



Cosmicflows-2

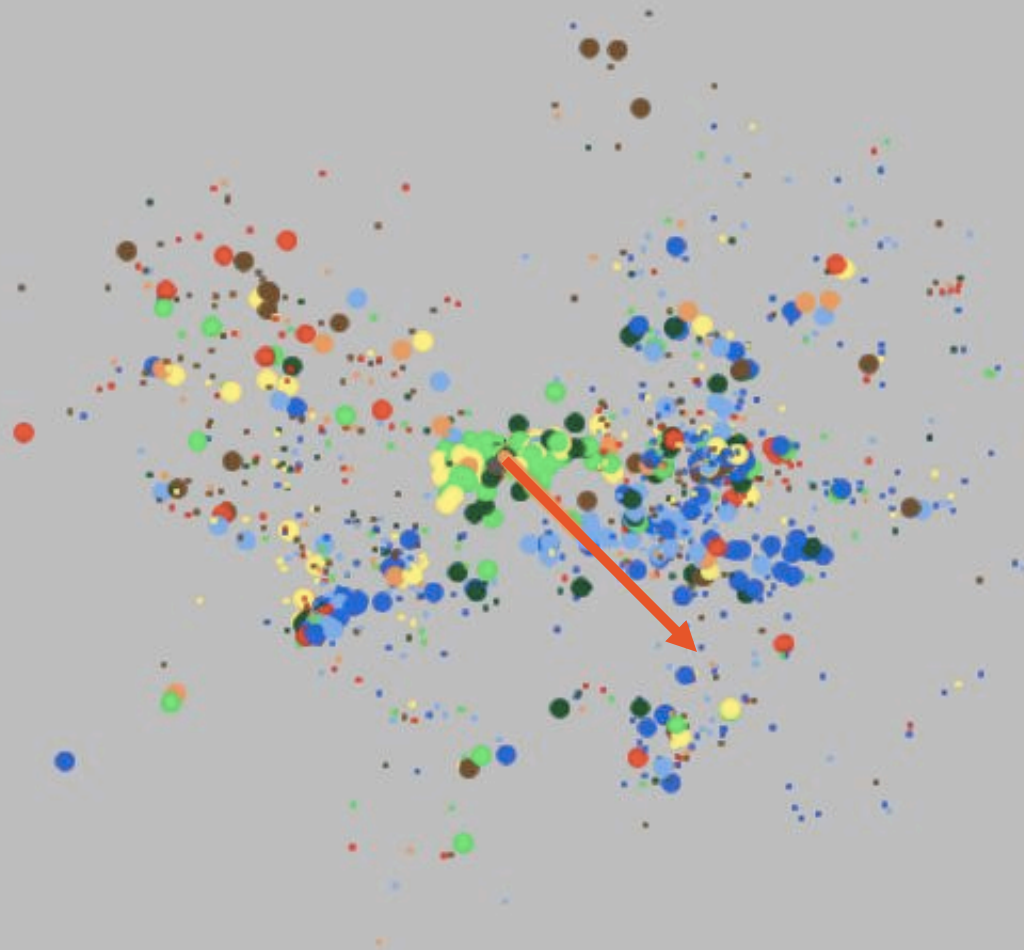
Cosmic Flows Program

- Measure distances d
 - Peculiar velocities: $V_{\text{pec}} = V_{\text{obs}} - H_0 d$
 - Infer 3D velocities and density field
- Project to initial conditions
 - Simulate evolution to present conditions

Gottloeber, Hoffman, Klypin, Yepes (CLUES collaboration)
Sorce, Kitaura

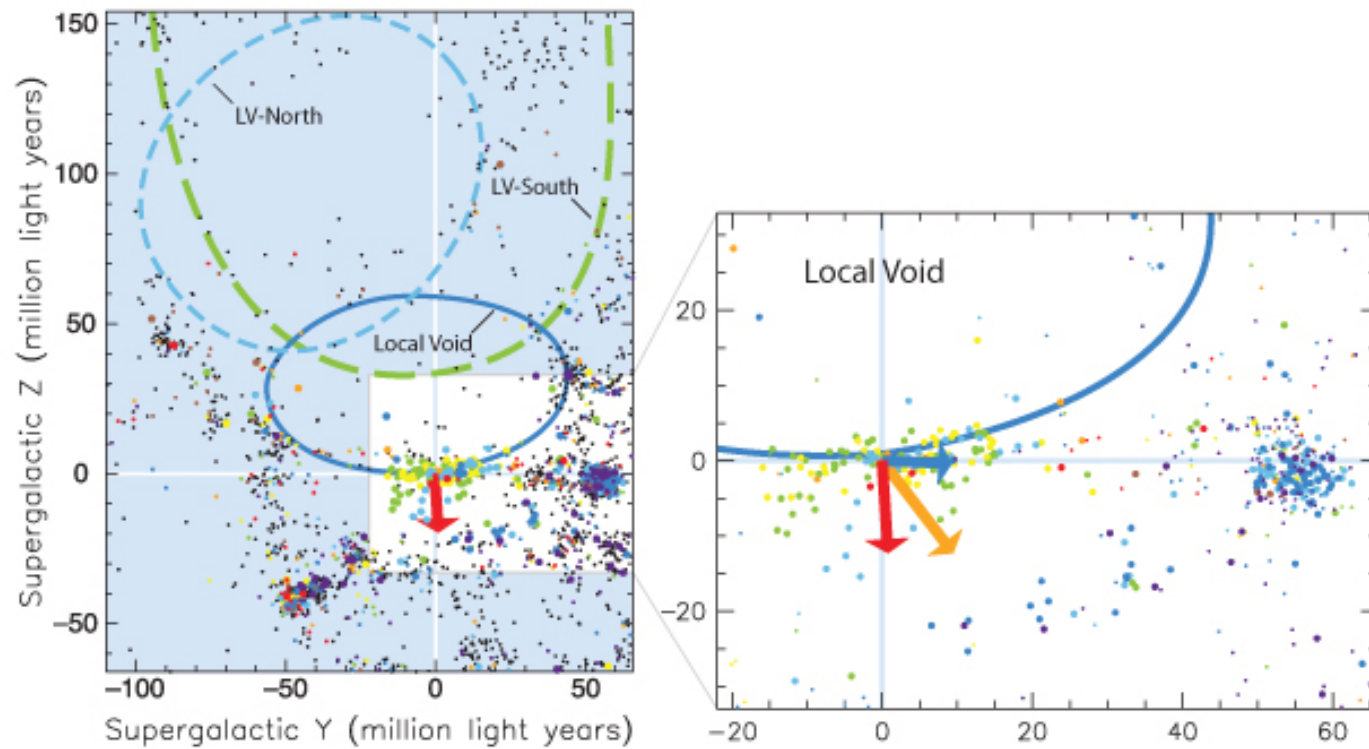
Most important result from Cosmicflows-1

BT, Shaya, Karachentsev, Courtois,
Kocevski, Rizzi, Peel [2008, ApJ,
676, 184]



The MW has a motion of 323
km/s w.r.t. 1800 galaxies
with measured distances
within 3000 km/s

green/yellow $V_{\text{pec}} \sim 0$
red $V_{\text{pec}} > +100$
blue $V_{\text{pec}} < -100$



1. tiny peculiar velocities within Local Sheet
2. discontinuity in peculiar velocities passing to adjacent structures
3. 185 km/s motion toward Virgo Cluster
4. 260 km/s motion away from Local Void

Cosmicflows-1: 1797 distances within 3300 km/s
(catalog in EDD) Tully et al. 2008, ApJ, 676, 184

Contributions to Cosmicflows-2

1209	[297 TRGB: Tip of the Red Giant Branch
		133 TRGB Literature
		31 RR Lyr, Horiz Br, Eclip Bin, Maser
		60 Cepheid Period-Luminosity
		382 SBF: Surface Brightness Fluctuation
		306 SNIa: Type Ia Supernova
		1508 FP: Fundamental Plane
		5998 TF: Luminosity-Linewidth

8315 distance measures within 30,000 km/s

Components of the Program

1. Extragalactic Distance Database
2. Tip of the Red Giant Branch distances
3. Luminosity–Linewidth (TF) distances
 - HI profiles
 - photometry
4. Cosmicflows–2 distance compilation
5. Modeling

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[EDD Home Page](#)



The Extragalactic Distance Database (EDD)

Instructions:

- Here, you create a merged table of data fields on galaxies from a variety of tables.
- You may enter a galaxy name below, or you can leave it blank and get all galaxies in the selected tables and cull it down by range limits and regular expression later
- Click catalogs 'on' to see and select data fields.
- Hold mouse over a catalog name to see a short description of it.
- Click on catalog names for a popup with information on the fields in the catalog.
- At the bottom of the page, select range of row numbers for initial query to prevent too much data from being transferred.
- Most browsers clear the column selections when you reload, but Firefox does not, so use reset button.

Features:

- Updated best distances in EDD Distances catalog (presently limited to $V < 3000$ km/s).
- Color images of galaxies observed with ACS and WFC2 in "CMDs/TRGB" catalog.
- 16,000 HI profiles uniformly analyzed in All Digital HI catalog.
- Hawaii Photometry catalog now available.

OPTIONAL: Enter Galaxy Name: Display only tables with info on this galaxy

Redshift Catalogs			
LEDA <input type="checkbox"/> on Entries: 98202	2MRS K<11.75 <input type="checkbox"/> on Entries: 43528	2MASS K<11.25 V <input type="checkbox"/> on Entries: 24746	2M++ <input type="checkbox"/> on Entries: 64745

[Submit](#) [All](#) [Reset](#)

Summary Distances			
EDD Distances <input type="checkbox"/> on Entries: 3529	Quality Distances <input type="checkbox"/> on Entries: 636	Cosmicflows-1 Distances <input type="checkbox"/> on Entries: 1797	SFI++ <input type="checkbox"/> on Entries: 5780

[Submit](#) [All](#) [Reset](#)

Stellar Distances					
CMDs/TRGB <input type="checkbox"/> on Entries: 325	ANGST <input type="checkbox"/> on Entries: 65	Araucaria <input type="checkbox"/> on Entries: 12	McConnachie <input type="checkbox"/> on Entries: 102	Tully SBF <input type="checkbox"/> on Entries: 299	Virgo/Fornax SBF <input type="checkbox"/> on Entries: 134

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SNIa						
5 Sources SNIa <input type="checkbox"/> on Entries: 318	Tully SNIa <input type="checkbox"/> on Entries: 126	Iba SNIa <input type="checkbox"/> on Entries: 132	Prieto SNIa <input type="checkbox"/> on Entries: 89	Union2 SNIa <input type="checkbox"/> on Entries: 255	Constitution SNIa <input type="checkbox"/> on Entries: 209	CSPI SNIa <input type="checkbox"/> on Entries: 34

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HI Linewidths						
All Digital HI <input type="checkbox"/> on Entries: 14219	Pre-Digital HI <input type="checkbox"/> on Entries: 4395	Springob/Cornell HI <input type="checkbox"/> on Entries: 8844	HI Namay <input type="checkbox"/> on Entries: 3720	HI Fisher <input type="checkbox"/> on Entries: 958	HIPASS 1000 <input type="checkbox"/> on Entries: 1000	WHISP <input type="checkbox"/> on Entries: 343

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Optical Linewidths
<input type="text"/>

<http://edd.ifa.hawaii.edu/secure/dfirst.php?>

Page 1 of 2

Extragalactic Distance Database

<http://edd.ifa.hawaii.edu>

EDD: Select Table & Columns

11/17/12 4:21 PM

Catinella/Cornell <input type="checkbox"/> on Entries: 403	Mathewson by Courteau <input type="checkbox"/> on Entries: 525	Dalcby Courteau <input type="checkbox"/> on Entries: 486	Courteau by Courteau <input type="checkbox"/> on Entries: 252	Verheijen by Courteau <input type="checkbox"/> on Entries: 38
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[Submit](#) [All](#) [Reset](#)

Photometry							
"Spitzer 3.61 Band Photometry" <input type="checkbox"/> on Entries: 232	Hawaii Photometry <input type="checkbox"/> on Entries: 524	Homogenized Photometry <input type="checkbox"/> on Entries: 5864	SDSS_Hall <input type="checkbox"/> on Entries: 3039	2MASS Large Galaxy Atlas <input type="checkbox"/> on Entries: 617	Cosmicflows SINGS <input type="checkbox"/> on Entries: 1272	Spitzer SINGS <input type="checkbox"/> on Entries: 75	Carnegie Hubble Program <input type="checkbox"/> on Entries: 480
SAG <input type="checkbox"/> on Entries: 2331	Aarvink H <input type="checkbox"/> on Entries: 204	Bernstein Coma <input type="checkbox"/> on Entries: 32	Bibbun <input type="checkbox"/> on Entries: 38	Bureau Fornax <input type="checkbox"/> on Entries: 22	Courteau <input type="checkbox"/> on Entries: 304	Mathewson revised by Courteau <input type="checkbox"/> on Entries: 957	Mathewson <input type="checkbox"/> on Entries: 2443
Deil'Antonio <input type="checkbox"/> on Entries: 241	Berandau <input type="checkbox"/> on Entries: 234	Dale SCI <input type="checkbox"/> on Entries: 520	Giovannelli SCI <input type="checkbox"/> on Entries: 782	Haines SFI/SCI <input type="checkbox"/> on Entries: 1727	Han Cluster <input type="checkbox"/> on Entries: 284	Han Perseus Pisces <input type="checkbox"/> on Entries: 59	Lu Virgo/Andromeda <input type="checkbox"/> on Entries: 303
McDonald Virgo <input type="checkbox"/> on Entries: 286	Mould Clusters <input type="checkbox"/> on Entries: 171	Pierce Field <input type="checkbox"/> on Entries: 715	Roth IRAS selected <input type="checkbox"/> on Entries: 156	Schommer Clusters <input type="checkbox"/> on Entries: 32	Verheijen UMa <input type="checkbox"/> on Entries: 78	Willick Clusters <input type="checkbox"/> on Entries: 156	Willick Perseus Pisces <input type="checkbox"/> on Entries: 381

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Fundamental Plane				
Blakeslee SMAC FP + SBF <input type="checkbox"/> on Entries: 164	Hudson SMAC FP <input type="checkbox"/> on Entries: 56	FP: SMAC3 <input type="checkbox"/> on Entries: 698	FP: EFAR <input type="checkbox"/> on Entries: 788	FP: ENFARc <input type="checkbox"/> on Entries: 452

[Submit](#) [All](#) [Reset](#)

