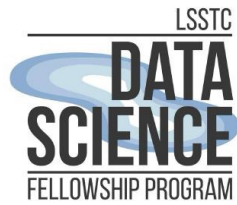




UTRGV



Prospects for ejected Binary BHs from GCs within 30Mpc

Dongming Jin
MODEST 16-NYC

Advisor: Matthew Benacquista

MOCCA: Mirek Giersz

Outlines

- 1. GC populations in hosting Galaxies**
2. Estimation of GCs within 30 Mpc
3. GCs simulated by MOCCA

GC per Galaxy (Harris Catalog:1306.2247v1)

	Name	MType	VMag	Dist	KMag	Av
count (unique)	422 (420)	422 (69)	421	421	345	422
	sigma	Reff	logMB	logMd	Ngc	logMGC
count	274	343	65	256		421

Duplicate (checked): NGC4417, VCC-1386

Missing (drop): Milky Way

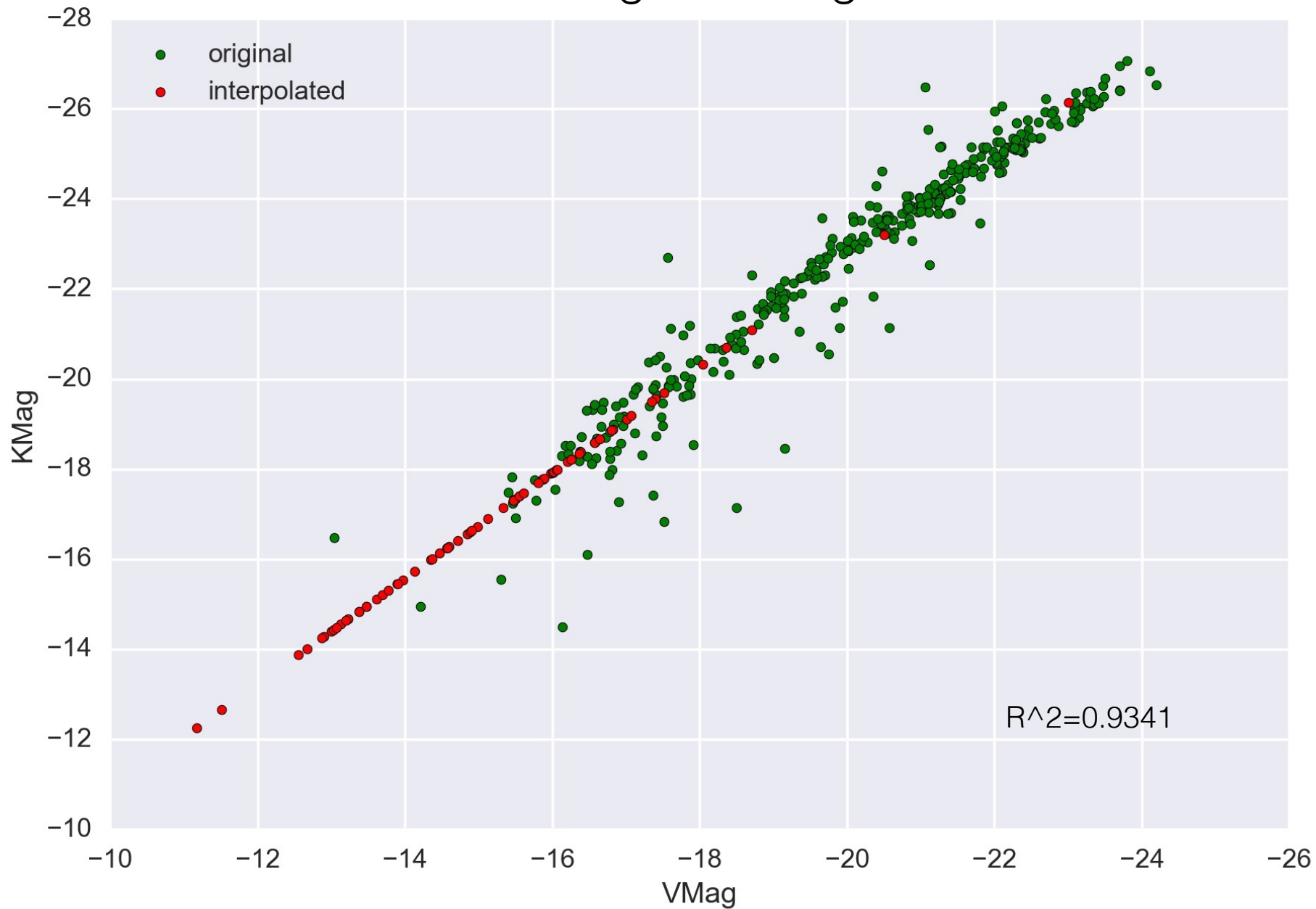
Missing (interpolated)

