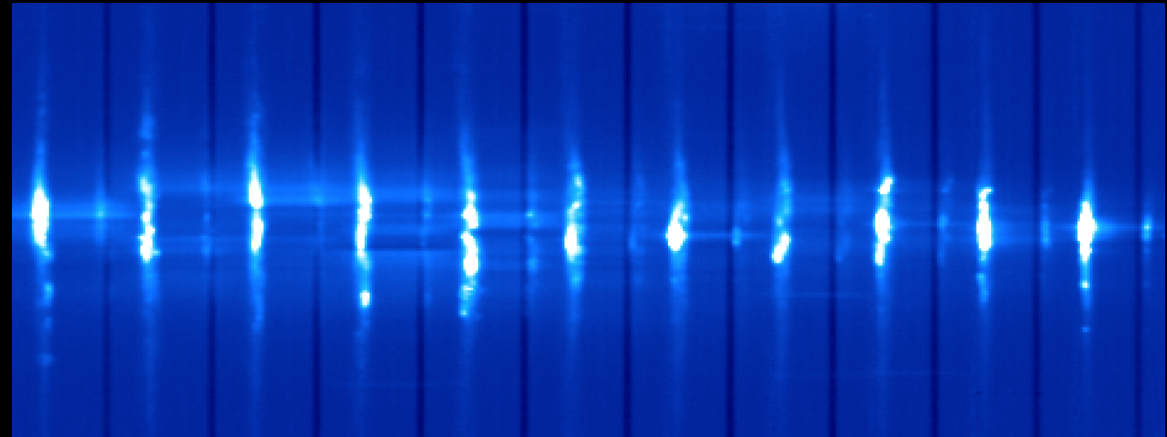
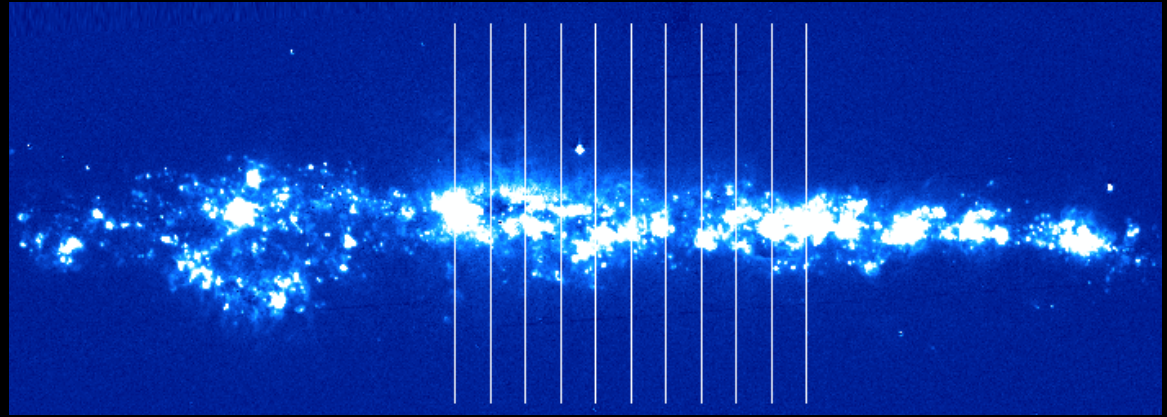
Model lags for upper and
lower half of each slit.

Top (blue): 19 km/s/kpc
Bottom (green): 15 km/s/kpc



NGC 4631

- SBd, $v_{\text{sys}} = 606 \text{ km/s}$
- 85-90° inclination
- $D = 7.6 \text{ Mpc}$
- moderate star formation rate
- interacting with companion galaxies