Supplementary Catalogs							
Replenished Catalog of Nearby Galaxies <input type="checkbox"/> on Entries: 826	Neighboring Galaxies <input type="checkbox"/> on Entries: 451	2MRS Augmented <input type="checkbox"/> on Entries: 28573	MAK Ypec <input type="checkbox"/> on Entries: 21295	YBK <input type="checkbox"/> on Entries: 30124	Tully 3000 <input type="checkbox"/> on Entries: 3497	Virgo Cluster Catalog <input type="checkbox"/> on Entries: 2994	Saunders PSCz <input type="checkbox"/> on Entries: 1690
Y3K MK<21 <input type="checkbox"/> on Entries: 1228	Karachentsev Revised Flat Galaxy Catalog <input type="checkbox"/> on Entries: 4444	Karachentsev RFGC 2MASS peculiar velocities <input type="checkbox"/> on Entries: 1222	Karachentsev RFGC peculiar velocities <input type="checkbox"/> on Entries: 1527	Parnovsky RFGC peculiar velocities <input type="checkbox"/> on Entries: 1623	MK Groups <input type="checkbox"/> on Entries: 11056	TF Calibrators <input type="checkbox"/> on Entries: 416	

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Choose rows to display initially:
start end

Curators: E. Shaya, R. Brent Tully, Luca Rizzi, Dmitry Makarov, Lidia Makarova, Helene Courtois, Brad Jacobs, Matt Zagursky

Luca Rizzi, Ed Shaya, Helene Courtois, Brad Jacobs, Dmitry Makarov, Matt Zagursky

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☐ on
 Entries: 3529

Quality Distances
☐ on
 Entries: 636

Cosmicflow-1 Distances
☒ on
 Entries: 1797

SFI++ Distances
☐ on
 Entries: 5780

Submit All Reset

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SNIs

5 Sources SNIa <input type="checkbox"/> on Entries: 318	Tonry SNIa <input type="checkbox"/> on Entries: 126	Iba SNIa <input type="checkbox"/> on Entries: 132	Prieto SNIa <input type="checkbox"/> on Entries: 89	Union 2 SNIa <input type="checkbox"/> on Entries: 255	Constitution SNIa <input type="checkbox"/> on Entries: 209	CSPI SNIa <input type="checkbox"/> on Entries: 34	SNIa calibration <input type="checkbox"/> on Entries: 95
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Optical Linewidths				

Page 1 of 2

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11/17/12 4:21 PM

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The Extragalactic Distance Database: Display Request

Hide Control Panel

Requested Rows:

CMDs/TRGB Catalog

Control Panel: Column Min/Max, regular expression, sorting, visibility

PGC	PGC no	P	Name/CMD	Alt_Source	Dist	HST-GO	Camera	T814	T8_lo	T8_hi	606-814	eb_lo	eb_hi	555-814	CMDs/TRGB
	Min		String	String	Min	Min	String	Min	Min	Min	Min	Min	Min	Min	ea_lo
	Max		String	String	Max	Max	String	Max	Max	Max	Max	Max	Max	Max	ea
	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort
	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show

PGC	P	Name/CMD	Alt_Source	Dist	HST-GO	Camera	T814	T8_lo
				Mpc			mag	mag
143	1	DDO221		0.98	6813	WFPC2	20.99	20.90
621	1	ESO149-031	ANGRRR	3.21	9771	ACS	23.47	23.43
701	0	NGC24		7.26	12546	ACS	25.30	25.28
930	1	NGC45		6.61	9774	ACS	25.04	24.96
1014	1	NGC55	ANGST/4	2.11	8697	WFPC2	22.66	22.63
1038	1	ESO110-005	ANGST/6	1.92	10503	ACS	22.37	22.33
1305	1	IC10	LGS9/1c10/html/1c10.html	0.79	9683	ACS	22.01	21.99
1641	1	ESO294-010	ANGST/10	2.03	10503	ACS	22.48	22.44
1772	0	UGC288		6.74	12546	ACS	25.19	25.15
2004	1	NGC147	LGS9/ngc147/html/ngc147.html	0.73	6233	WFPC2	20.69	20.64
2329	1	NGC185	LGS9/ngc185/html/ngc185.html	0.64	6699	WFPC2	20.42	20.40
2429	1	NGC205	LGS9/ngc205/html/ngc205.html	0.78	6699	WFPC2	20.64	20.63
2555	1	NGC221	LGS9/m32/html/m32.html	0.71	5464	WFPC2	20.66	20.65
2557	1	M31	LGS9/m31/html/m31.html	0.81	6859	WFPC2	20.81	20.77
2578	1	DDO226		4.90	8192	WFPC2	24.44	24.32
2758	1	NGC247	ANGST/21	3.70	10915	ACS	23.84	23.82
2789	1	NGC253	ANGST/22	3.68	10523	ACS	23.82	23.80
2881	1	ESO540-030	ANGST/23	3.55	10503	ACS	23.71	23.67
2902	1	DDO6	ANGST/24	3.42	8192	WFPC2	23.63	23.55
2933	1	ESO540-032	ANGST/25	3.61	10503	ACS	23.75	23.72
3085	1	SMC	LGS9/smc/html/smc.html		8059	WFPC2		
3238	1	NGC309	ANGST/27	2.08	10915	ACS	22.59	22.55
3792	1	LGS3	LCID/0004-637X/730/1/14/	0.65	6695	WFPC2	20.11	19.76
3844	1	IC1613	LCID/0004-637X/712/2/1259/	0.75	7496	WFPC2	20.40	20.37

Delimiter for download:

☐ XML (VOTable) ☐ comma ☒ pipe ☐ tab ☐ space ☐ fixed format



The Extragalactic Distance Database: Display Request

Hide Control Panel

Requested Rows:

CMDs/TRGB Catalog

Control Panel: Column Min/Max, regular expression, sorting, visibility

PGC	PGC no	P	Name/CMD	Alt_Source	Dist	HST-GO	Camera	T814	T8_lo	T8_hi	606-814	eb_lo	eb_hi	555-814	ea_lo	ea
	Min		String	String	Min	Min	String	Min	Min	Min	Min	Min	Min	Min	Min	Min
	Max		String	String	Max	Max	String	Max	Max	Max	Max	Max	Max	Max	Max	Max
	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort
	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide

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2329	1	NGC185	LGS9/ngc185/html/ngc185.html	0.64	6699	WFPC2	20.42	20.40
2429	1	NGC205	LGS9/ngc205/html/ngc205.html	0.78	6699	WFPC2	20.64	20.63
2555	1	NGC221	LGS9/m32/html/m32.html	0.71	5464	WFPC2	20.66	20.65
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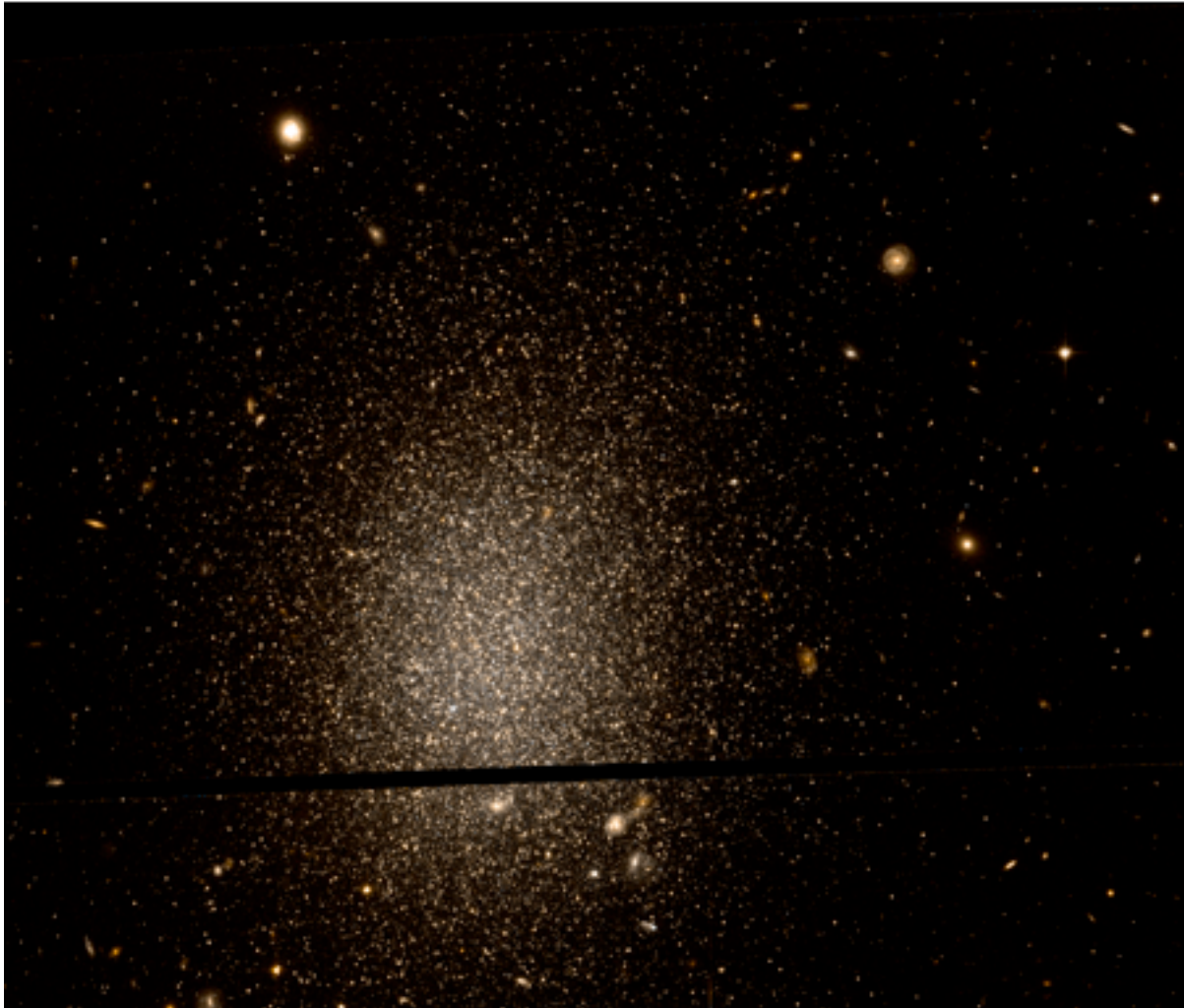
Select PGC 1038

pgc	P	Name/CMD	Alt_Source	Dist	HST- GO	Camera	T814	T8_lo	T8_hi	606- 814	eb_lo	eb_hi	555- 814	ea_lo	ea_hi	TRGB	T_lo	T_hi
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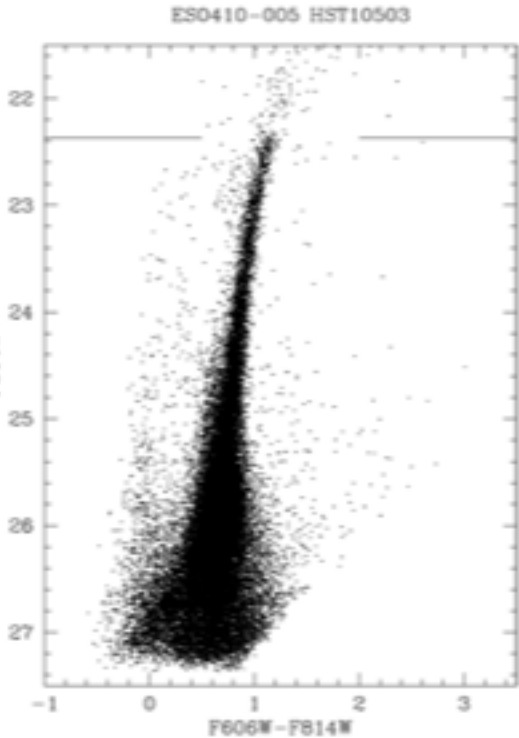
Available HST proposals for PGC 1038

144 pixels

11/18/12 3:12 PM



Proposal: 10503



int (in yellow) of ESO410-005from Program 1050:

Absolute calibration

Pop I:

HST Key Project Cepheid PLR and follow up

LMC distance modulus 18.48 (IR Cepheid + Eclipsing Binary)

Pop II:

TRGB tied to RR Lyr, Horizontal Branch distances

to dSph companions of our Galaxy

Pop I and Pop II scales agree to within 0.01 mag

Cepheid, TRGB, and Maser distances to NGC 4258 agree

Absolute calibration

Pop I:

HST Key Project Cepheid PLR and follow up

LMC distance modulus 18.48 (IR Cepheid + Eclipsing Binary)

Pop II:

TRGB tied to RR Lyr, Horizontal Branch distances

to dSph companions of our Galaxy

Pop I and Pop II scales agree to within 0.01 mag

Cepheid, TRGB, and Maser distances to NGC 4258 agree

TO COME:

- * GAIA parallaxes (supplemented by HST parallaxes)
- * More eclipsing binaries within Local Group
- * IR Cepheid calibrations

SBF: Surface Brightness Fluctuation

Cosmicflows-2

Ground-based: ~ 300 distances within ~ 40 Mpc (Tonry et al. 2001)

HST: Virgo (Mei et al. 2007); Fornax (Blakeslee et al. 2009)

Cosmicflows-3??

HST IR: $\Rightarrow 100$ Mpc

HST IR TRGB sweet spot: 40–100 Mpc

10% HST distance in **one orbit** if < 100 Mpc

< 40 Mpc can be obtained from ground based observations

Luminosity-Linewidth (TF)

EDO: Select Table & Columns

11/17/12 4:14 PM

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- Hold mouse over a catalog name to see a short description of it.
- Click on catalog names for a popup with information on the fields in the catalog.
- At the bottom of the page, select range of row numbers for initial query to prevent too much data from being transferred.
- Most browsers clear the column selections when you reload, but Firefox does not, so use reset button.

Features:

- Updated best distances in EDD Distances catalog (presently limited to $V < 3000$ km/s).
- Color images of galaxies observed with ACS and WFC2 in "CMDs/TRGB" catalog.
- 16,000 HI profiles uniformly analyzed in All Digital HI catalog.
- Hawaii Photometry catalog now available.