Missing: unknown correlation

Derived from sigma & Reff

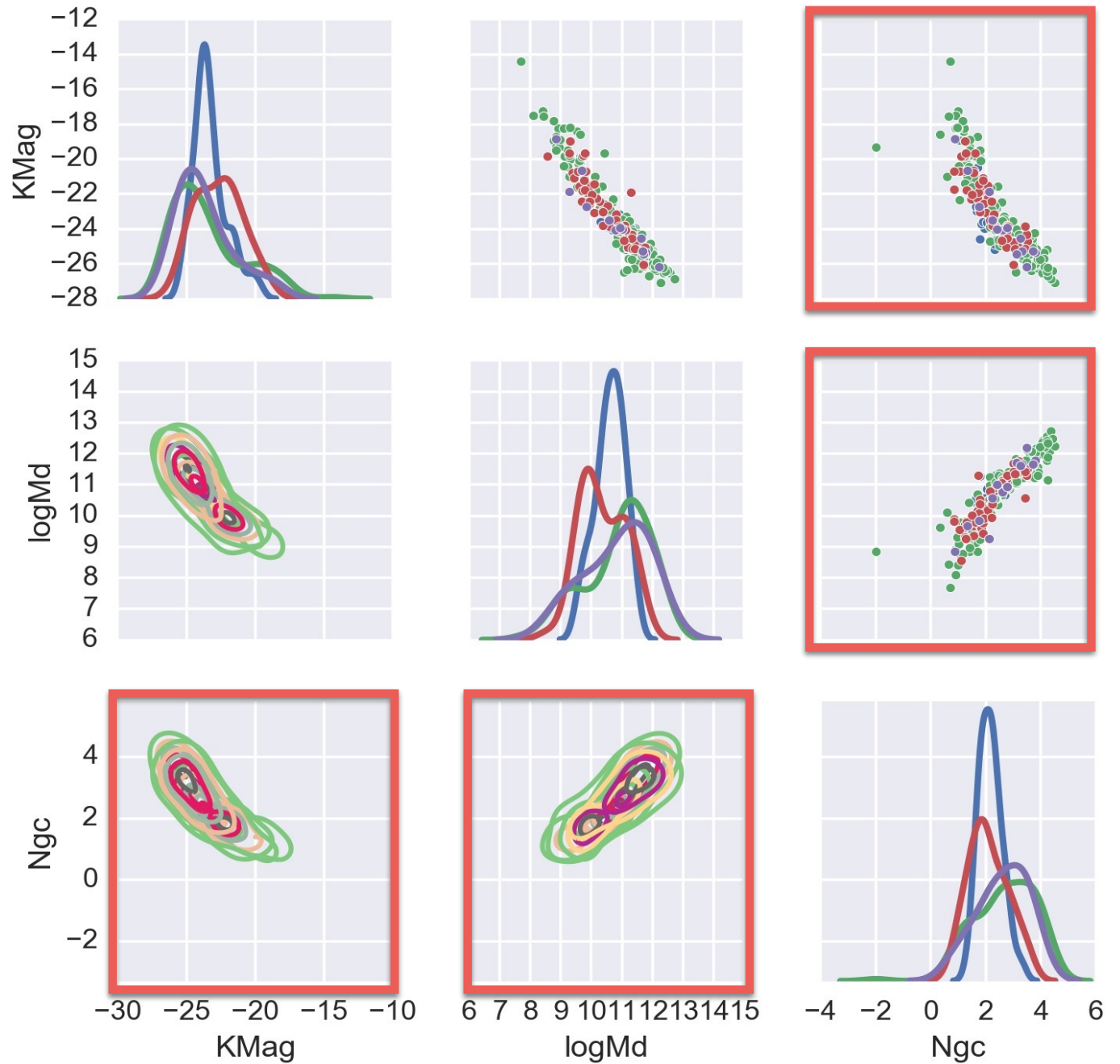
NGC2915: logMGC=0; Ngc=3

K-Mag vs V-Mag

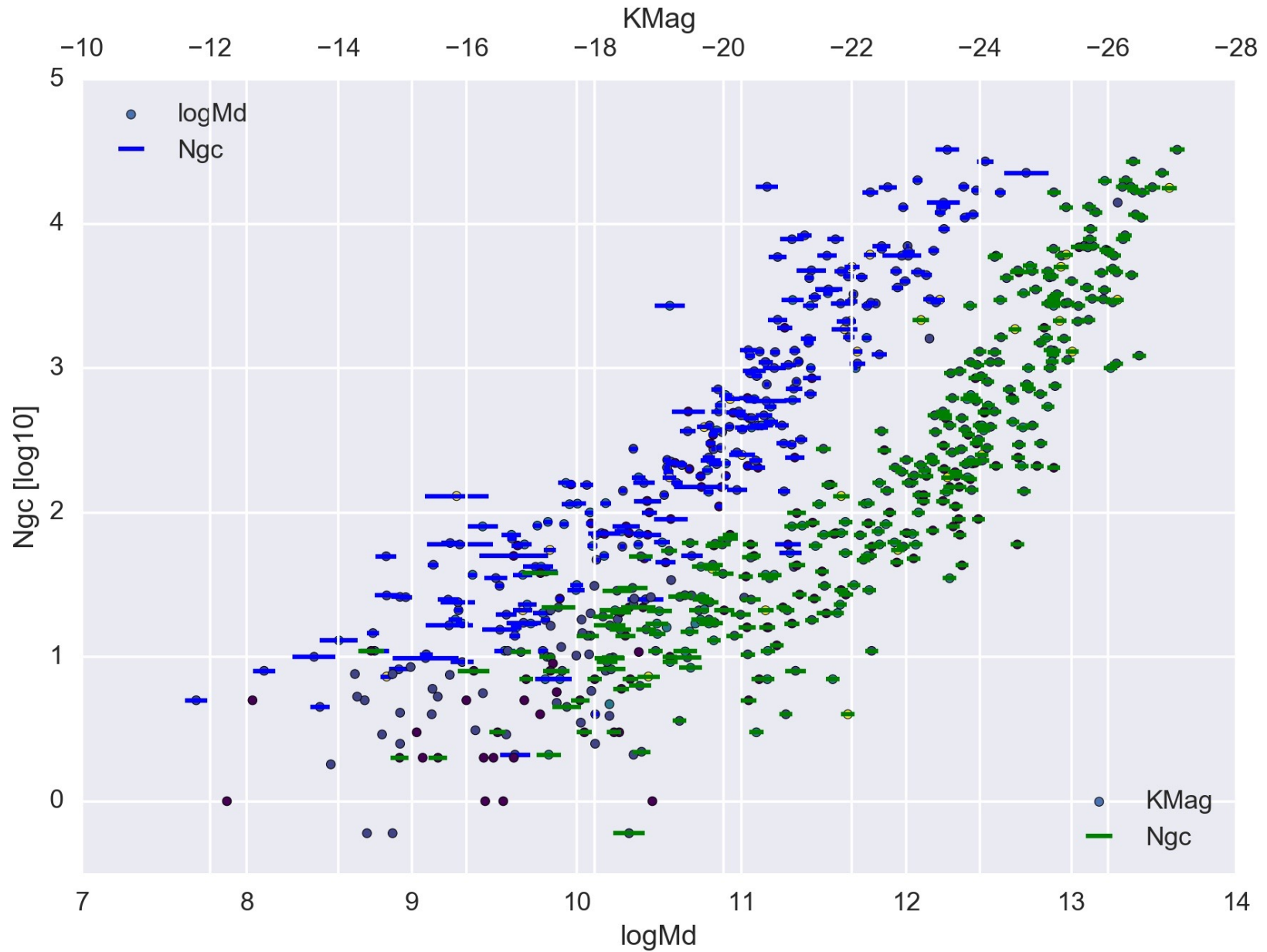


GC Population Correlation

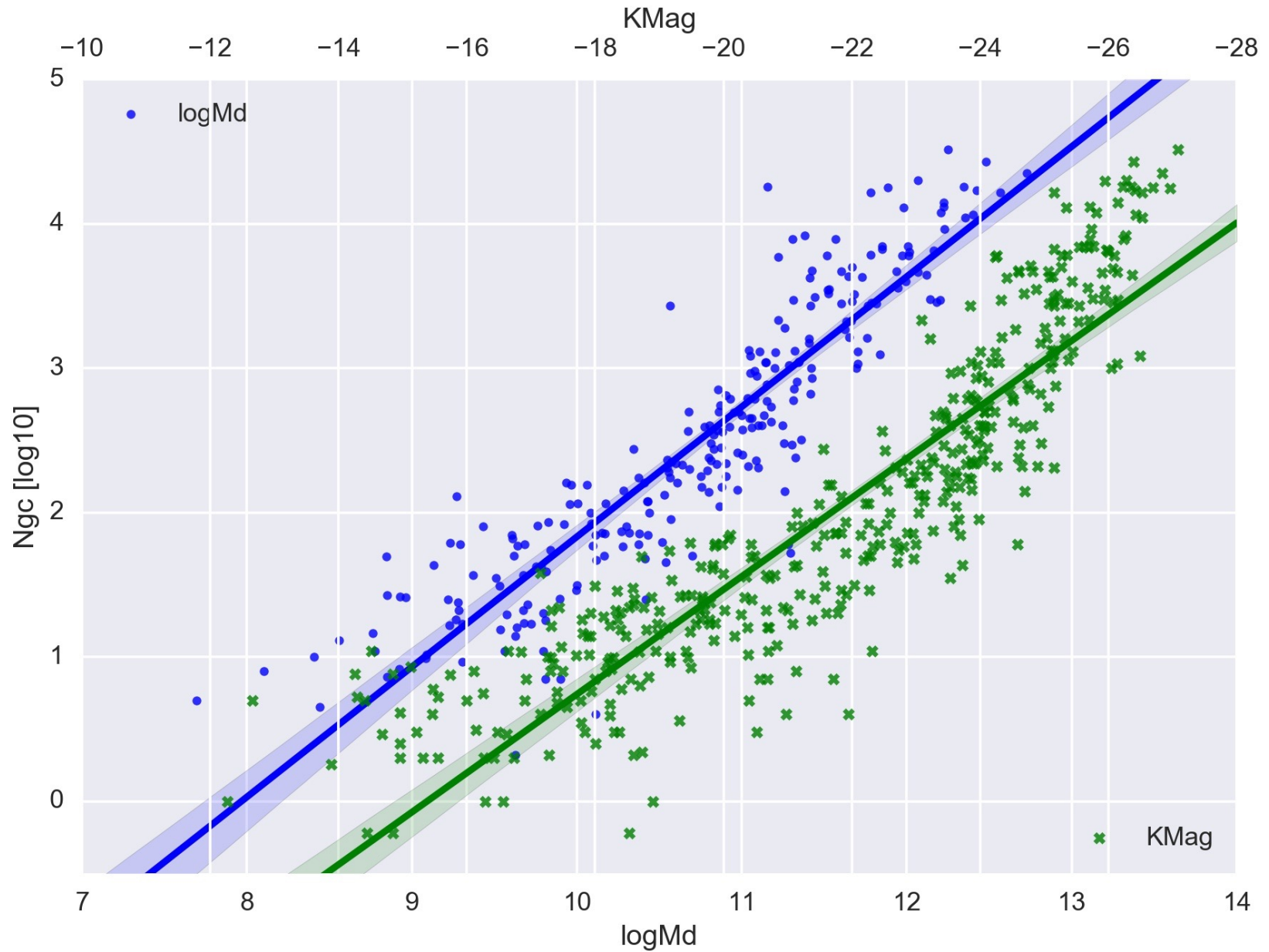
MType	iMType
Spiral/Irr	1
E	2
S0	3
S/E0	6