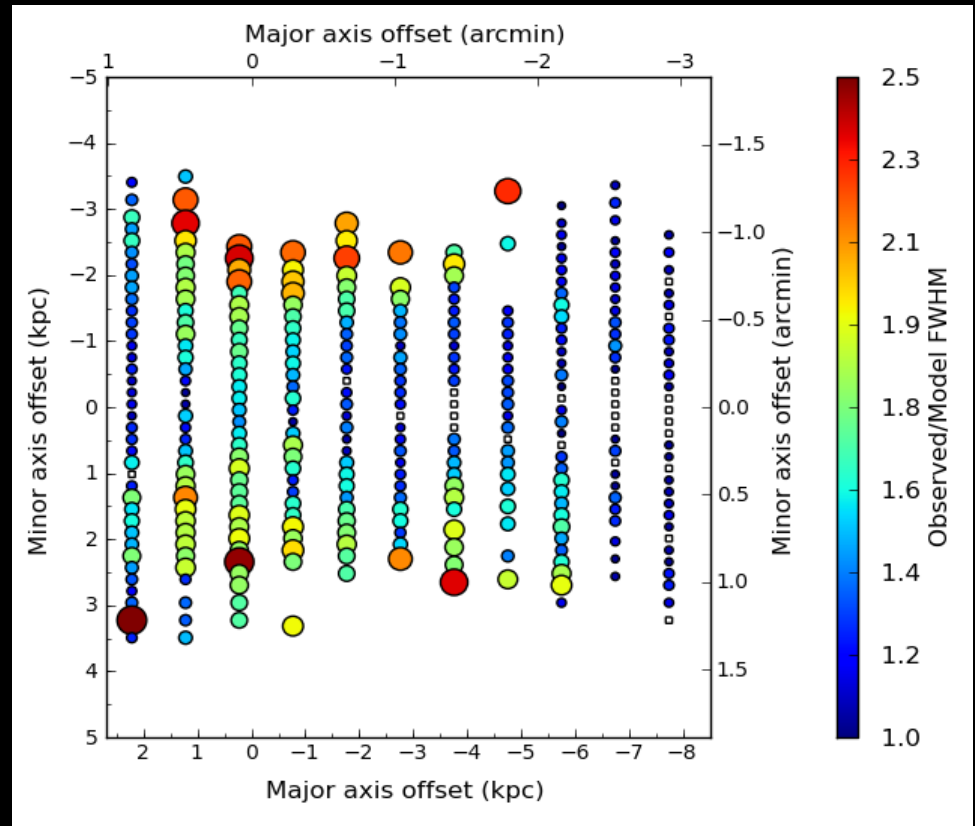
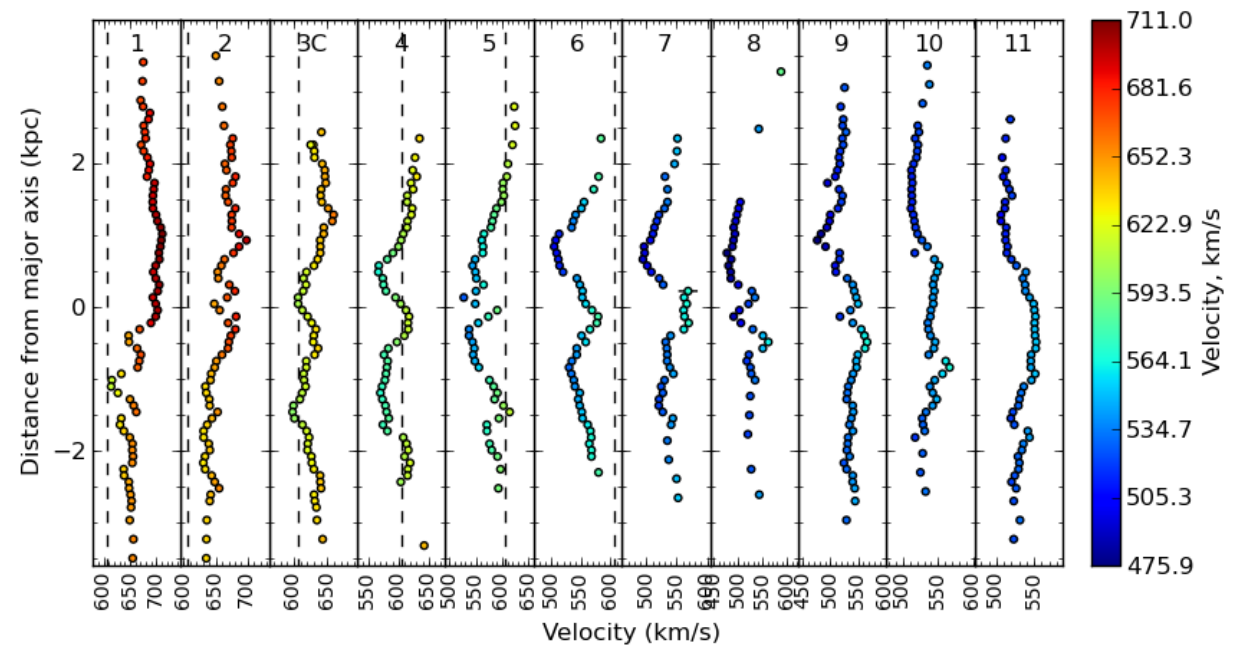
6.75 hour exposure