OPTIONAL: Enter Galaxy Name: Display only tables with info on this galaxy

Redshift Catalogs

LEDA

Entries: 98202

2MRS K<17.75

Entries: 43528

2MASS K<11.25 V

Entries: 24746

2M++

Entries: 64745

Submit

All

Reset

Summary Distances

EDD Distances

Entries: 3529

Quality Distances

Entries: 636

Cosmicflows-1 Distances

Entries: 1797

SFI++

Entries: 5780

Submit

All

Reset

Stellar Distances

CMDs/TRGB

Entries: 325

ANGST

Entries: 65

Araucaria

Entries: 12

McConnachie

Entries: 102

Tolmy SBF

Entries: 299

Virgo/Fornax SBF

Entries: 134

Hydra/Coma/Scorpius SBF

Entries: 31

Submit

All

Reset

SN Ia

5 Sources SN Ia

Entries: 318

Tolmy SN Ia

Entries: 126

Iba SN Ia

Entries: 132

Prieto SN Ia

Entries: 89

Union2 SN Ia

Entries: 255

Constitution SN Ia

Entries: 209

CSP1 SN Ia

Entries: 34

SN Ia calibration

Entries: 95

Submit

All

Reset

HI Linewidths

All Digital HI

Entries: 14219

Pr. Digital HI

Entries: 4395

Springob/Cornell HI

Entries: 8844

HI Namcay

Entries: 3720

HI Fisher

Entries: 958

HIPASS 1000

Entries: 1000

WHISP

Entries: 343

Submit

All

Reset

Optical Linewidths

<http://edd.ifa.hawaii.edu/secure/dfirst.php?>

Page 1 of 2

Extragalactic Distance Database

EDO: Select Table & Columns

11/17/12 4:21 PM

Catella/Cornell

Entries: 403

Mathewson by Courteau

Entries: 525

Dale by Courteau

Entries: 486

Courteau by Courteau

Entries: 252

Verheijen by Courteau

Entries: 38

Submit

All

Reset

Photometry

"Spitzer 3.6 Band Photometry"

Entries: 232

Hawaii Photometry

Entries: 524

Homogenized Photometry

Entries: 5864

SDSS Half

Entries: 3039

2MASS Large Galaxy Atlas

Entries: 617

Cosmicflows

Entries: 1272

Spitzer SINGS

Entries: 75

Carnegie Hubble Program

Entries: 480

Submit

All

Reset

Fundamental Plane

Bikarsh SMAC FP + SBF

Entries: 164

Hudson SMAC FP

Entries: 56

FP + SMAC3

Entries: 698

FP + EFAR

Entries: 788

FP + ENEARc

Entries: 452

Submit

All

Reset

Supplementary Catalogs

Replenished Catalog of Nearby Galaxies

Entries: 826

Neighboring Galaxies

Entries: 451

2MRS Augmented

Entries: 28573

MAK Ypec

Entries: 21295

YBK

Entries: 30124

Tully 2000

Entries: 3497

Virgo Cluster Catalog

Entries: 2994

Saunders PSCs

Entries: 1690

Submit

All

Reset

Choose rows to display initially:

1

200

start

end

Cursors: E. Shaya, R. Brent Tully, Luca Rizzi, Dmitry Makarov, Lidia Makarova, Helene Courtois, Brad Jacobs, Matt Zagursky

Courtois, Fisher, Koribalski, Makarov, Mitronova, Heraudeau, Sorce, Neill, Seibert, Jarrett

HI

optical

Spitzer

WISE



Arecibo, GBT, Parkes, Nancay, Effelsberg, NRAO 300', 140'
 -- new observations and archival

The Extragalactic Distance Database: Display Request

Hide Control Panel

Requested Rows:

All Digital HI catalog

Control Panel: Column Min/Max, regular expression, sorting, visibility

PGC	PGC no	Name/Profile	Vh_av	Wmx_av	eW_av	N_av	Source1	Tel1	Vhel1	Wm501	Wcm501	Wmx1	e_W1	SN1	Flux1	R
Min		String	Min	Min	Min	Min	String	String	Min	Min	Min	Min	Min	Min	Min	
Max		String	Max	Max	Max	Max	String	String	Max	Max	Max	Max	Max	Max	Max	
Sort		Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	
show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show

PGC	Name/Profile	Vh_av	Wmx_av	eW_av	N_av	Source1	Tel1	Vhel1	Wm501	Wcm501	Wmx1	e_W1	SN1	Flux1	Res1	Ns1	Fm5
		km/s	km/s	km/s				km/s	km/s	km/s	km/s	km/s		Jy.km/s	km/s		mJ
4	AGC331060	4458	154	16	1	shg2005	AOif	4458	173	162	154	16	8.5	1.85	8.5	2	
6	AGC331061	6002	217	20	1	shg2005	AOif	6002	248	226	217	20	2.0	0.82	8.6	4	
12	PG0000012	6548	400	19	1	tmc2006	Nanc	6548	424	409	400	19	2.4	3.40	11.0	1	
16	PG0000016	5668	296	20	1	tmc2006	Nanc	5668	316	305	296	20	2.2	1.04	11.0	1	
20	AGC331066					shg2005	AOif	7380	269	245		50	3.8	2.40	8.7	4	
29	AGC331067					shg2005	AOif	12701	163	147		50	2.4	0.53	8.9	2	
38	UGC12893	1108	78	19	1	shg2005	AOif	1108	87	82	78	19	3.8	2.41	8.5	1	
40	PG0000040	7282	289	20	1	tmc2006	Nanc	7282	316	298	289	20	5.0	5.20	10.8	2	
47	UGC12896					shg2005	AOif	7676	181	172		25	3.6	2.61	8.8	1	
53	UGC12895	6769	158	17	1	shg2005	AOif	6769	175	167	158	17	6.1	3.76	8.8	1	
54	UGC12892					shg2005	AOif	8858	375	355		27	1.7	0.55	8.8	2	
55	UGC12898	4779	179	10	1	shg2005	AOif	4779	195	188	179	10	14.9	4.30	8.5	1	
58	AGC331071					shg2005	AOif	8795	488	457		100	0.7	0.36	8.7	4	
68	BS538-017	7664	206	18	1	tmc2006	Nanc	7664	226	215	206	18	4.0	1.61	10.8	1	
70	UGC12900	6800	426	12	2	shg2005	AOif	6804	449	435	426	15	7.9	8.55	8.6	1	
73	AGC036544	6909	139	14	2	shg2005	Nanc	6910	165	150	142	20	7.5	3.55	5.5	4	
76	UGC12901	6920	409	18	1	shg2005	AOif	6920	432	418	409	18	4.6	3.82	8.8	1	
94	UGC012905	4098	188	14	1	ctm2010	GBT	4098	203	197	188	14	8.9	3.61	1.6	4	
101	UGC12906					shg2005	AOif	5306	304	294		40	3.7	3.97	8.5	1	
102	UGC12909	5048	428	20	1	shg2005	AOif	5048	449	437	428	20	2.5	5.58	8.7	1	
110	UGC12910	3974	56	12	1	shg2005	AOif	3974	64	59	56	12	12.1	2.93	8.6	1	
112	UGC12911	4794	271	20	1	shg2005	AOif	4794	289	280	271	20	2.5	1.29	8.7	1	
116	UGC12912	9268	318	19	1	shg2005	AOif	9268	342	327	318	19	3.7	1.71	8.9	1	
117	AGC331079	9133	193	19	1	shg2005	AOif	9133	213	202	193	19	2.1	0.92	8.8	1	

Delimiter for download:
☐ XML (VOTable) ☐ comma ☒ pipe ☐ tab ☐ space ☐ fixed format

17,738 galaxies!



The Extragalactic Distance Database: Display Request

Hide Control Panel

Requested Rows:

All Digital HI catalog

Control Panel: Column Min/Max, regular expression, sorting, visibility

PGC	PGC no	Name/Profile	Vh_av	Wmx_av	eW_av	N_av	Source1	Tel1	Vhel1	Wm501	Wcm501	Wmx1	e_W1	SN1	Flux1	R
	Min		Min	Min	Min	Min	String	String	Min	Min	Min	Min	Min	Min	Min	
	Max		Max	Max	Max	Max	String	String	Max	Max	Max	Max	Max	Max	Max	
	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	
	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide

PGC	Name/Profile	Vh_av	Wmx_av	eW_av	N_av	Source1	Tel1	Vhel1	Wm501	Wcm501	Wmx1	e_W1	SN1	Flux1	Res1	Ns1	Fm5
		km/s	km/s	km/s				km/s	km/s	km/s	km/s	km/s		Jy.km/s	km/s		mJ
4	AGC331060	4458	154	16	1	shg2005	AOIf	4458	173	162	154	16	8.5	1.85	8.5	2	
6	AGC331061	6002	217	20	1	shg2005	AOIf	6002	248	226	217	20	2.0	0.82	8.6	4	
12	PG0000012	6548	400	19	1	tmc2006	Nanc	6548	424	409	400	19	2.4	3.40	11.0	1	
16	PG0000016	5668	296	20	1	tmc2006	Nanc	5668	316	305	296	20	2.2	1.04	11.0	1	
20	AGC331066					shg2005	AOIf	7380	269	245		50	3.8	2.40	8.7	4	
29	AGC331067					shg2005	AOIf	12701	163	147		50	2.4	0.53	8.9	2	
38	UGC12893	1108	78	19	1	shg2005	AOIf	1108	87	82	78	19	3.8	2.41	8.5	1	
40	PG0000040	7282	289	20	1	tmc2006	Nanc	7282	316	298	289	20	5.0	5.20	10.8	2	
47	UGC12896					shg2005	AOIf	7676	181	172		25	3.6	2.61	8.8	1	
53	UGC12895	6769	158	17	1	shg2005	AOIf	6769	175	167	158	17	6.1	3.76	8.8	1	
54	UGC12892					shg2005	AOIf	8858	375	355		27	1.7	0.55	8.8	2	
55	UGC12898	4779	179	10	1	shg2005	AOIf	4779	195	188	179	10	14.9	4.30	8.5	1	
58	AGC331071					shg2005	AOIf	8795	488	457		100	0.7	0.36	8.7	4	
64	SSS38-012	7664	206	18	1	tmc2006	Nanc	7664	226	215	206	18	4.0	1.61	10.8	1	
70	UGC12900	6800	426	12	2	shg2005	AOIf	6804	449	435	426	15	7.9	8.55	8.6	1	
73	AGC036544	6909	139	14	2	shg2005	Nanc	6910	165	150	142	20	7.5	3.55	5.5	4	
76	UGC12901	6920	409	18	1	shg2005	AOIf	6920	432	418	409	18	4.6	3.82	8.8	1	
94	UGC012905	4098	188	14	1	ctm2010	GBT	4098	203	197	188	14	8.9	3.61	1.6	4	
101	UGC12906					shg2005	AOIf	5306	304	294		40	3.7	3.97	8.5	1	
102	UGC12909	5048	428	20	1	shg2005	AOIf	5048	449	437	428	20	2.5	5.58	8.7	1	
110	UGC12910	3974	56	12	1	shg2005	AOIf	3974	64	59	56	12	12.1	2.93	8.6	1	
112	UGC12911	4794	271	20	1	shg2005	AOIf	4794	289	280	271	20	2.5	1.29	8.7	1	
116	UGC12912	9268	318	19	1	shg2005	AOIf	9268	342	327	318	19	3.7	1.71	8.9	1	
117	AGC331079	9133	193	19	1	shg2005	AOIf	9133	213	202	193	19	2.1	0.92	8.8	1	

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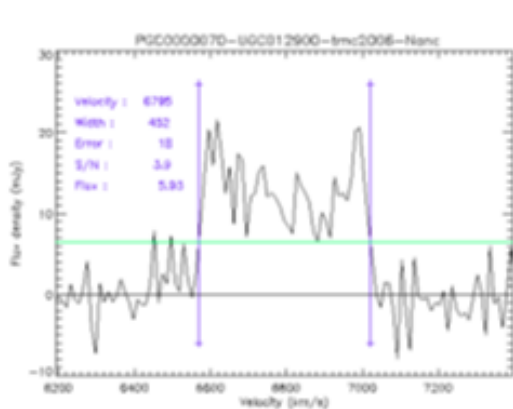
Download

Download rows 1 to 200

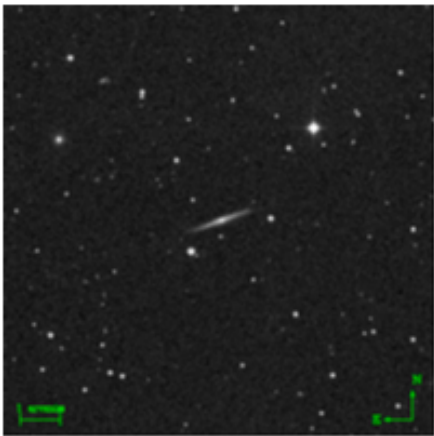
Results from the [All Digital HI catalog](#)

pgc	Name/Profile	Vh_av	Wmx_av	eW_av	N_av	Source1	Tel1	Vhel1	Wm501	Wcm501	Wmx1	e_W1	SN1	Flux1	Res1	Ns1	Fm501	Source2	Tel2	Vhel2	Wm502	W
70	UGC12900	6800	426	12	2	shg2005	AO1f	6804	449	435	426	15	7.9	8.55	8.6	1	6.5	lmc2006	Nanc	6795	452	4

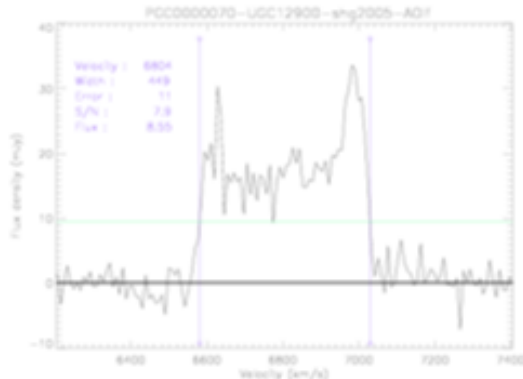
Available profiles for PGC 70



[Ascii Profile](#)



Select PGC
70



[Ascii Profile](#)

Profiles for 18,000 galaxies in EDD

Optical and IR Photometry

EDO: Select Table & Columns

11/17/12 4:14 PM

Secure site for proprietary users only. All others will be prosecuted.

[EDO Home Page](#)



The Extragalactic Distance Database (EDD)

Instructions:

- Here, you create a merged table of data fields on galaxies from a variety of tables.
- You may enter a galaxy name below, or you can leave it blank and get all galaxies in the selected tables and cull it down by range limits and regular expression later.
- Click catalogs 'on' to see and select data fields.
- Hold mouse over a catalog name to see a short description of it.
- Click on catalog names for a popup with information on the fields in the catalog.
- At the bottom of the page, select range of row numbers for initial query to prevent too much data from being transferred.
- Most browsers clear the column selections when you reload, but Firefox does not, so use reset button.

Features:

- Updated best distances in EDD Distances catalog (presently limited to $V < 3000$ km/s).
- Color images of galaxies observed with ACS and WFC3 in "CMDs/TRGB" catalog.
- 16,000 HI profiles uniformly analyzed in All Digital HI catalog.
- Hawaii Photometry catalog now available.