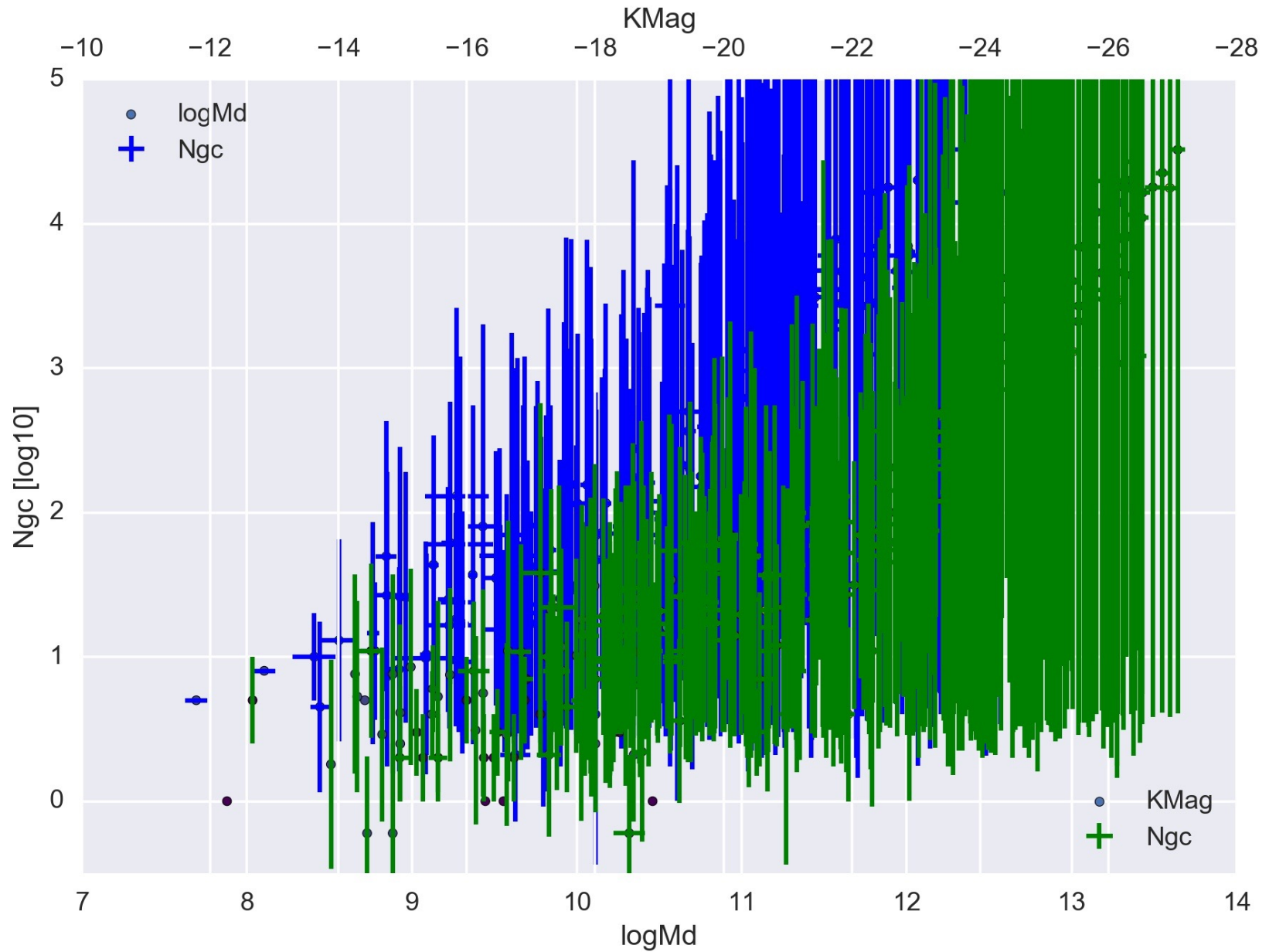
GC Population Correlation



GC Population Correlation

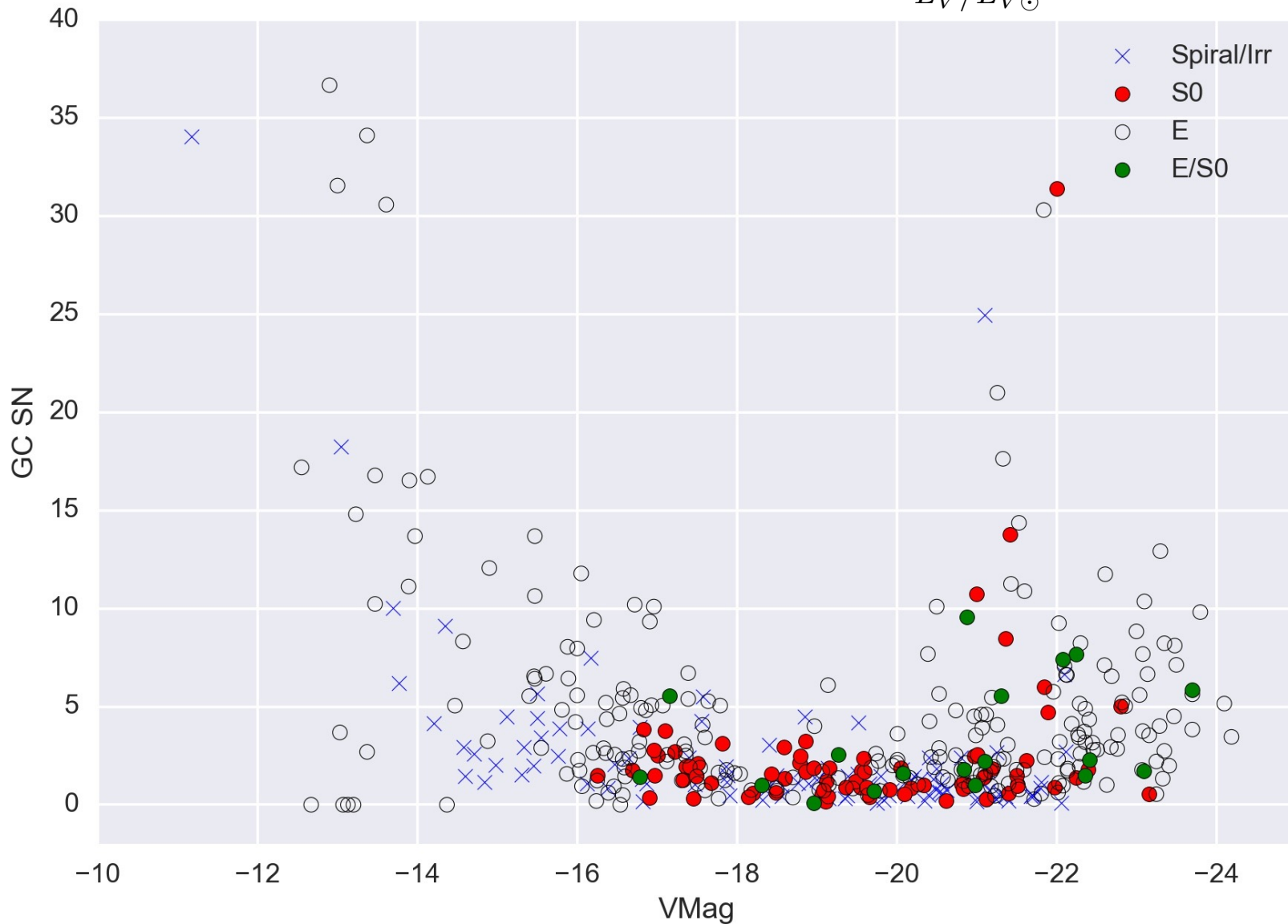


GC Population Correlation



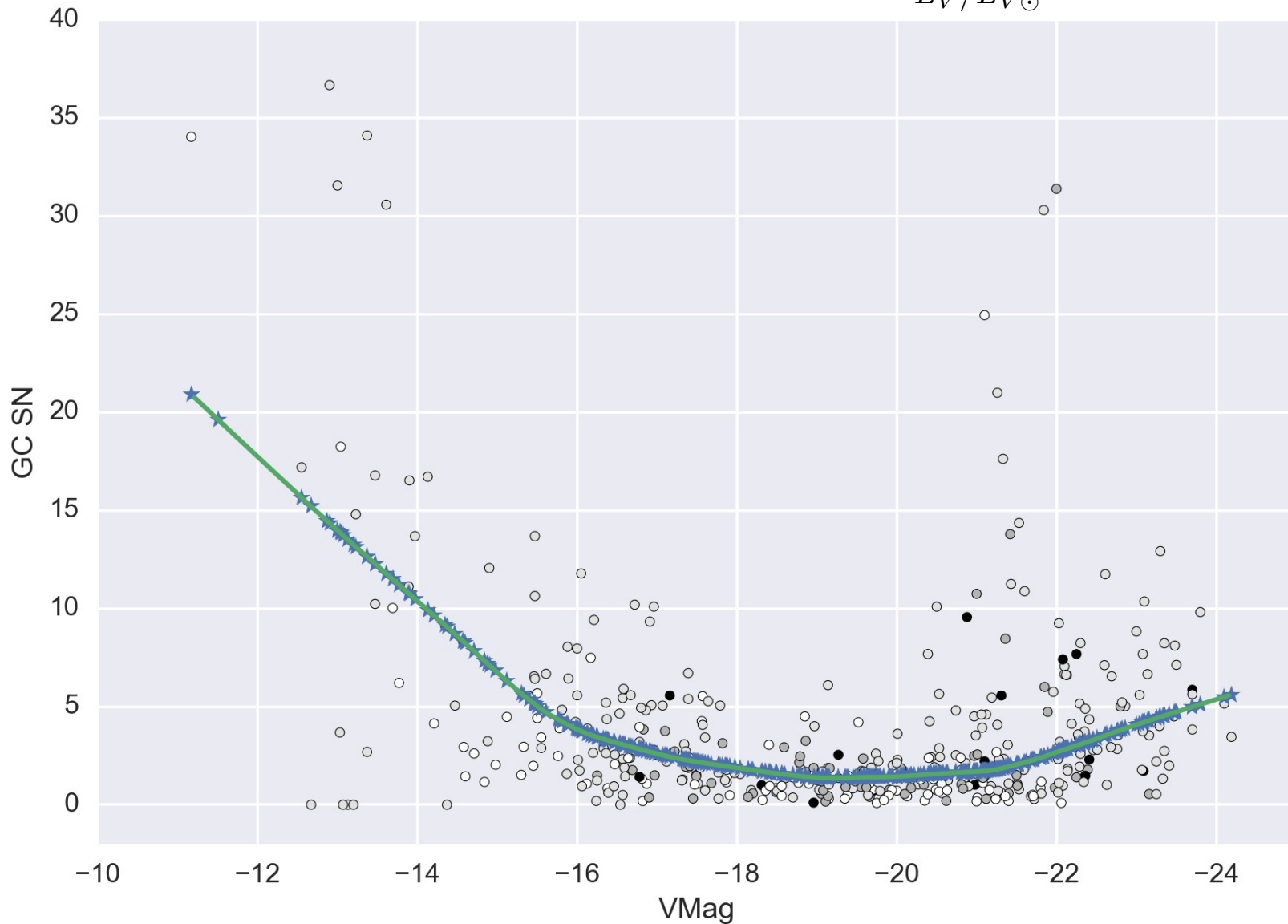
GC Specific Number

$$S_N \equiv N_{GC} \times 10^{0.4(M_T^V + 15)} = (8.51 \times 10^7) \frac{N_{GC}}{L_V/L_{V\odot}}$$