Central and approaching side

Emission extends +/- 4 kpc

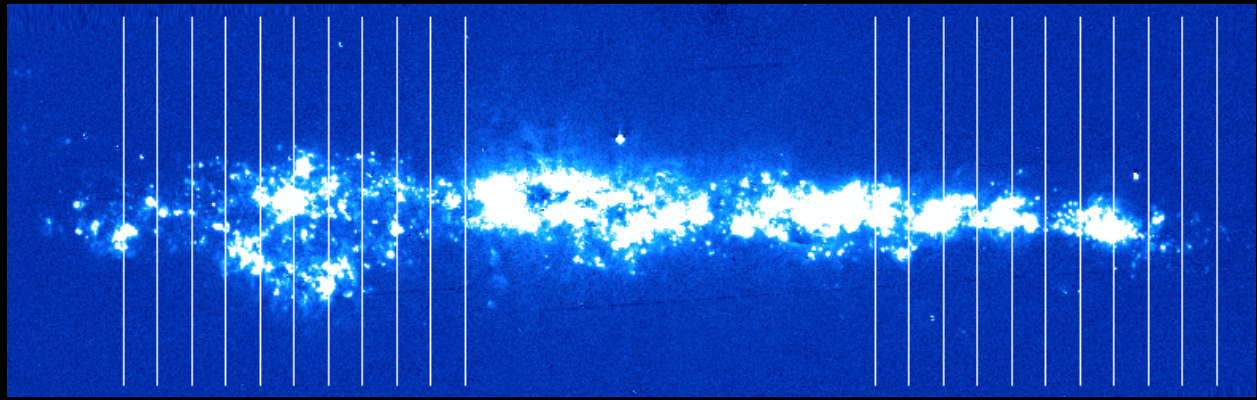
NGC 4631

- Galaxy center is near slit 3
- Modeled with 85° inclination
- Lag 20-40 km/s/kpc in slits 5-8
- Observed/model line widths show excess broadening, possibly from outflows