OPTIONAL: Enter Galaxy Name: Display only tables with info on this galaxy

Redshift Catalogs			
LEDA <input type="checkbox"/> on Entries: 98202	2MRS K<17.5 <input type="checkbox"/> on Entries: 43528	2MASS K<12.5 V <input type="checkbox"/> on Entries: 24746	2M++ <input type="checkbox"/> on Entries: 64745

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Summary Distances			
EDD Distances <input type="checkbox"/> on Entries: 3529	Quality Distances <input type="checkbox"/> on Entries: 636	Cosmicflows-1 Distances <input type="checkbox"/> on Entries: 1797	SFI++ <input type="checkbox"/> on Entries: 5780

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Stellar Distances					
CMDs/TRGB <input type="checkbox"/> on Entries: 325	ANGST <input type="checkbox"/> on Entries: 65	Araucaria <input type="checkbox"/> on Entries: 12	McConnachie <input type="checkbox"/> on Entries: 102	Tully SBF <input type="checkbox"/> on Entries: 299	Virgo/Fornax SBF <input type="checkbox"/> on Entries: 134

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SNIa						
5 Sources SNIa <input type="checkbox"/> on Entries: 318	Tully SNIa <input type="checkbox"/> on Entries: 126	Jha SNIa <input type="checkbox"/> on Entries: 132	Prieto SNIa <input type="checkbox"/> on Entries: 89	Union2 SNIa <input type="checkbox"/> on Entries: 255	Constitution SNIa <input type="checkbox"/> on Entries: 209	CSPI SNIa <input type="checkbox"/> on Entries: 34

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HI Linewidths						
All Digital HI <input type="checkbox"/> on Entries: 14219	Pre-Digital HI <input type="checkbox"/> on Entries: 4395	Springob/Cornell HI <input type="checkbox"/> on Entries: 8844	HI Nancay <input type="checkbox"/> on Entries: 3720	HI Fisher <input type="checkbox"/> on Entries: 958	HIPASS 1000 <input type="checkbox"/> on Entries: 1000	WHISP <input type="checkbox"/> on Entries: 343

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Optical Linewidths
<input type="checkbox"/> on

<http://edd.ifa.hawaii.edu/secure/dfirst.php?>

Page 1 of 2

Extragalactic Distance Database

EDO: Select Table & Columns

11/17/12 4:21 PM

Catinella/Cornell <input type="checkbox"/> on Entries: 403	Mathewson by Courteau <input type="checkbox"/> on Entries: 525	Dalcby Courteau <input type="checkbox"/> on Entries: 486	Courteau by Courteau <input type="checkbox"/> on Entries: 252	Verheijen by Courteau <input type="checkbox"/> on Entries: 38
--	--	--	---	---

[Submit](#) [All](#) [Reset](#)

Photometry							
"Spitzer 3.6 Band Photometry" <input type="checkbox"/> on Entries: 232	Hawaii Photometry <input type="checkbox"/> on Entries: 524	Homogenized Photometry <input type="checkbox"/> on Entries: 5864	SDSS Half <input type="checkbox"/> on Entries: 3039	2MASS Large Galaxy Atlas <input type="checkbox"/> on Entries: 617	Cosmicflows SINGS <input type="checkbox"/> on Entries: 1272	Spitzer SINGS <input type="checkbox"/> on Entries: 75	Carnegie Hubble Program <input type="checkbox"/> on Entries: 480
S4G <input type="checkbox"/> on Entries: 2331	Aarvold H <input type="checkbox"/> on Entries: 204	Bernstein Coma <input type="checkbox"/> on Entries: 32	Bothun <input type="checkbox"/> on Entries: 38	Bureau Fornax <input type="checkbox"/> on Entries: 22	Courteau <input type="checkbox"/> on Entries: 304	Mathewson revised by Courteau <input type="checkbox"/> on Entries: 957	Mathewson <input type="checkbox"/> on Entries: 2443
Deil'Antonio <input type="checkbox"/> on Entries: 241	Berandau <input type="checkbox"/> on Entries: 234	Dale SCI <input type="checkbox"/> on Entries: 520	Giovanelli SCI <input type="checkbox"/> on Entries: 782	Haines SFI/SCI <input type="checkbox"/> on Entries: 1727	Han Cluster <input type="checkbox"/> on Entries: 284	Han Perseus Pisces <input type="checkbox"/> on Entries: 59	Lu Virgo/Andromeda <input type="checkbox"/> on Entries: 303
McDonald Virgo <input type="checkbox"/> on Entries: 286	Mould Clusters <input type="checkbox"/> on Entries: 171	Pierce Field <input type="checkbox"/> on Entries: 715	Roth IRAS selected <input type="checkbox"/> on Entries: 156	Schommer Clusters <input type="checkbox"/> on Entries: 32	Verheijen UMa <input type="checkbox"/> on Entries: 78	Willick Clusters <input type="checkbox"/> on Entries: 156	Willick Perseus Pisces <input type="checkbox"/> on Entries: 381

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Fundamental Plane				
Blakeslee SMAC FP + SBF <input type="checkbox"/> on Entries: 164	Hudson SMAC FP <input type="checkbox"/> on Entries: 56	FP: SMAC3 <input type="checkbox"/> on Entries: 698	FP: EFAR <input type="checkbox"/> on Entries: 788	FP: ENFARc <input type="checkbox"/> on Entries: 452

[Submit](#) [All](#) [Reset](#)

Supplementary Catalogs					
Replenished Catalog of Nearby Galaxies <input type="checkbox"/> on Entries: 826	Neighboring Galaxies <input type="checkbox"/> on Entries: 451	2MRS Augmented <input type="checkbox"/> on Entries: 28573	MAK Ypec <input type="checkbox"/> on Entries: 21295	YBK <input type="checkbox"/> on Entries: 30124	Tully 3000 <input type="checkbox"/> on Entries: 3497
Y3B MK<21 <input type="checkbox"/> on Entries: 1228	Karachentsev Revised Flat Galaxy Catalog <input type="checkbox"/> on Entries: 4444	Karachentsev RFGC 2MASS peculiar velocities <input type="checkbox"/> on Entries: 1222	Karachentsev RFGC peculiar velocities <input type="checkbox"/> on Entries: 1527	Parnovsky RFGC peculiar velocities <input type="checkbox"/> on Entries: 1623	MK Groups <input type="checkbox"/> on Entries: 11056
Virgo Cluster Catalog <input type="checkbox"/> on Entries: 2994	Saunders PSCz <input type="checkbox"/> on Entries: 1690	TF Calibrators <input type="checkbox"/> on Entries: 416			

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Choose rows to display initially: start end

Curators: E. Shaya, R. Brent Tully, Luca Rizzi, Dmitry Makarov, Lidia Makarova, Helene Courtois, Brad Jacobs, Matt Zagursky



The Extragalactic Distance Database: Display Request

Hide Control Panel

Spitzer 3.6 μ m Photometry

Requested Rows:

Control Panel: Column Min/Max, regular expression, sorting, visibility

PGC	P	Name/Photom	Date	Exp	a26.5	m_26.5	m_tot	e_m	m_ext	S80	"Spitzer [3.6] Band Photometry"				
PGC no	P	Name/Photom	Date	Exp	a26.5	m_26.5	m_tot	e_m	m_ext	S80	alpha	b/a	e_b/a	PA	
Min	Min	String	String	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	
Max	Max	String	String	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	
Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	
show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	

"Spitzer [3.6] Band Photometry"														
PGC	P	Name/Photom	Date	Exp	a26.5	m_26.5	m_tot	e_m	m_ext	S80	alpha	b/a	e_b/a	PA
			ymdhm	sec	arcsec	mag	mag	mag	mag	mag/as^2	arcsec			deg
3664	1	UGC00633	2009.10.03T11:59:01.257	240.0	60	13.41	13.408	0.002	13.398	18.78	8.5	0.28	0.01	11
3771	1	UGC00646	2009.10.03T12:14:19.244	240.0	76	12.92	12.925	0.007	12.902	19.56	11.9	0.39	0.01	103
3866	1	UGC00669	2009.10.03T12:06:41.241	240.0	78	13.32	13.306	0.004	13.316	18.41	10.5	0.23	0.00	124
3950	1	UGC00679	2009.10.03T12:21:58.033	240.0	56	15.76	15.726	0.005	15.724	20.77	10.7	0.23	0.00	99
4210	1	UGC00732	2009.10.03T11:27:55.283	240.0	58	13.45	13.445	0.005	13.436	19.61	9.1	0.58	0.01	79
4561	1	NGC0444	2009.10.03T11:11:42.894	240.0	75	14.00	13.998	0.003	13.986	19.75	12.1	0.26	0.01	161
4596	1	NGC0452	2009.10.03T11:04:17.699	240.0	107	11.95	11.948	0.008	11.941	19.56	16.7	0.45	0.04	34
4735	1	UGC00841	2009.10.03T10:56:17.704	240.0	68	13.99	14.002	0.003	13.984	19.35	10.4	0.25	0.00	54
5061	1	NGC0496	2009.10.03T10:41:08.119	240.0	61	13.11	13.100	0.002	13.101	19.30	9.1	0.65	0.03	29
5132	1	NGC0512	2009.10.03T10:33:38.526	240.0	77	12.29	12.299	0.003	12.288	17.44	9.2	0.27	0.01	114
5284	1	UGC00987	2009.10.04T09:31:21.676	240.0	77	12.45	12.447	0.003	12.442	19.16	11.3	0.41	0.00	29
5341	1	PGC005341	2009.08.29T23:18:31.199	120.0	108	12.87	12.862	0.002	12.863	19.03	15.7	0.20	0.01	22
5344	1	NGC0536	2009.10.04T18:13:25.066	240.0	113	11.67	11.662	0.007	11.652	19.61	17.8	0.56	0.00	68
6502	1	NGC0668	2009.10.03T10:17:09.738	240.0	67	12.58	12.572	0.006	12.567	19.67	10.6	0.71	0.02	28
6602	1	UGC01257	2009.10.03T10:09:38.156	240.0	46	13.75	13.767	0.009	13.739	19.76	7.3	0.53	0.02	107
6624	1	NGC0673	2009.08.29T15:33:50.353	120.0	91	12.04	12.027	0.003	12.031	18.82	12.9	0.56	0.03	16
6799	1	NGC0688	2009.10.04T19:05:23.417	240.0	80	12.37	12.360	0.007	12.342	20.25	13.8	0.77	0.00	146
6851	1	UGC01316	2009.10.04T17:57:20.688	240.0	30	15.63	15.628	0.005	15.604	20.41	5.4	0.47	0.02	177
6865	1	UGC01319	2009.10.04T06:08:08.222	240.0	42	13.12	13.116	0.013	13.115	18.54	5.7	0.82	0.06	164
7066	1	UGC01366	2009.10.04T06:00:32.223	240.0	79	12.85	12.847	0.006	12.839	18.65	10.9	0.32	0.02	138
7382	1	NGC0753	2009.10.04T05:45:24.243	240.0	99	11.62	11.611	0.004	11.605	19.56	15.5	0.77	0.02	132
7504	1	UGC01459	2009.10.04T03:37:16.339	240.0	180	13.11	13.067	0.026	13.103	19.00	26.0	0.17	0.01	107
9332	1	NGC0925	2004.08.14T06:43:13.827	120.0	309	10.82	10.791	0.005	10.796	20.09	52.4	0.34	0.02	107
9560	1	NGC0958	2009.10.07T15:36:31.447	240.0	97	11.13	11.130	0.002	11.126	17.55	11.7	0.36	0.05	11

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The Extragalactic Distance Database: Display Request

Hide Control Panel

Spitzer 3.6 μ m Photometry

Requested Rows:

Control Panel: Column Min/Max, regular expression, sorting, visibility

PGC	P	Name/Photom	Date	Exp	a26.5	m_26.5	m_tot	e_m	m_ext	S80	"Spitzer [3.6] Band Photometry"				
PGC no	P	Name/Photom	Date	Exp	a26.5	m_26.5	m_tot	e_m	m_ext	S80	alpha	b/a	e_b/a	PA	
Min	Min	String	String	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	
Max	Max	String	String	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	
Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	Sort	
show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	hide	show	