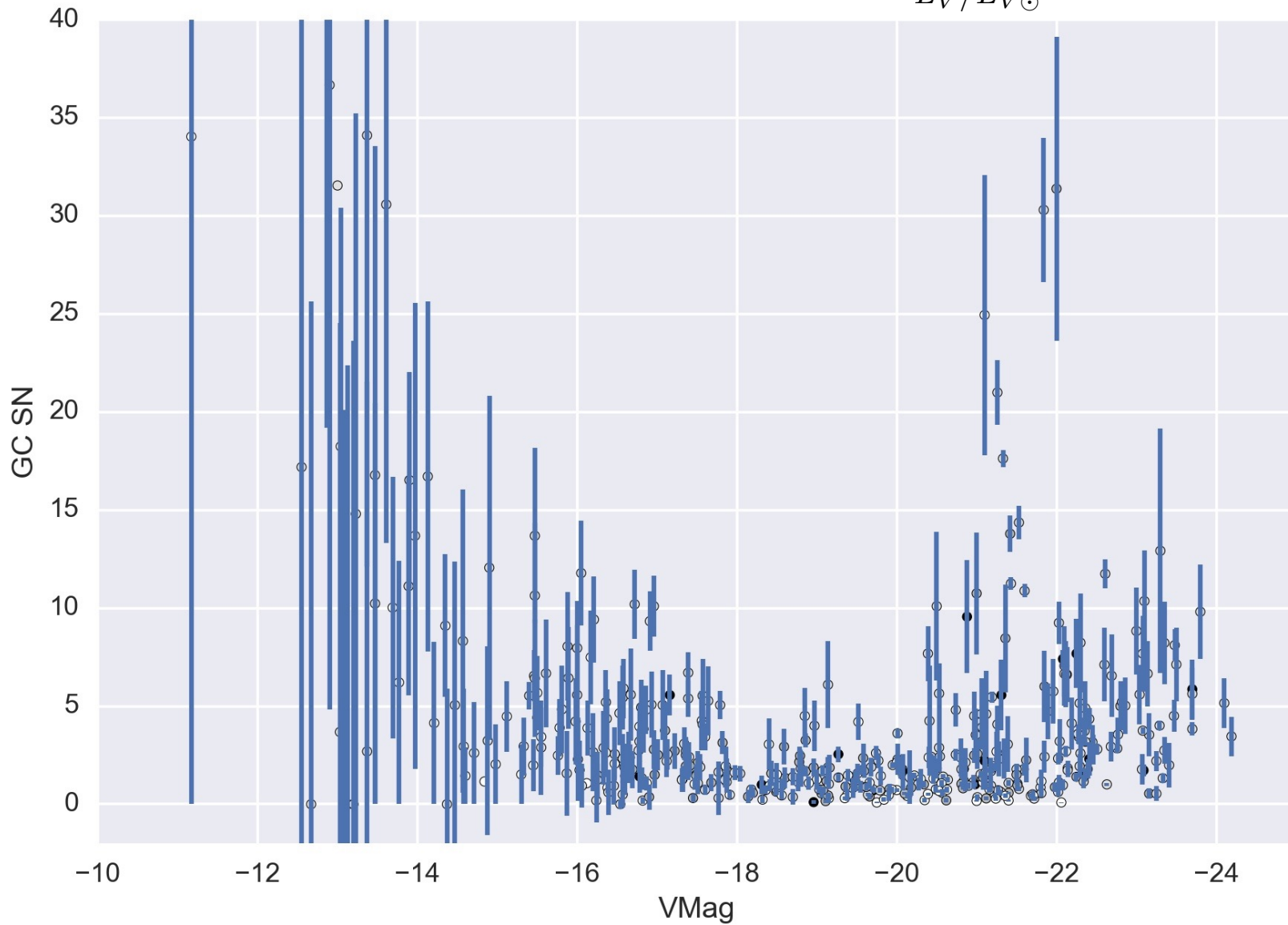
GC Specific Number

$$S_N \equiv N_{GC} \times 10^{0.4(M_T^V + 15)} = (8.51 \times 10^7) \frac{N_{GC}}{L_V/L_{V\odot}}$$



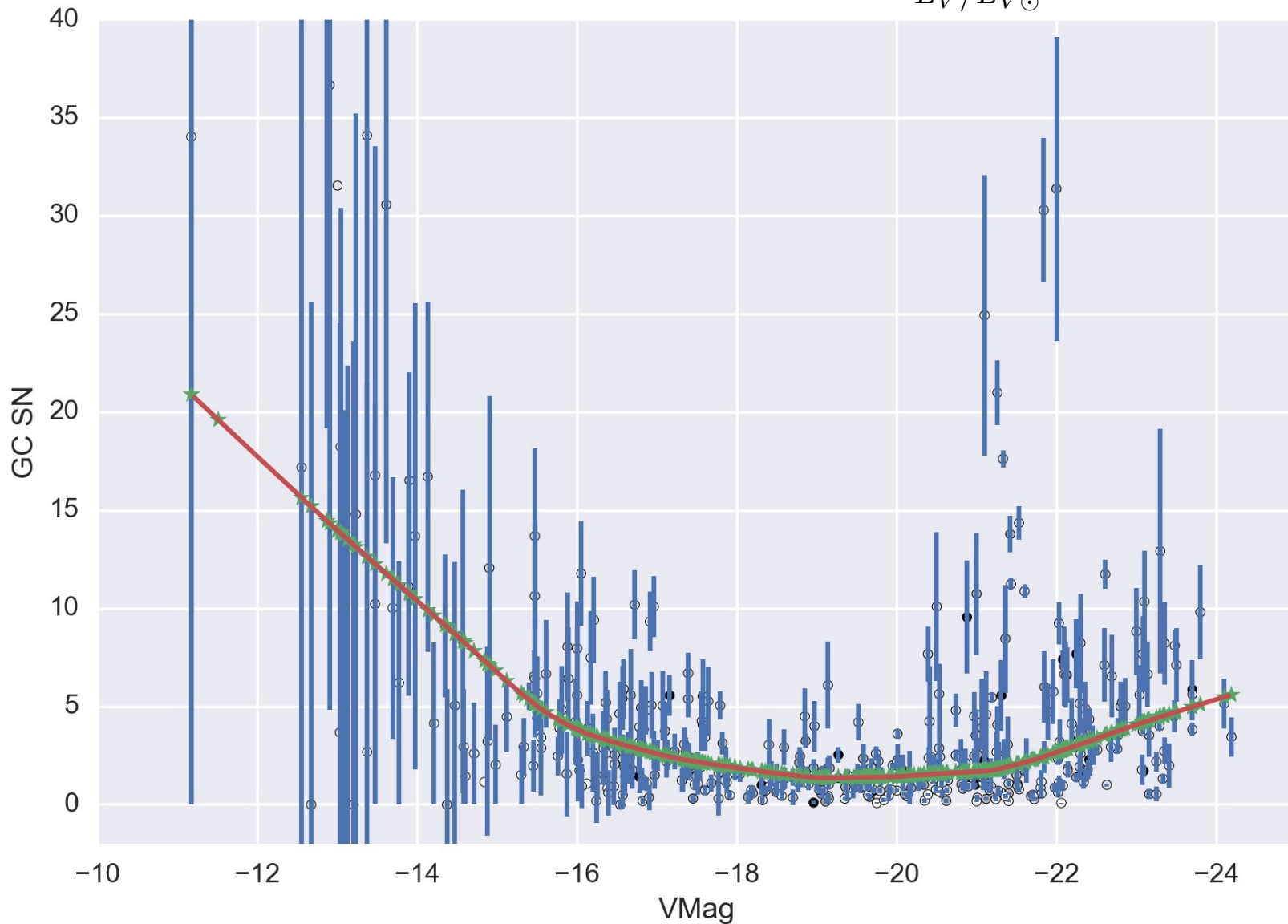
GC Specific Number

$$S_N \equiv N_{GC} \times 10^{0.4(M_T^V + 15)} = (8.51 \times 10^7) \frac{N_{GC}}{L_V/L_{V\odot}}$$



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Outlines

1. GC populations in hosting Galaxies
- 2. Estimation of GCs within 30 Mpc**
3. GCs simulated by MOCCA

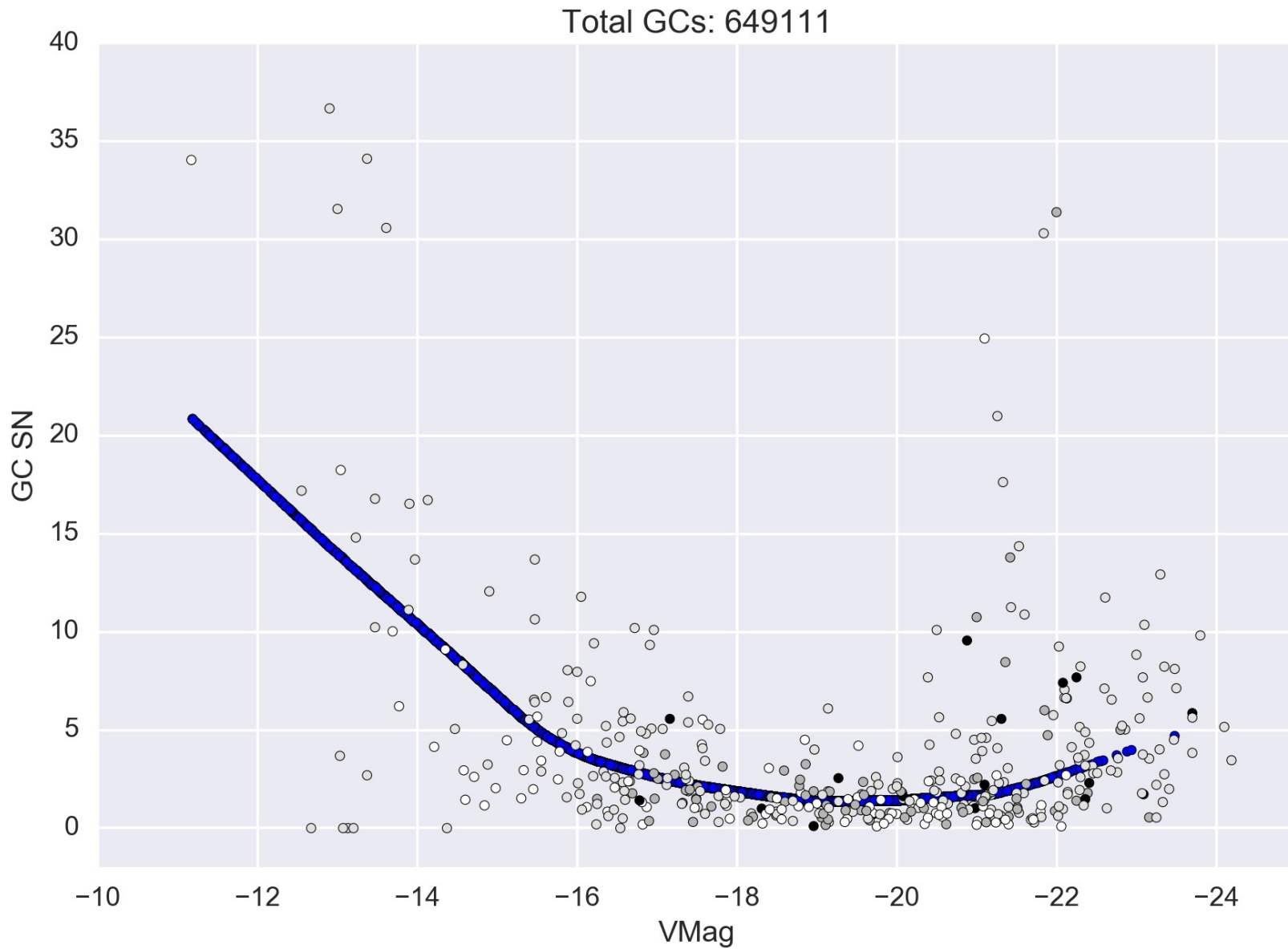
GW Galaxy (White:1306.2247v1)