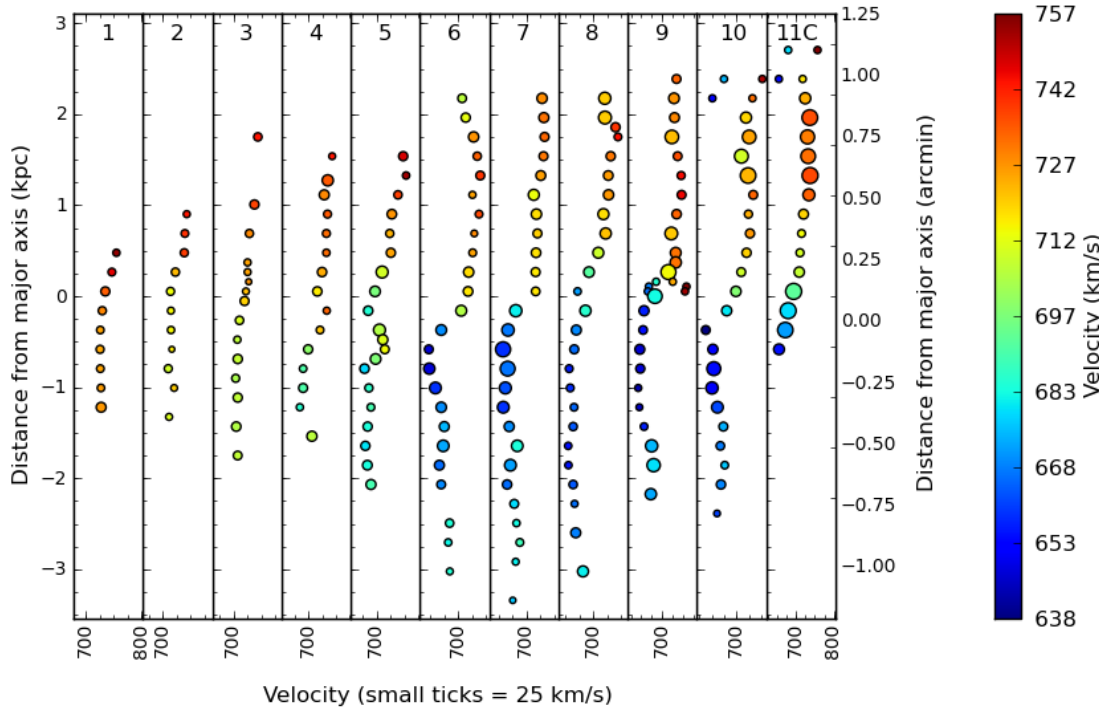
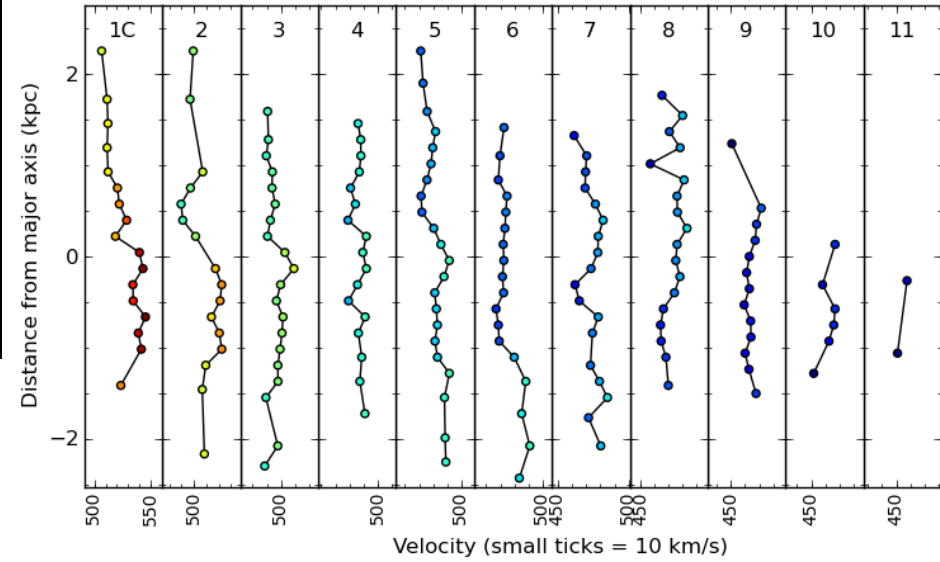


NGC 4631

- East and West fields



- West (approaching) is completely edge-on
- No lagging component



- East (receding) shows signs of significant warp in lower half

Galaxy	Distance (Mpc)	v_{sys} (km s ⁻¹)	i (°)	v_{rot} (km s ⁻¹)	D_{25} (arcmin)	M_B (mag)	H α extent (kpc)	Lag (km s ⁻¹ kpc ⁻¹)
NGC 891	9.5	529	90	212.1	12.2	-19.96	3.0 - 4.0	15-19
NGC 3044	16.1	1335	90	153.1	4.4	-19.74	1.0 - 2.0	20-30
NGC 3079	25.8	1125	88	208.4	7.7	-21.01	2.5 - 3.3	Inc.
NGC 3628	7.7	846	87	211.7	14.8	-19.96	1.0	None
NGC 4013	17.1	835	84	181.7	4.7	-19.55	1.0 - 1.5	None
NGC 4244 N	4.4	247	90	89.1	15.8	-17.60	0.5 - 1.0	20-30; 60-70
NGC 4244 S							1.0	20-30
NGC 4517	11.1	1131	90	139.8	9.5	-19.58	1.7	?
NGC 4565 E	10.8	1228	87	244.9	16.2	-20.34	1.5 - 2.0	Inc.
NGC 4565 W							1.0 - 1.5	Inc.
NGC 4631 E	7.6	606	85	138.4	14.7	-20.12	1.0 - 3.0	None
NGC 4631 C							3.0	20-40
NGC 4631 W							1.5 - 2.0	None
NGC 4762	16.8	942	87	110.0	8.3	-20.04	None	None
NGC 5229	5.1	365	90	55.8	3.5	-15.82	0.2 - 0.3	None
NGC 5907	17.2	666	87	226.7	11.2	-20.55	2.0	Inc.
UGC 4278	13.6	565	90	78.9	4.3	-17.45	0.4 - 0.5	None
UGC 7321	6.0	403	90	94.5	5.1	-14.79	0.25	None