"Spitzer [3.6] Band Photometry"														
PGC	P	Name/Photom	Date	Exp	a26.5	m_26.5	m_tot	e_m	m_ext	S80	alpha	b/a	e_b/a	PA
			ymdhm	sec	arcsec	mag	mag	mag	mag	mag/as^2	arcsec			deg
3664	1	UGC00633	2009.10.03T11:59:01.257	240.0	60	13.41	13.408	0.002	13.398	18.78	8.5	0.28	0.01	11
3771	1	UGC00646	2009.10.03T12:14:19.244	240.0	76	12.92	12.925	0.007	12.902	19.56	11.9	0.39	0.01	103
3866	1	UGC00669	2009.10.03T12:06:41.241	240.0	78	13.32	13.306	0.004	13.316	18.41	10.5	0.23	0.00	124
3950	1	UGC00679	2009.10.03T12:21:58.033	240.0	56	15.76	15.726	0.005	15.724	20.77	10.7	0.23	0.00	99
4210	1	UGC00732	2009.10.03T11:27:55.283	240.0	58	13.45	13.445	0.005	13.436	19.61	9.1	0.58	0.01	79
4561	1	NGC0444	2009.10.03T11:11:42.894	240.0	75	14.00	13.998	0.003	13.986	19.75	12.1	0.26	0.01	161
4596	1	NGC0452	2009.10.03T11:04:17.699	240.0	107	11.95	11.948	0.008	11.941	19.56	16.7	0.45	0.04	34
4735	1	UGC00841	2009.10.03T10:56:17.704	240.0	68	13.99	14.002	0.003	13.984	19.35	10.4	0.25	0.00	54
5061	1	NGC0496	2009.10.03T10:41:08.119	240.0	61	13.11	13.100	0.002	13.101	19.30	9.1	0.65	0.03	29
5132	1	NGC0512	2009.10.03T10:33:38.526	240.0	77	12.29	12.299	0.003	12.288	17.44	9.2	0.27	0.01	114
5284	1	UGC00987	2009.10.04T09:31:21.676	240.0	77	12.45	12.447	0.003	12.442	19.16	11.3	0.41	0.00	29
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6799	1	NGC0688	2009.10.04T19:05:23.417	240.0	80	12.37	12.360	0.007	12.342	20.25	13.8	0.77	0.00	146
6851	1	UGC01316	2009.10.04T17:57:20.688	240.0	30	15.63	15.628	0.005	15.604	20.41	5.4	0.47	0.02	177
6865	1	UGC01319	2009.10.04T06:08:08.222	240.0	42	13.12	13.116	0.013	13.115	18.54	5.7	0.82	0.06	164
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933	1	NGC0925	2004.08.14T06:43:13.827	120.0	309	10.82	10.791	0.005	10.796	20.09	52.4	0.34	0.02	107
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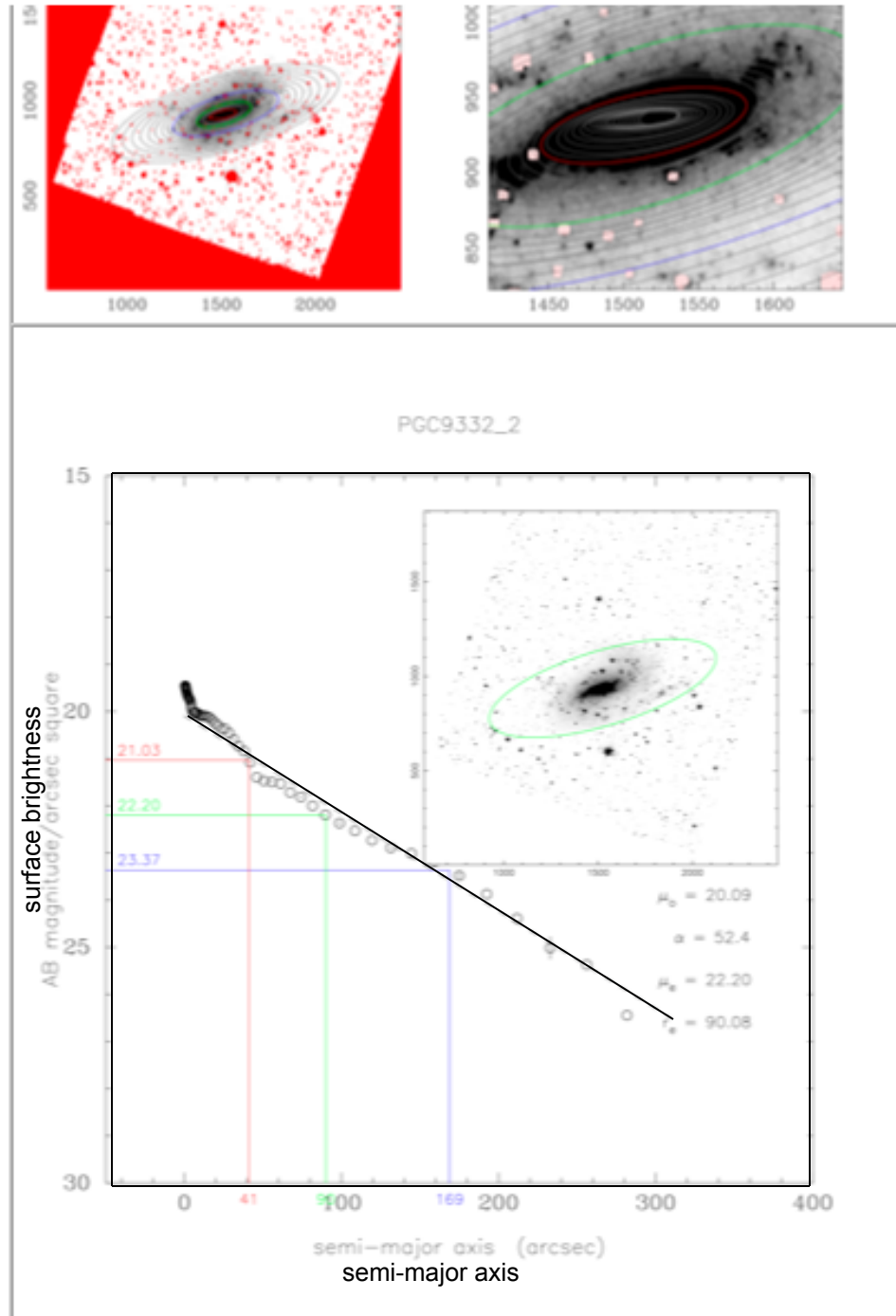
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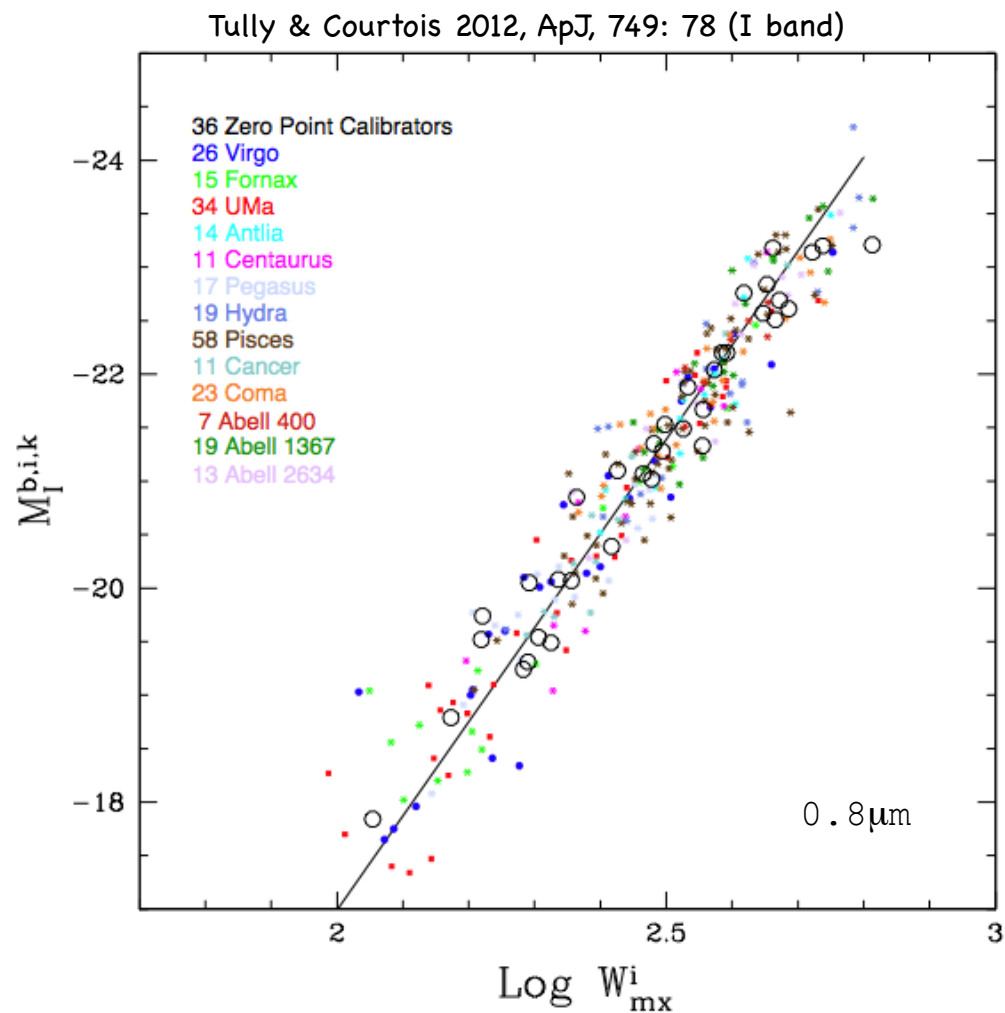
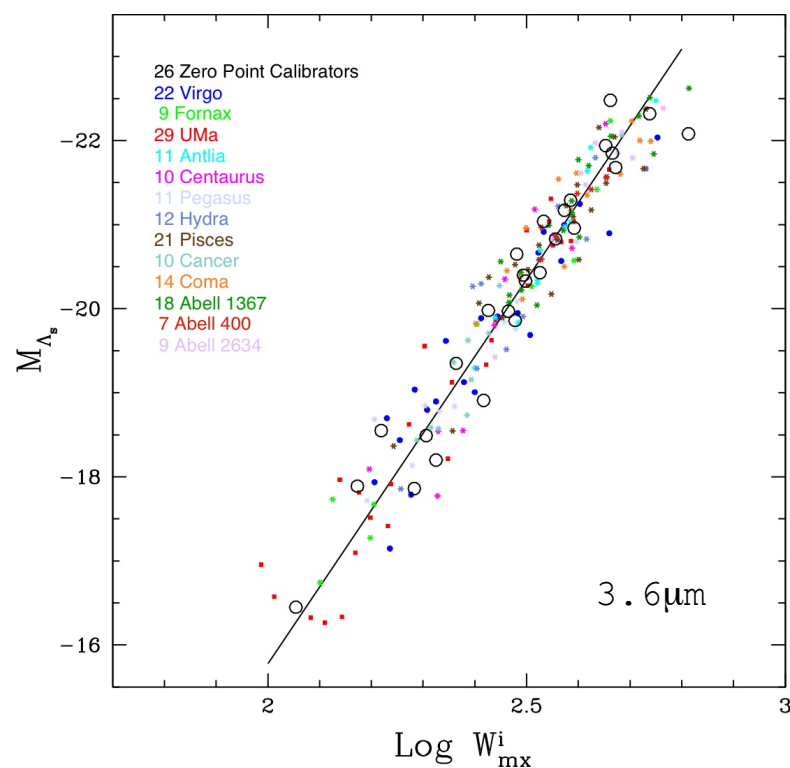
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Select PGC 9332



Spitzer photometry magnitudes
for 4000 galaxies in EDD
- WISE magnitudes coming soon

CF2: I & [3.6] band Luminosity - HI Linewidth Calibration



Sorce et al. 2013, ApJ, 765: 94 (Spitzer mid-IR)

Luminosity-Linewidth Summary

~2000 in common CF2 and SFI++

~2000 CF2 only

~2000 SFI++ only

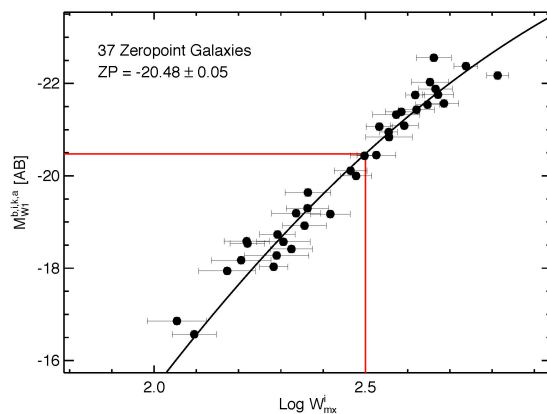
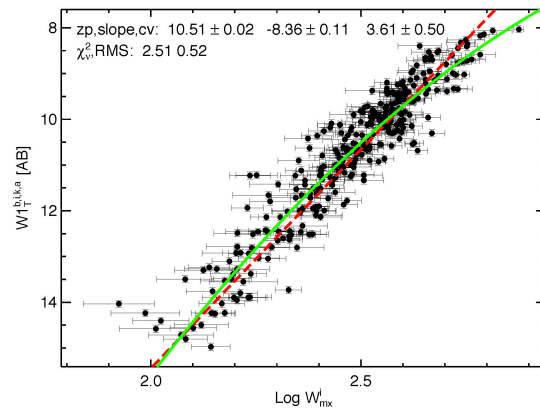
~6000 total

CF2: our analysis

SFI++: Springob et al. 2007

Cosmicflows-3??

curvature in mid-IR
luminosity–linewidth
correlation



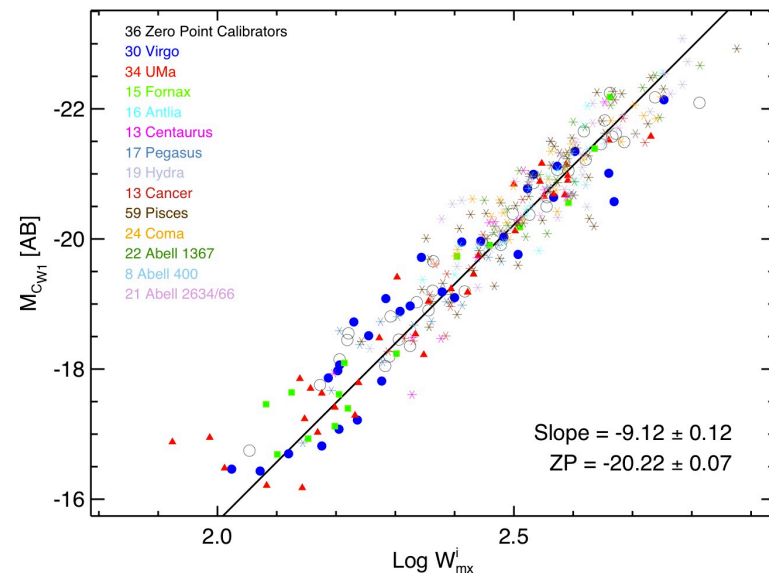
Anticipate sample of $\sim 10,000$ galaxies

Spitzer [3.6] photometry for 2300 galaxies
Sorce et al. 2014, MNRAS, 444, 527

WISE W1 and W2 photometry calibration
Neill et al. 2014, ApJ, 792, 129

PanSTARRS g,r,i,z photometry
Zagursky et al. 2015??

WISE 3.4 micron – color corrected



Fundamental Plane (FP)

EFAR: Colless et al. (2001)	— 11	— 28 clusters
SMAC: Hudson et al. (2001)	— 19	
ENEARc: Bernardi et al. (2002)		

Cosmicflows 2: 1508 galaxies in 133 clusters

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EFAR: Colless et al. (2001)	11	28 clusters
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Cosmicflows 2: 1508 galaxies in 133 clusters

6dFGS coming soon with 9000 southern FP distances!!

Campbell et al. 2014, MNRAS, 443, 1231

Springob et al. 2014??

Magoulas et al. 2014??

Type Ia Supernovae (SNIa)

Backbone (all z)

Amanullah et al. 2010 (UNION2)

Supplements ($z < 0.1$)

Prieto et al. 2006

Jha et al. 2007

Hicken et al. 2009

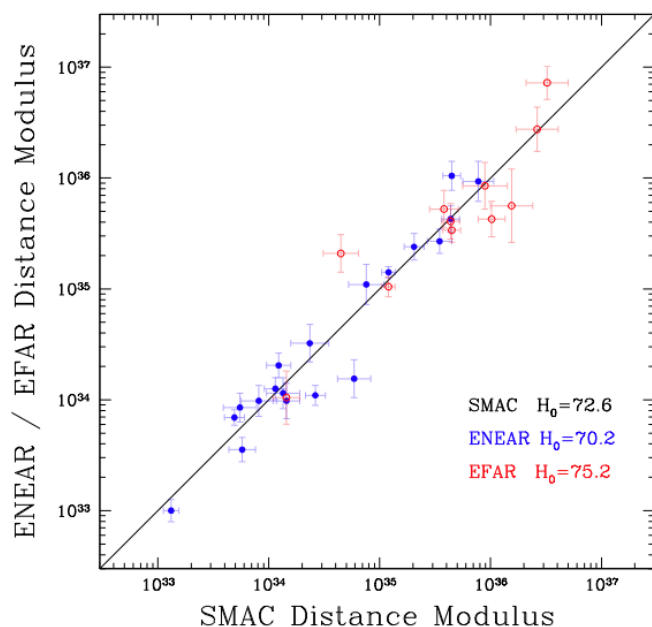
Folatelli et al. 2010

306 SNIa distances $z < 0.1$

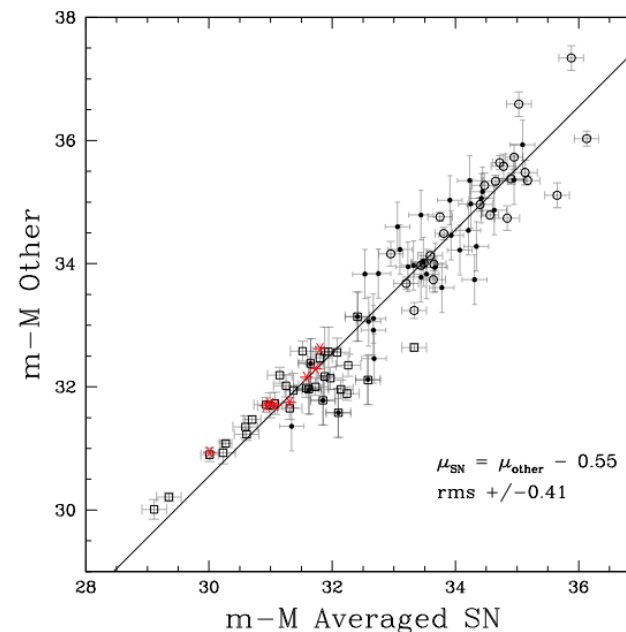
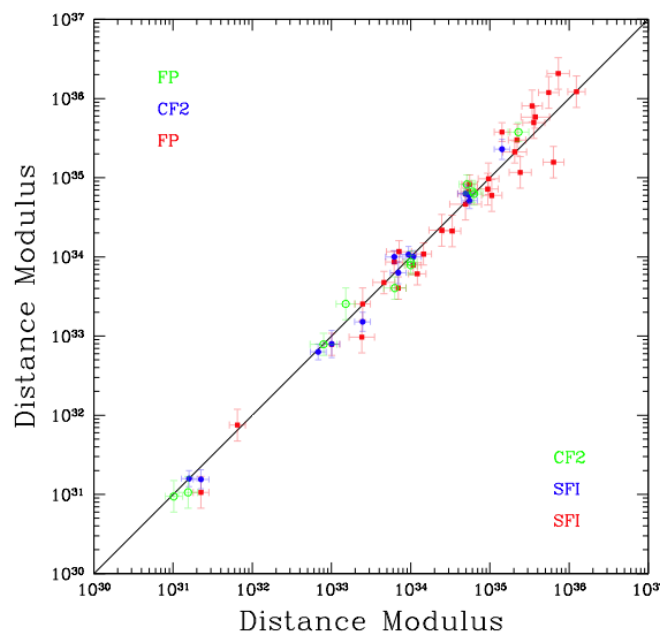
CF2: SNIa Calibration and H_0



combine 3 FP sources



combine 2 TF and 3 FP with
I-band CF2 zero point



Cepheid, SBF, TF, FP
set SNIa scale with
I-band CF2 zero point

CF2: SNIa calibration and H_0

(continued)