- Name duplicated
-> Dist > 30 Mpc : drop
- Mag data missing
-> drop: lower bound of GC
- Mag data mismatch
-> interpolate by correlation

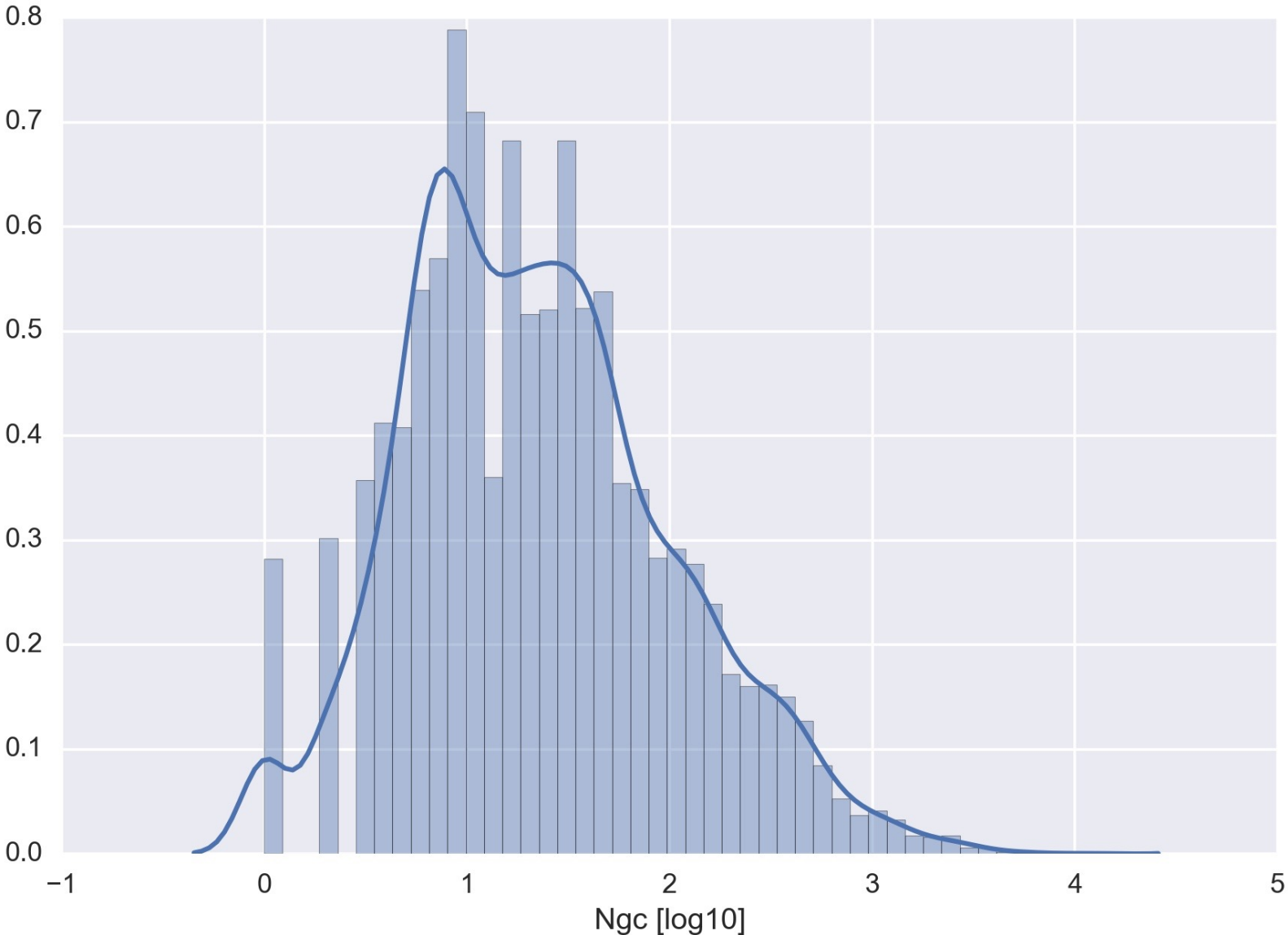
	Name	Dist
63638	PGC138606	34.347
68443	PGC166081	72.361
68880	PGC166081	24.847
130474	PGC138606	35.569
178917	6dFJ1705055-200214	112.653
178919	6dFJ1704153-203840	117.694
179298	6dFJ1705055-200214	112.653
179620	6dFJ1704153-203840	116.194