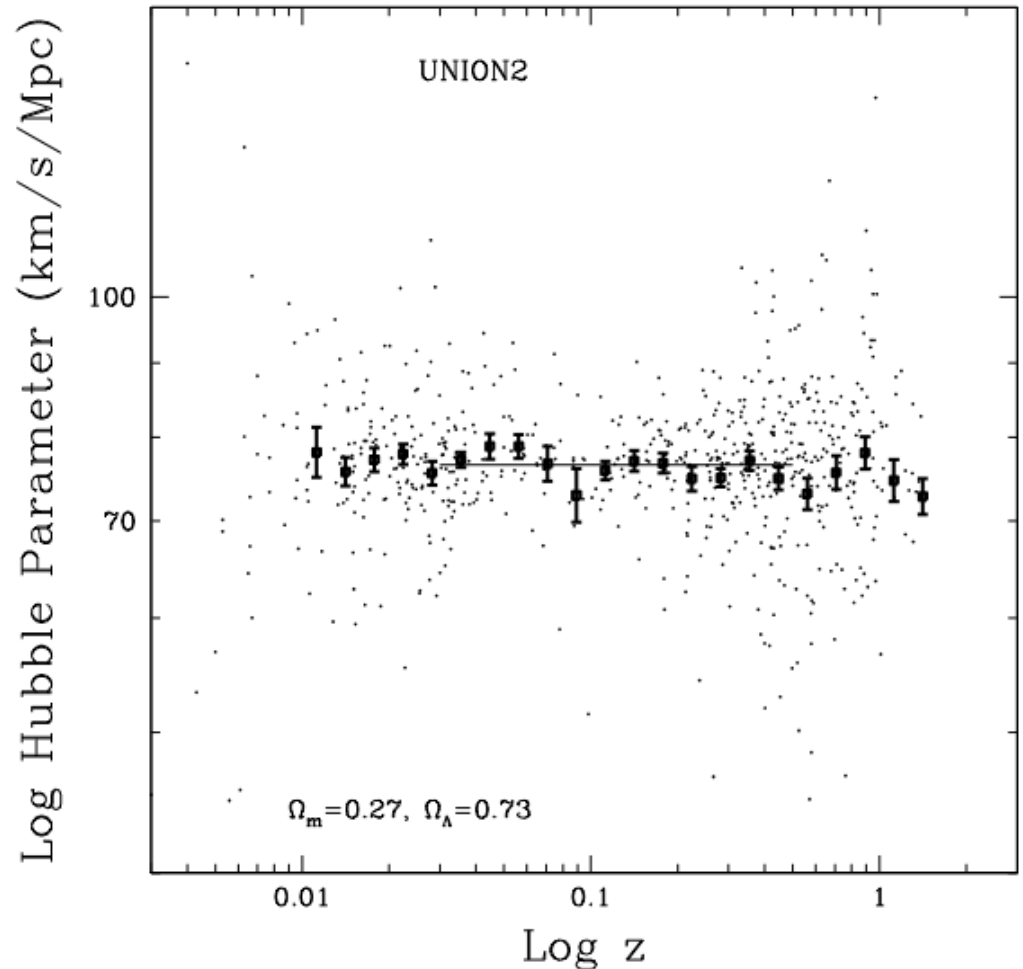
UNION2 SNIa sample shifted to [3.6]-band CF2 zero point. Fit over interval $0.03 < z < 0.5$

$$H_0 = 75.2 \pm 3.0 \text{ km/s/Mpc}$$

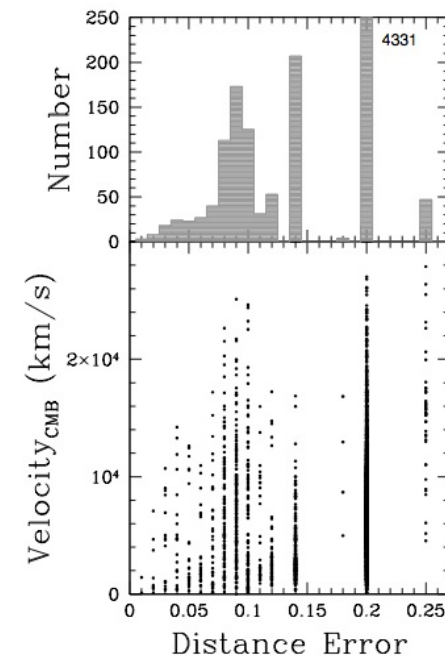
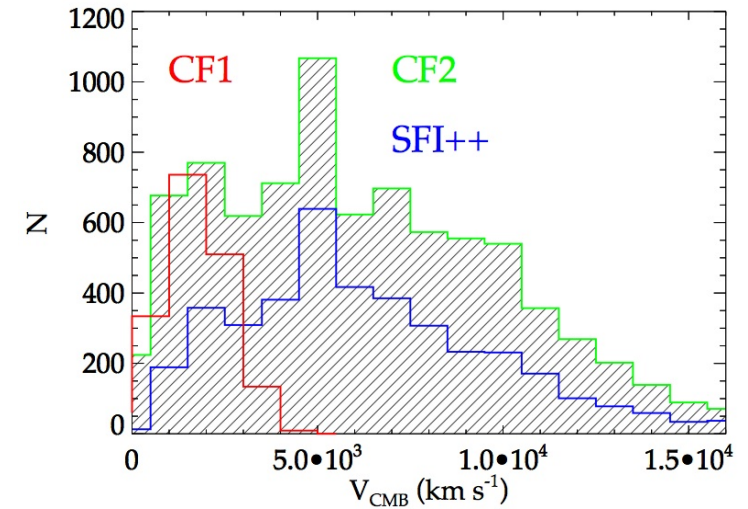
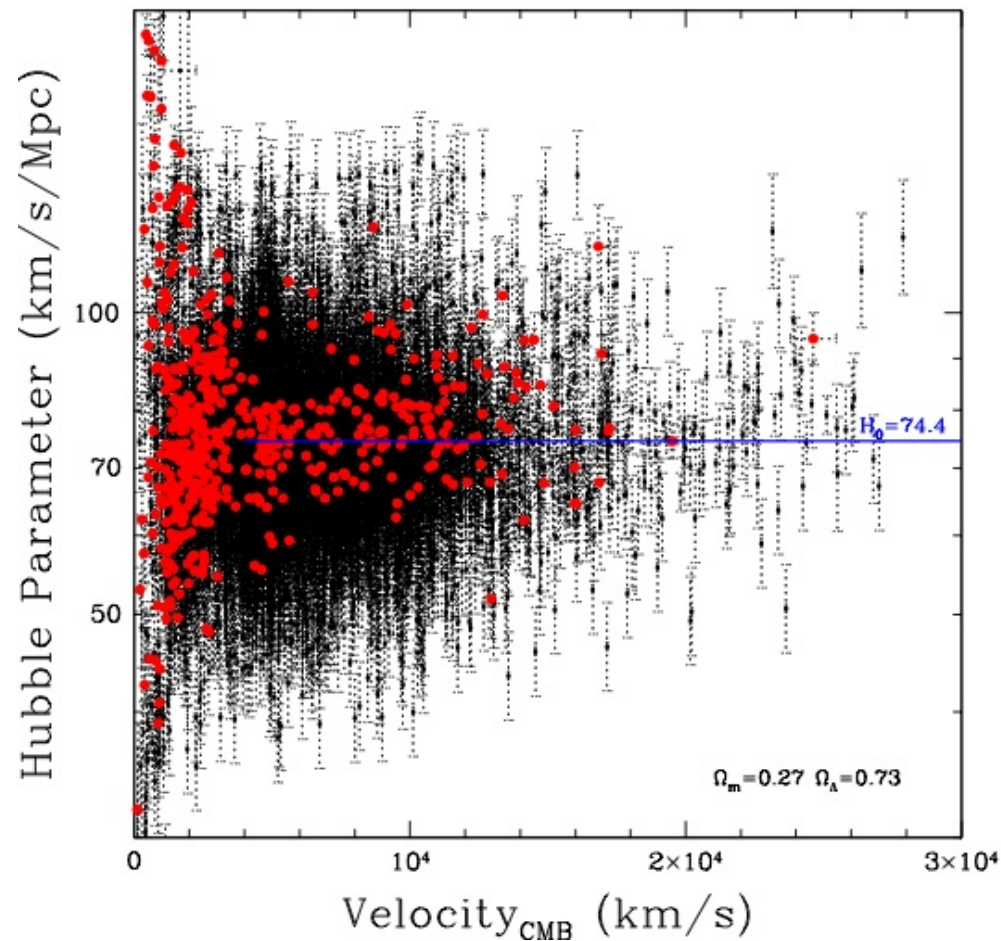
WISE recalibration (2014):
 $H_0 = 74.4 \pm 2.8 \text{ km/s/Mpc}$

I \rightarrow [3.6] lowers H_0 2%
LMC revision raises H_0 1%

Courtois & Tully 2012, ApJ, 749, 174
Sorce, Tully, Courtois 2012, ApJL, 758, L12
Neill, Seibert, Tully et al., 2014, ApJ, 792, 129



Cosmicflows-2 Ensemble



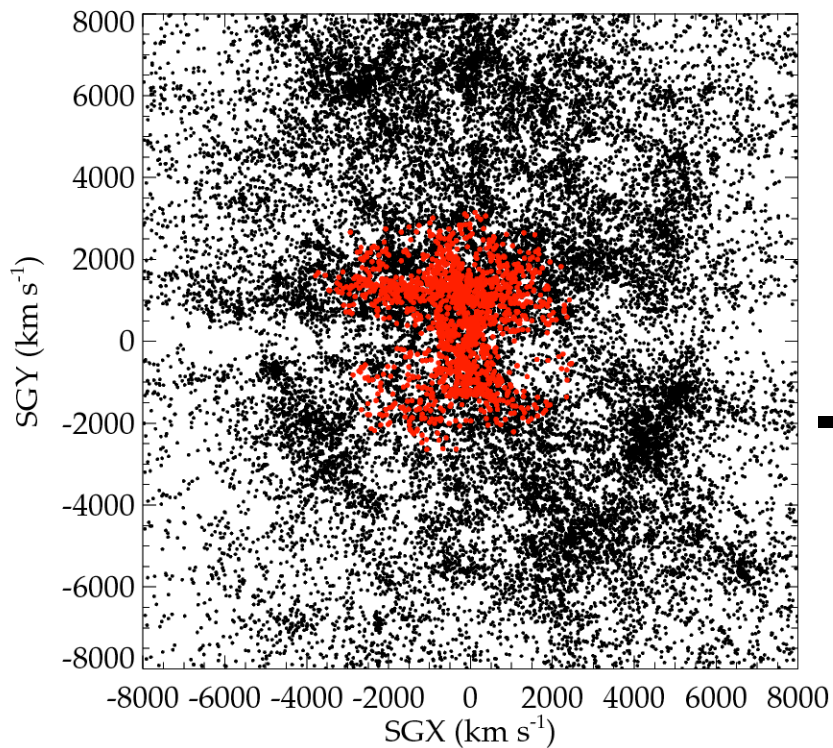
534 groups + 4691 individuals = 5225 entities

Cosmicflows-1 => Cosmicflows-2

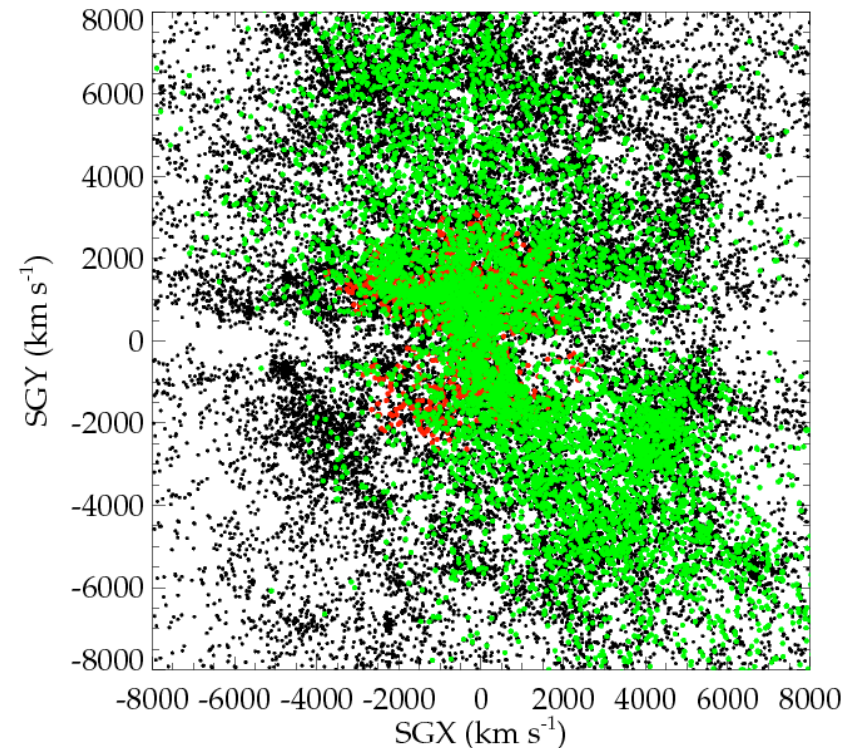
CF1: 1800 galaxies
 $V < 3,000 \text{ km/s}$



CF2: 8000 galaxies
 $V < 30,000 \text{ km/s}$



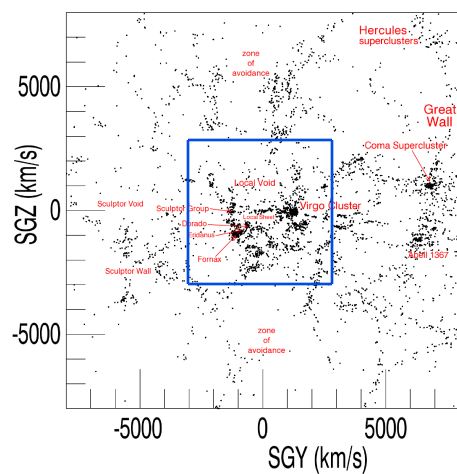
2008



2013

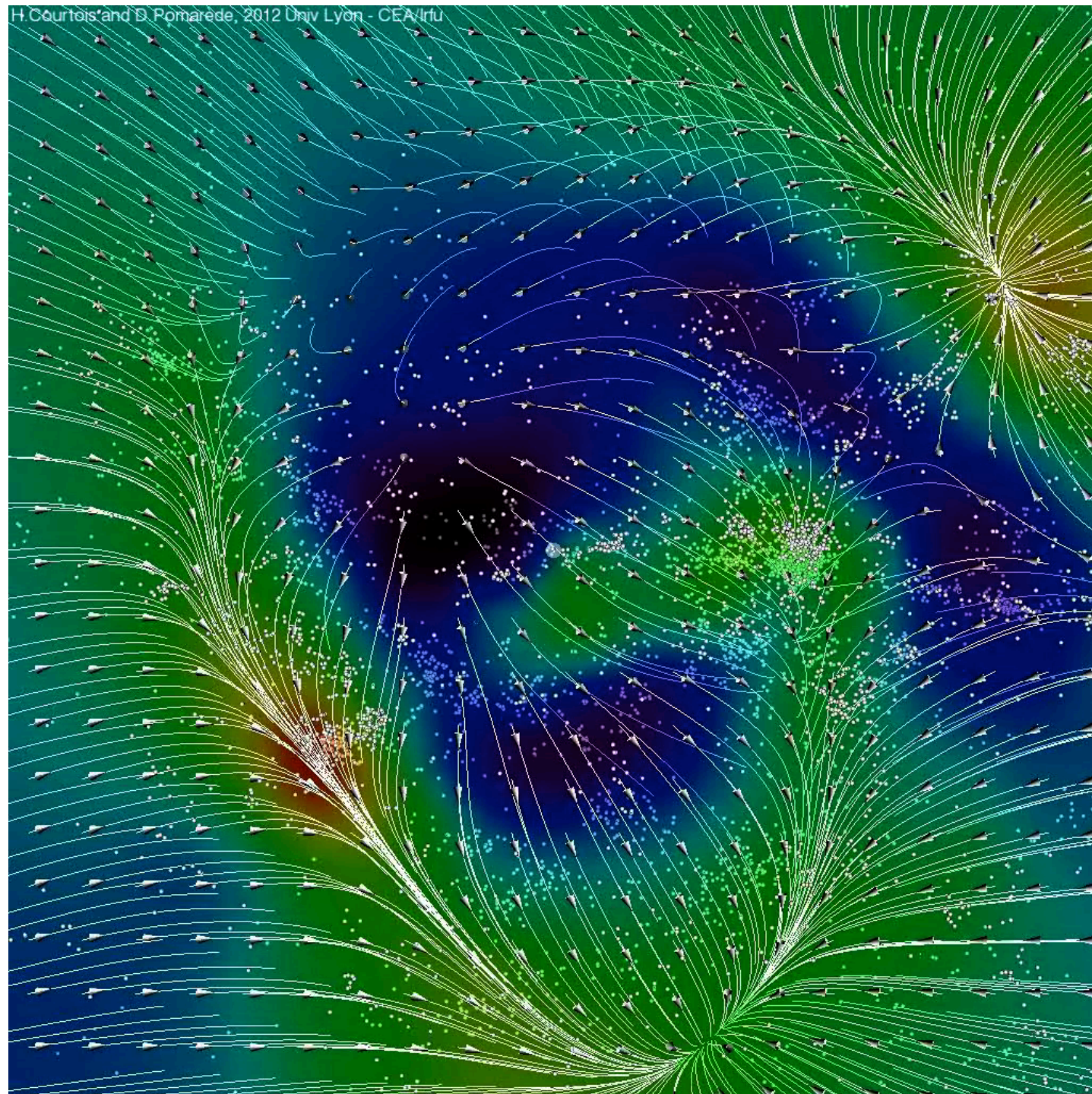
Wiener Filter reconstructions of
3D velocity fields and density
maps. Results from
cosmicflows-1

Courtois, Pomarede, Hoffman
2013, AJ, 146, 69
Expulsion from the Local Void.



SGZ

SGY



Wiener Filter with Constrained Realizations

- Estimate Bayesian probability that data fits prior model that structure emerged from initial Gaussian fluctuations.
- Model assumes Λ CDM WMAP power spectrum.
- Wiener filter schematic: $P_k/(P_k + \sigma^2)$ where P_k is power spectrum and σ is error \Rightarrow data dominates estimator if errors are small but filter attenuates to zero if errors dominate.
- Constrained realization: sample variation of actual field by drawing from Gaussian field consistent with power spectrum \Rightarrow in regions dominated by good quality data CR are dominated by data but in regions of poor data the realizations reflect random sampling.
- CR's sample the statistical scatter about mean WF field.

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Properties of peculiar velocities in the linear regime

- Scale of non-linearity for velocity field is a few Mpc (10x larger for density field)
- Coherent tidal flows => information on structure well beyond domain of direct observations
- Decomposition of divergent (local) and tidal components:
$$\text{Div}V = -H_0 \Omega^{0.55} \delta$$
- Local flows about arbitrary centers and with arbitrary radius can be studied by setting densities to null field outside selected radius; tidal flows are residuals from local flows
- V-web: order 3 eigenvalues of shear tensor $\lambda_1 > \lambda_2 > \lambda_3$
 - knot: 3 above threshold;
 - filament: 2 above threshold;
 - sheet: 1 above threshold;
 - void: 0 above threshold

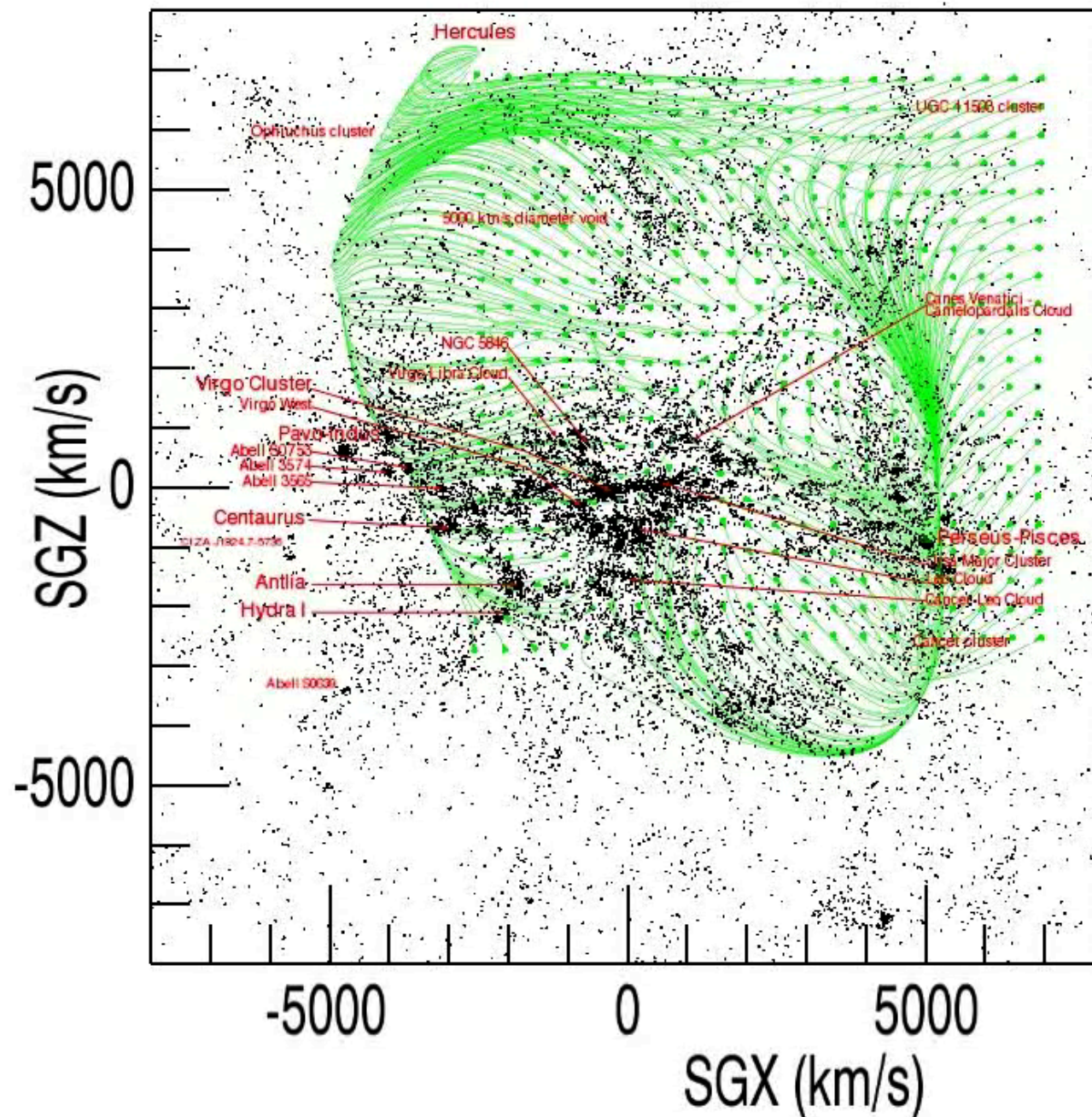
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Properties of peculiar velocities in the linear regime

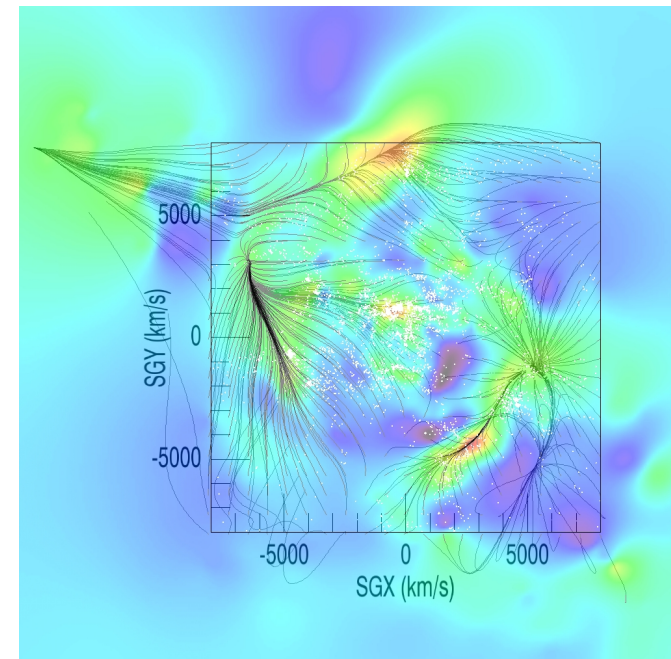
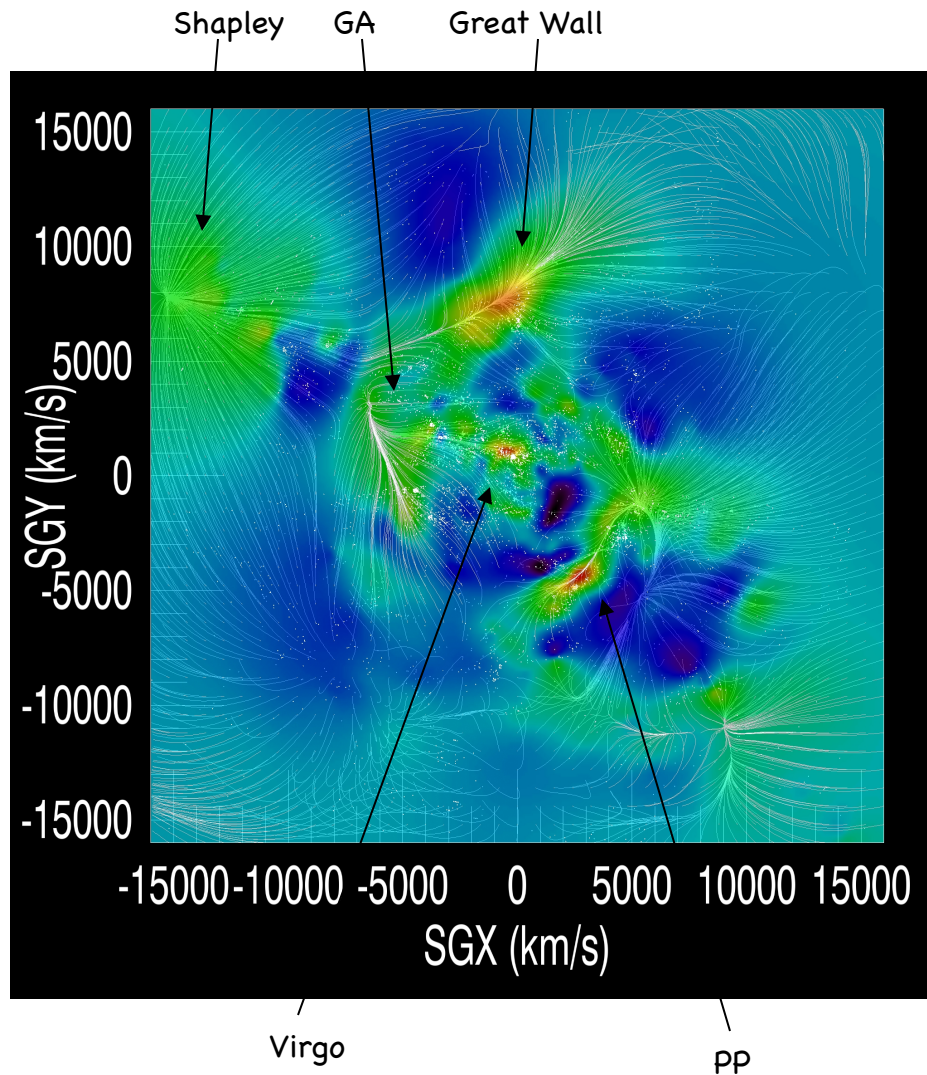
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Preliminary Wiener Filter result from Cosmicflows-2