	Name	Type	BMag	IMag	IMag-BMag	Dist
count	8946	5979	7877	5606	32	8946

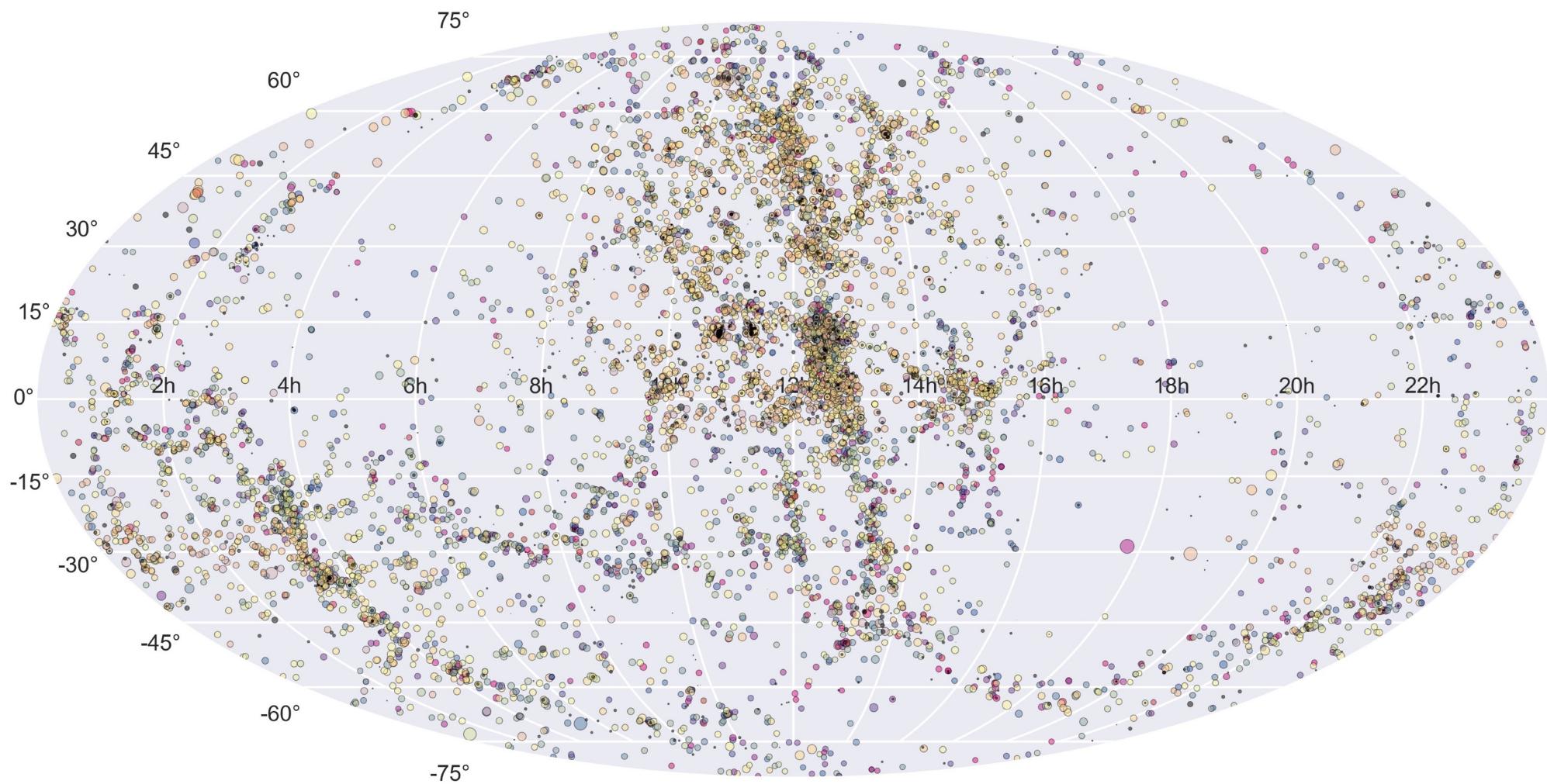
GCs inside Galaxies within 30 Mpc



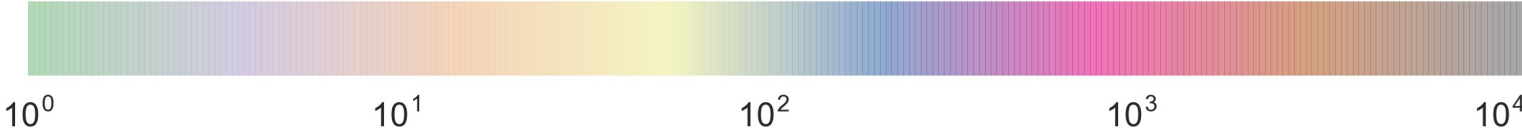
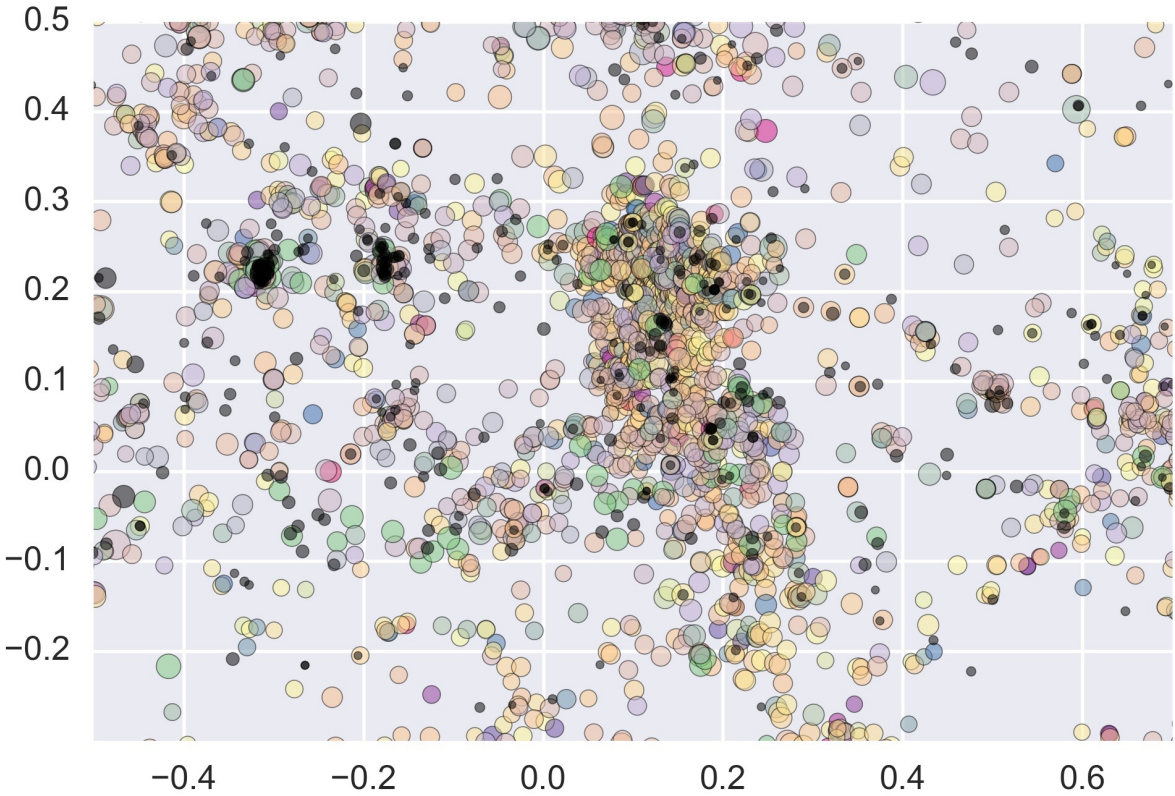
GCs inside Galaxies within 30 Mpc



GCs inside Galaxies within 30 Mpc



GCs inside Galaxies within 30 Mpc



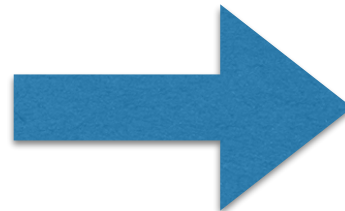
Outlines

1. GC populations in hosting Galaxies
2. Estimation of GCs within 30 Mpc
- 3. GCs simulated by MOCCA**

GC models by MOCCA

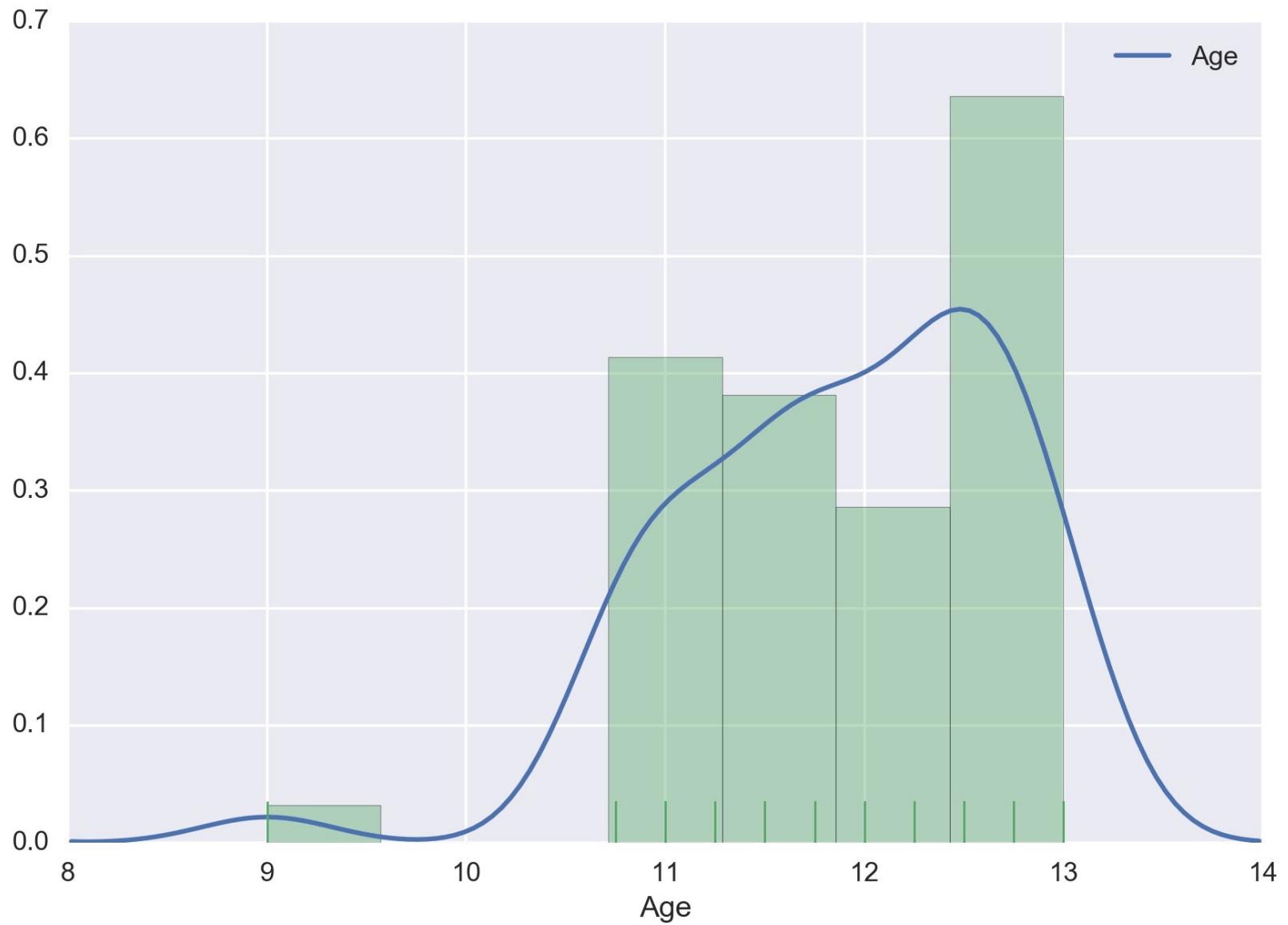
Model	Mmax	IMF	Binary semi	amax	ecc	interaction
King W0=6	100 Msun	Kroupa 1993	Kroupa 2013	50 AU	Thermal	Fewbody