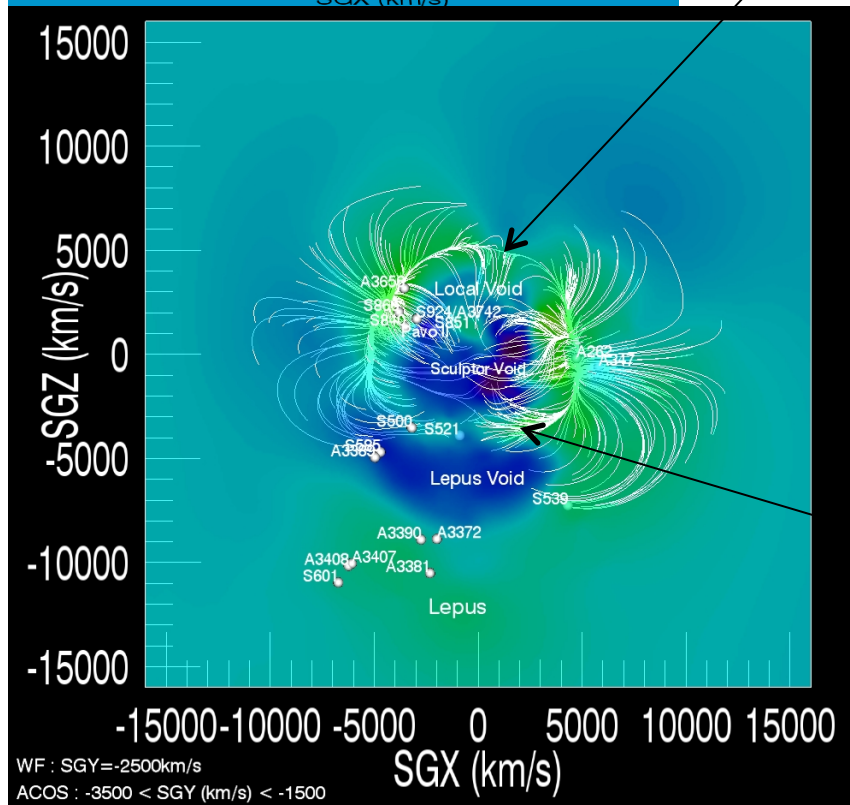
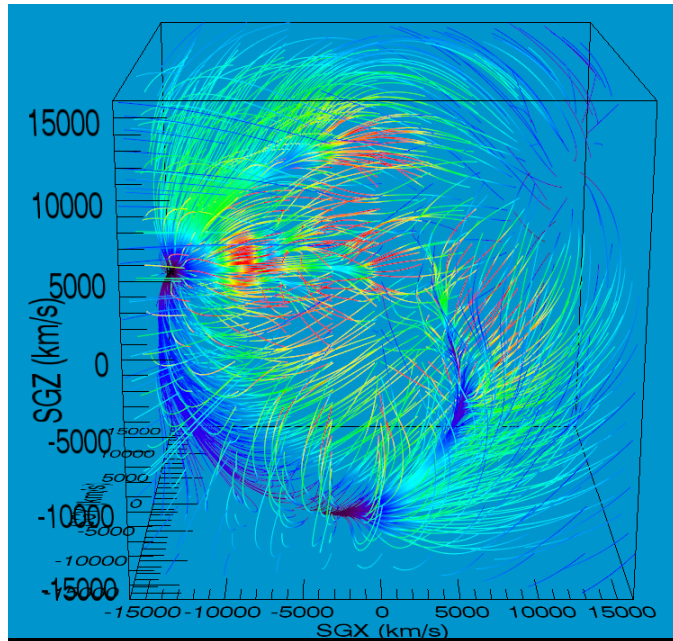
Wiener Filter Reconstructions with Cosmicflows-2

3D velocities and density map computed from CF2 peculiar velocities



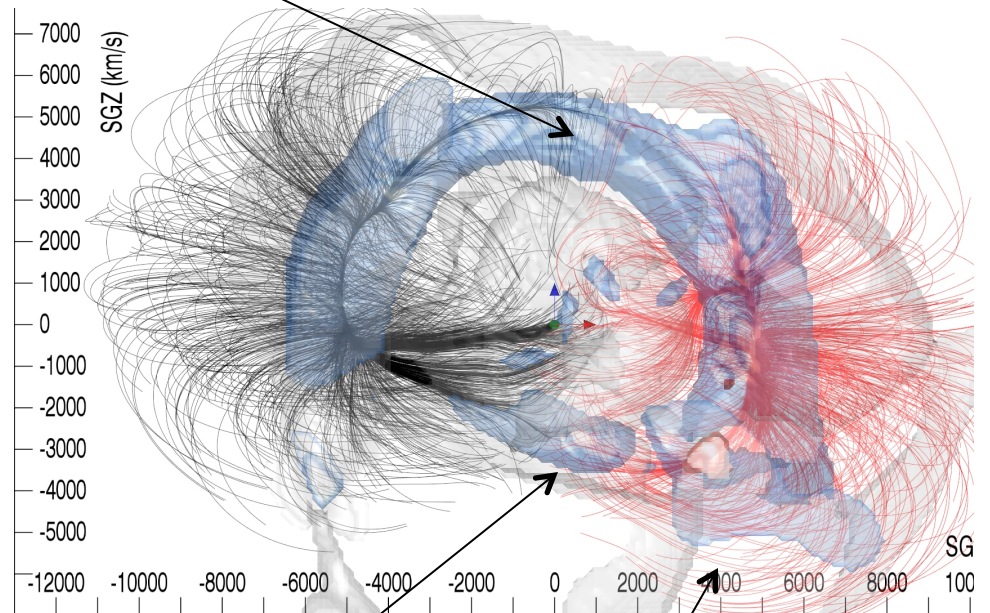
Hoffman, Pomaredé, Courtois

Watershed Connections



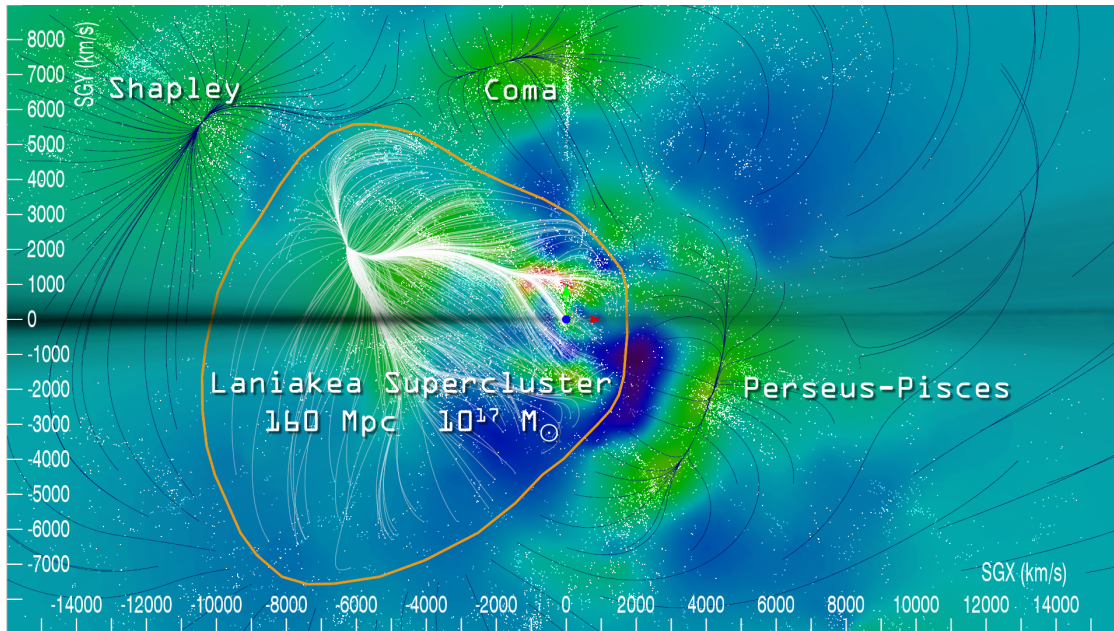
"Arch"

Laniakea



Perseus-Pisces

Antlia Wall Extension

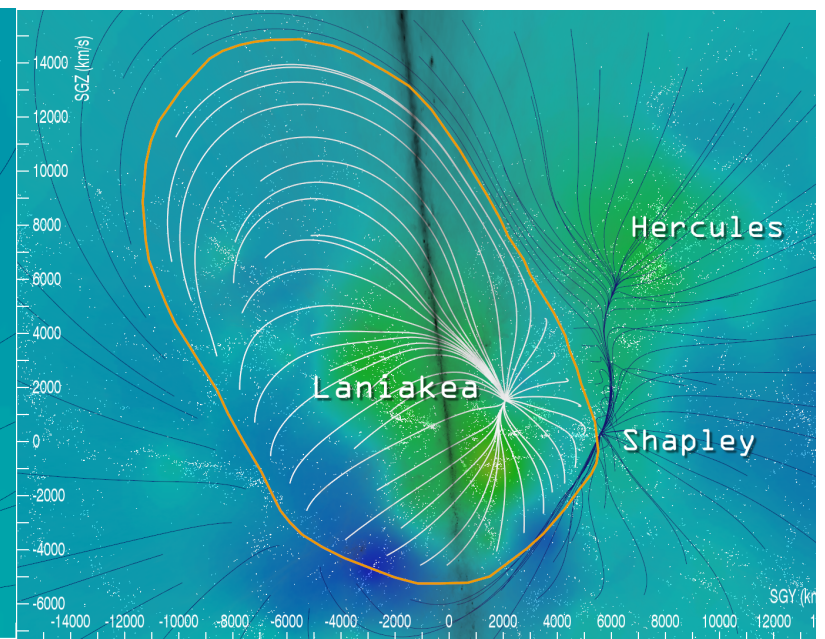
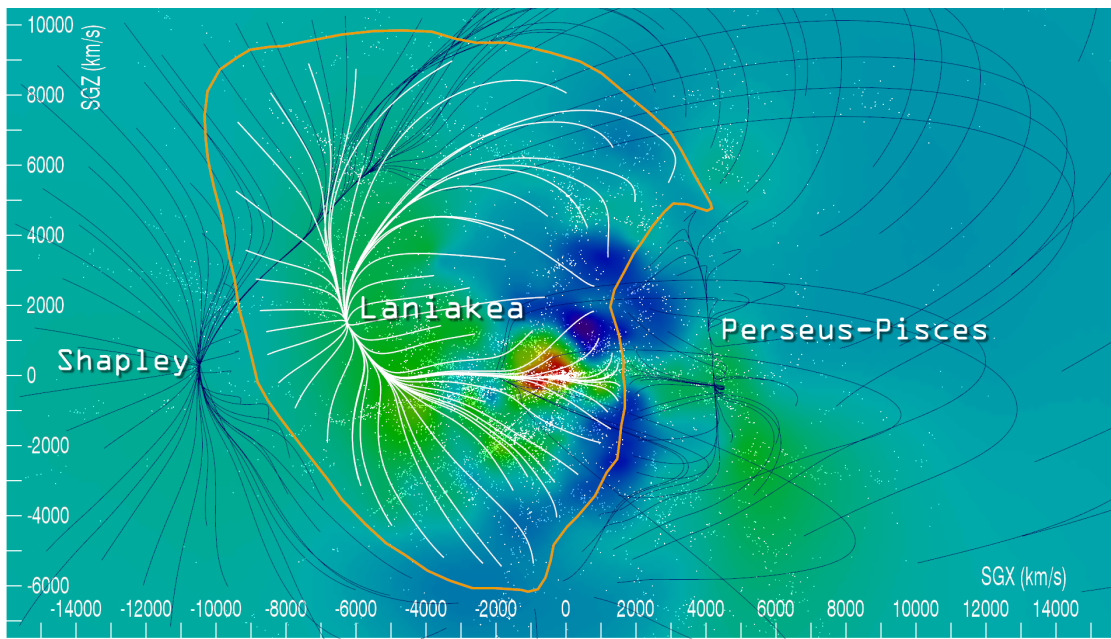


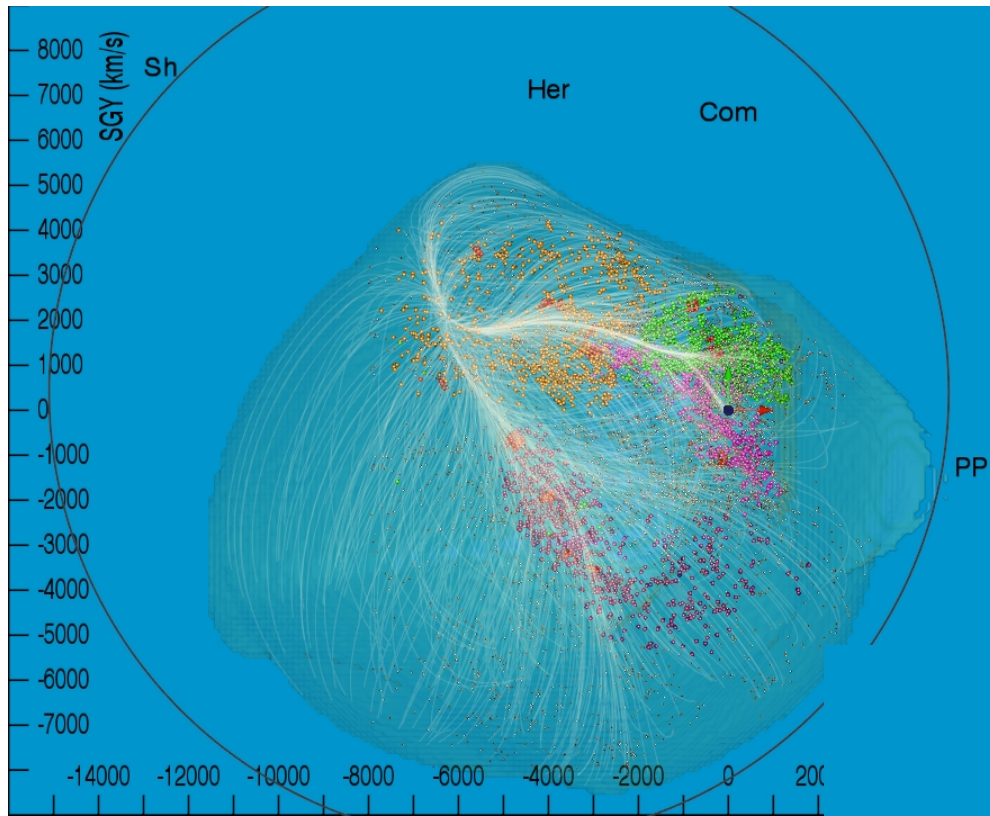
Laniakea Supercluster

supercluster: a bounded region of infall toward a local basin of attraction

lani – sky, heaven

akea – broad, wide, spacious, immeasurable





Laniakea