N	[0.5M, 1M]
[Fe/H]	[-1.54, -0.56, sun]
W0	[2, 5, 6, 11]
Repeat	3
Total	24 x 3

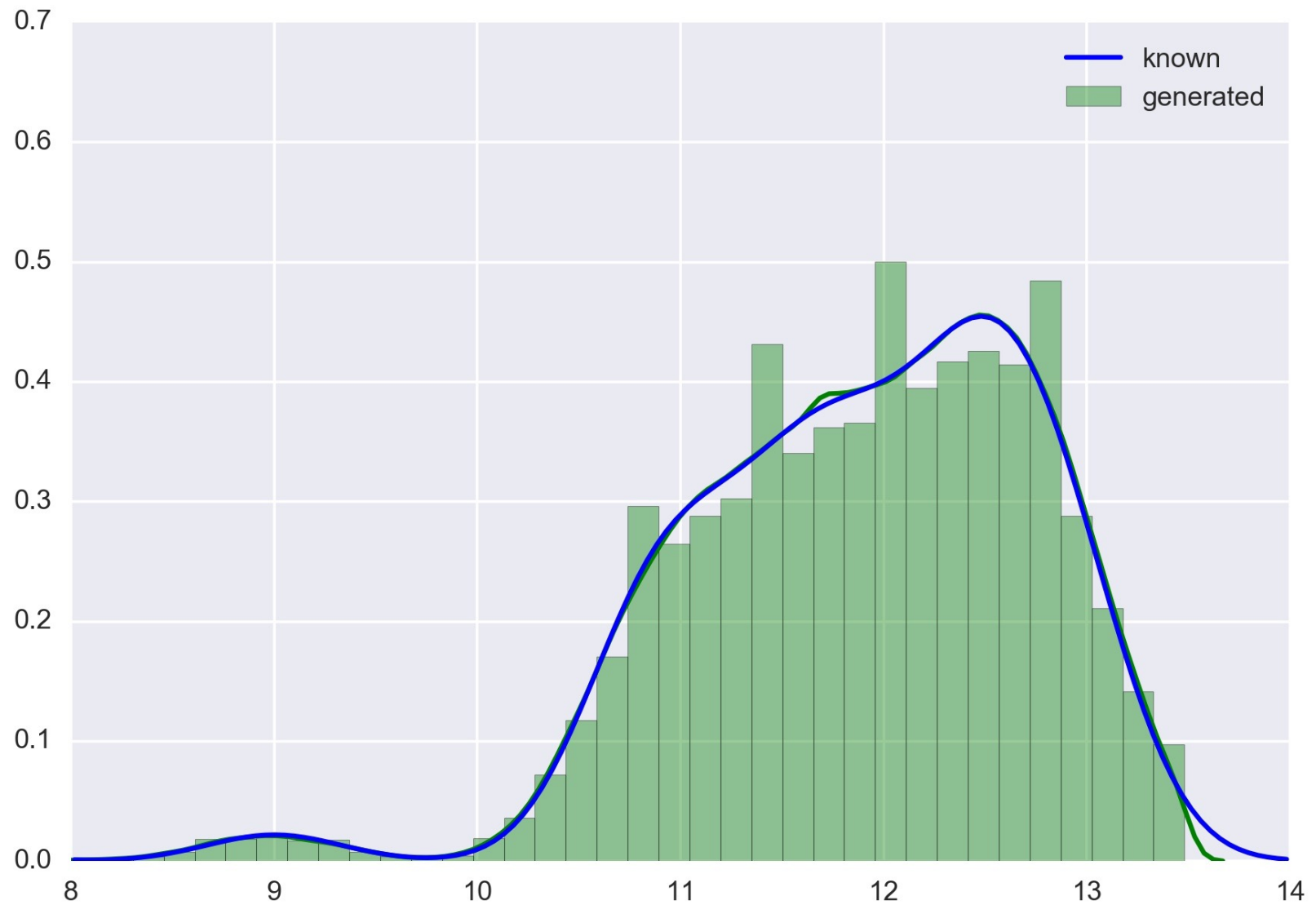


N	[0.5M, 1M]
[Fe/H]	[-1.54, -0.56, sun]
f_b	[0.1:0.1:0.5]
R_tidal	[25, 50, 100]
R_plum	[20, 25, 60]
Repeat	5 + 3
Total	324 x 8

MW GC Ages (Vandenberg: 1308.2257)



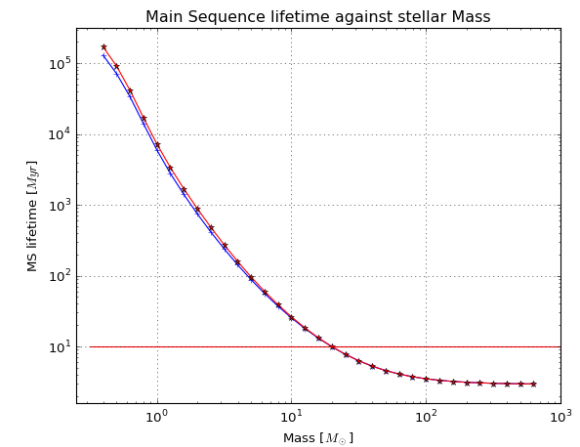
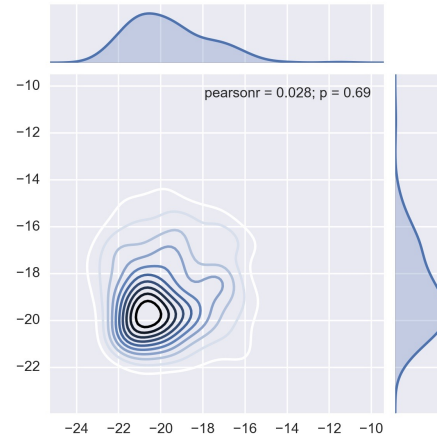
MW GC Ages (Vandenberg: 1308.2257)



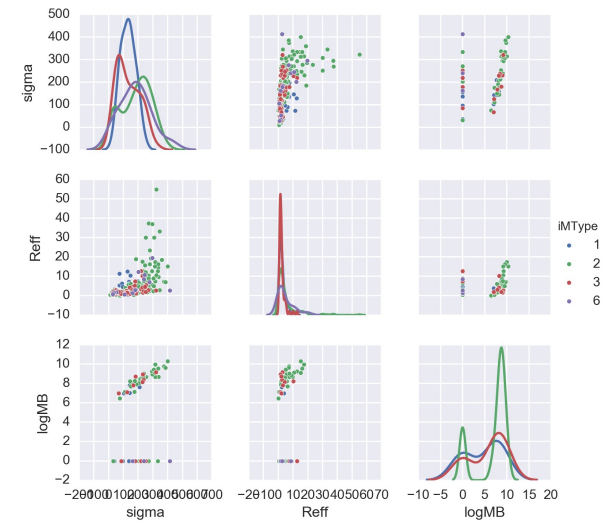
Sample of GCs inside Galaxies within 30 Mpc

Host Galaxy	RA	Dec	Dist	VMag	Model	Age
47889	22.20836	45.32823	14.454	-19.308214	136-5	10.409449
27692	12.25139	33.19722	15.136	-20.238214	38-4	11.732283
29491	12.64122	4.31900	14.256	-19.608214	18-5	11.732283
3833	1.57172	-29.41844	26.424	-22.318214	85-5	12.157480
10223	4.47819	-46.32122	15.681	-16.258214	253-5	13.055118
53732	7.69118	-30.11211	24.236	-20.518214	151-2	10.929134
18300	9.37361	-61.04930	25.351	-22.028214	308-5	12.204724
23004	10.90992	56.98981	26.546	-20.248214	70-2	12.582677
24674	11.41735	-9.79533	23.659	-21.658214	174-3	12.346457
42533	17.54006	7.06030	25.942	-22.148214	105-1	12.251969

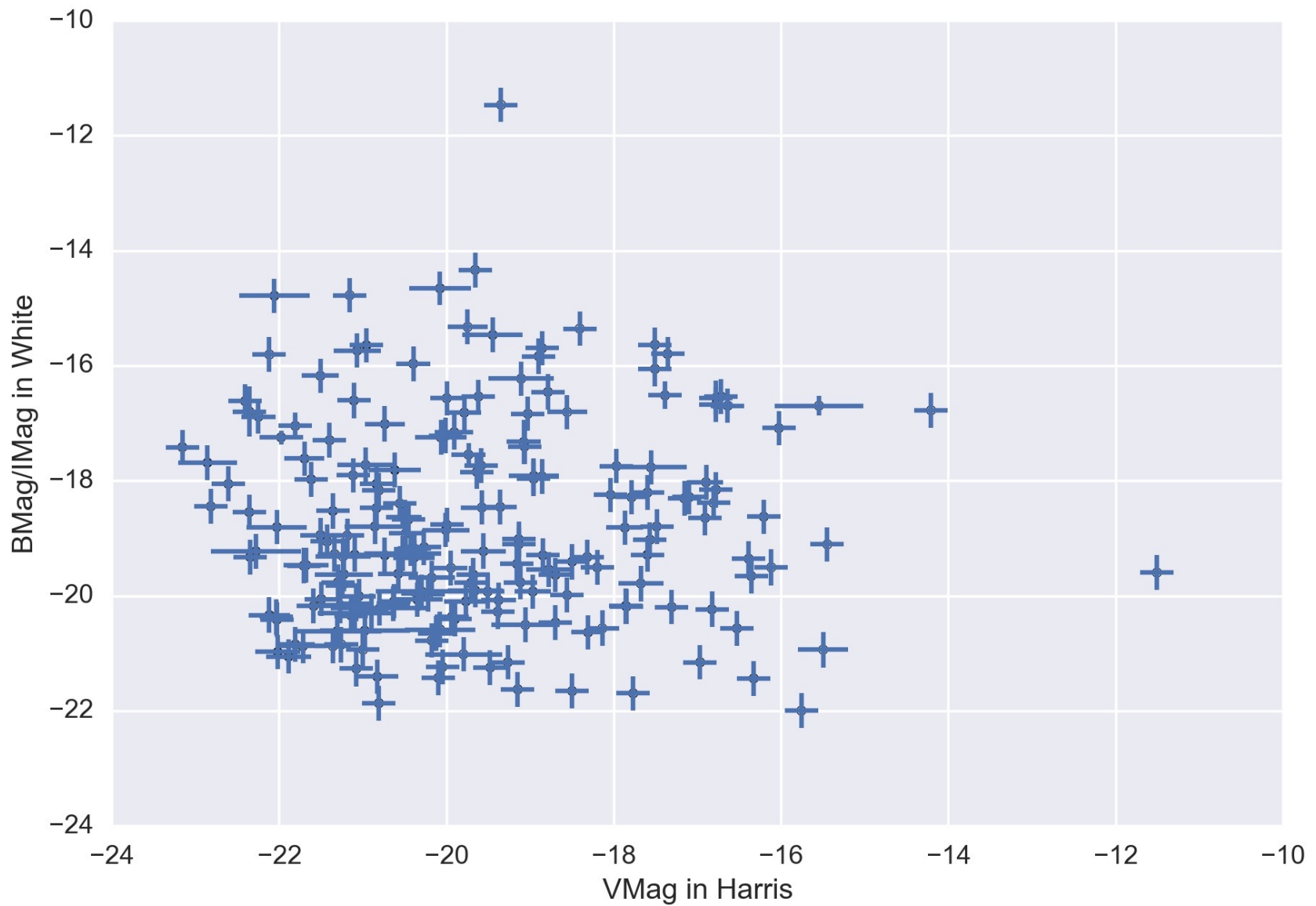
Future Work



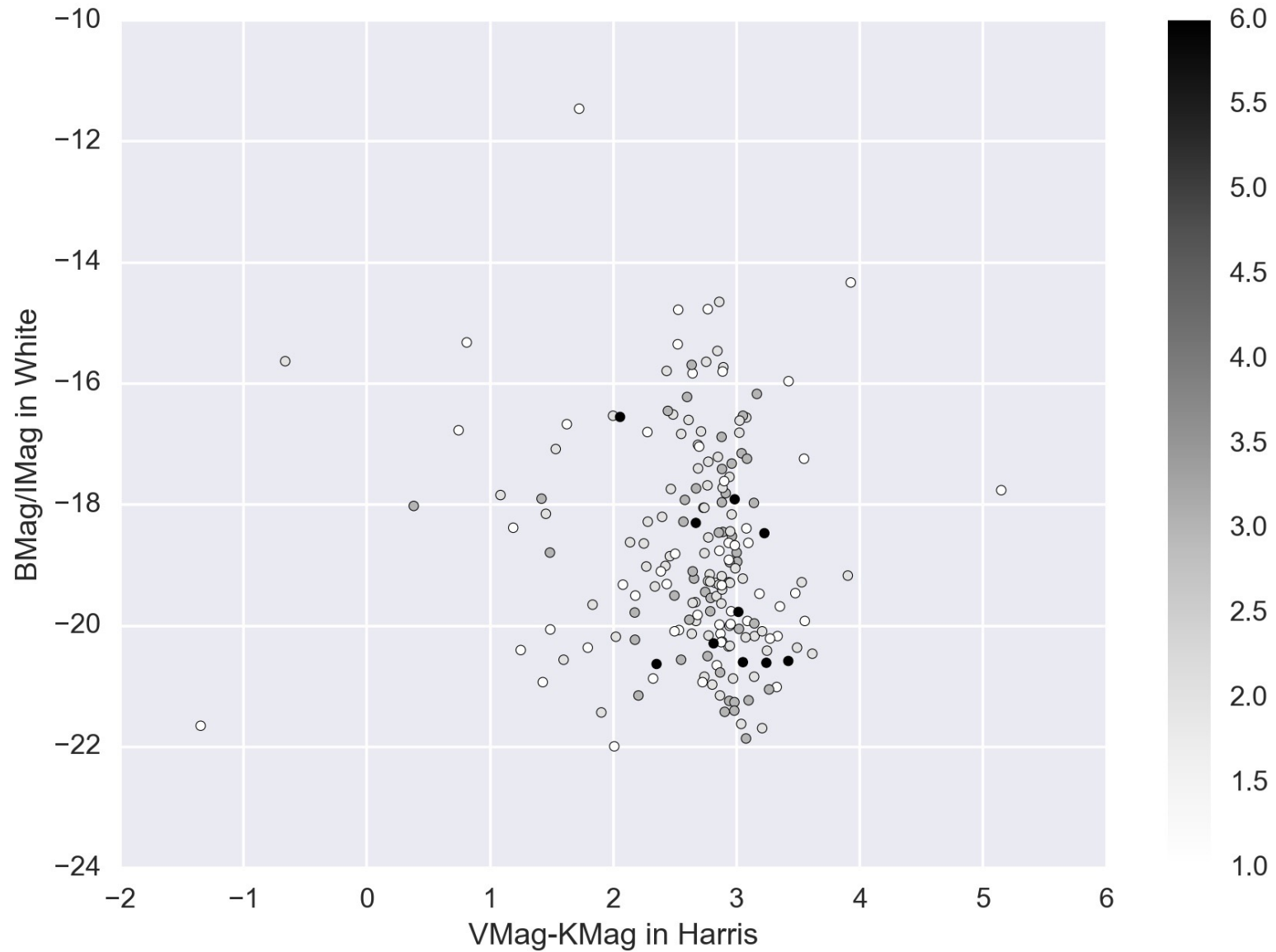
- To resolve
 - B Mag to V Mag conversion or build B Mag - SN relation
 - Stellar evolution for massive stars in MOCCA
- To perfect
 - Extragalactic GC age spread
 - Count variance based on repeated simulations
- To explore
 - (red/blue) GC populations for galaxies with different morph. & evolution path
 - Prospect of GW events by space-borne detector



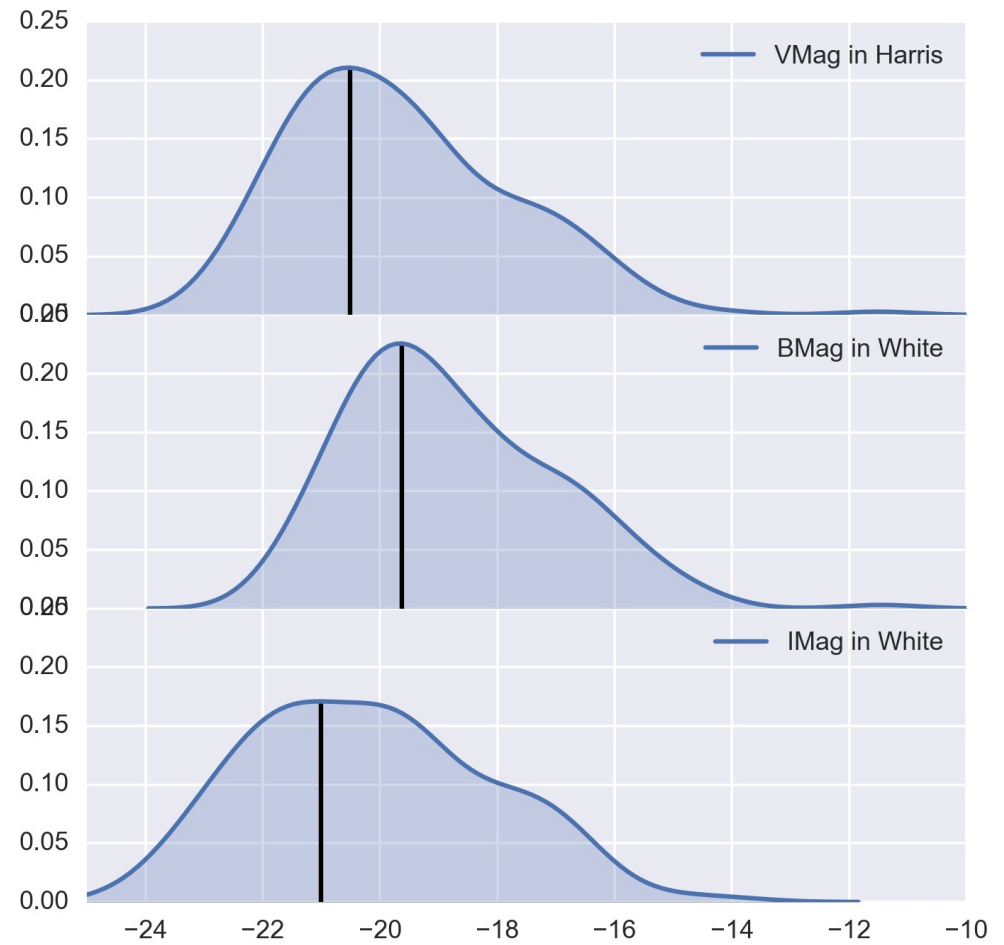
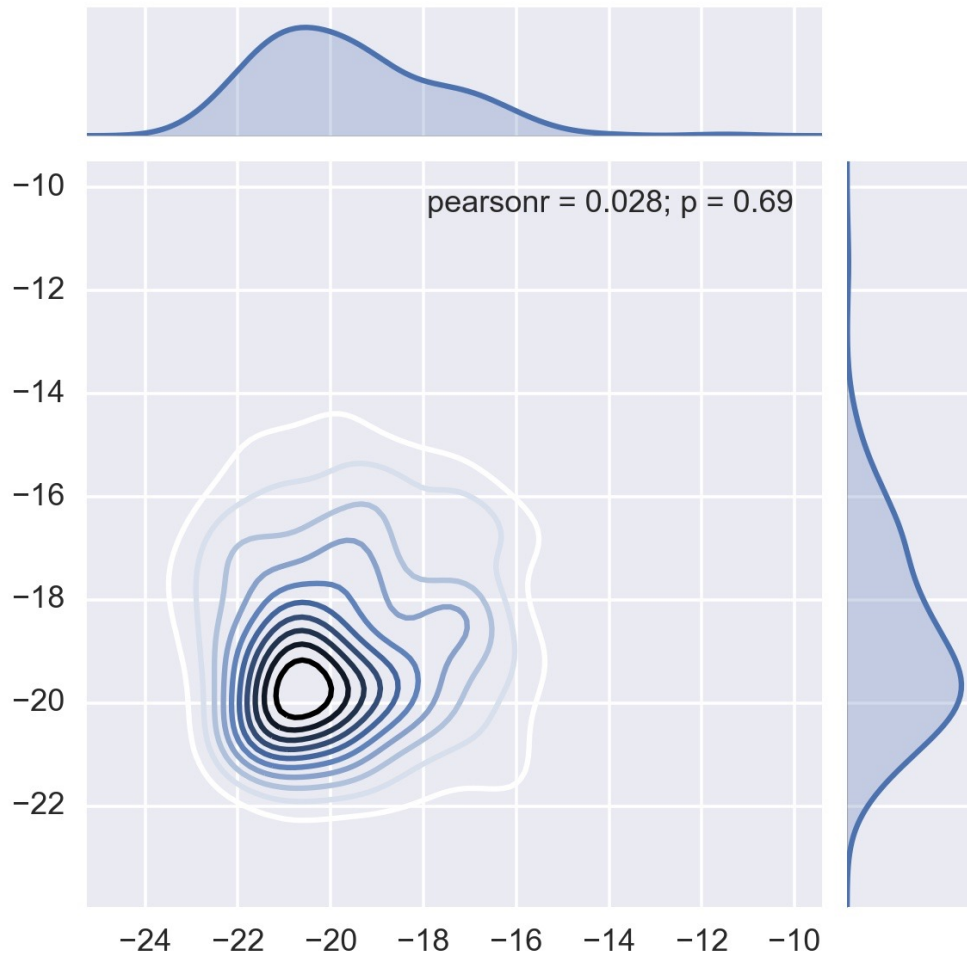
Joint Galaxies in Harris & White: 197



Joint Galaxies in Harris & White: 197

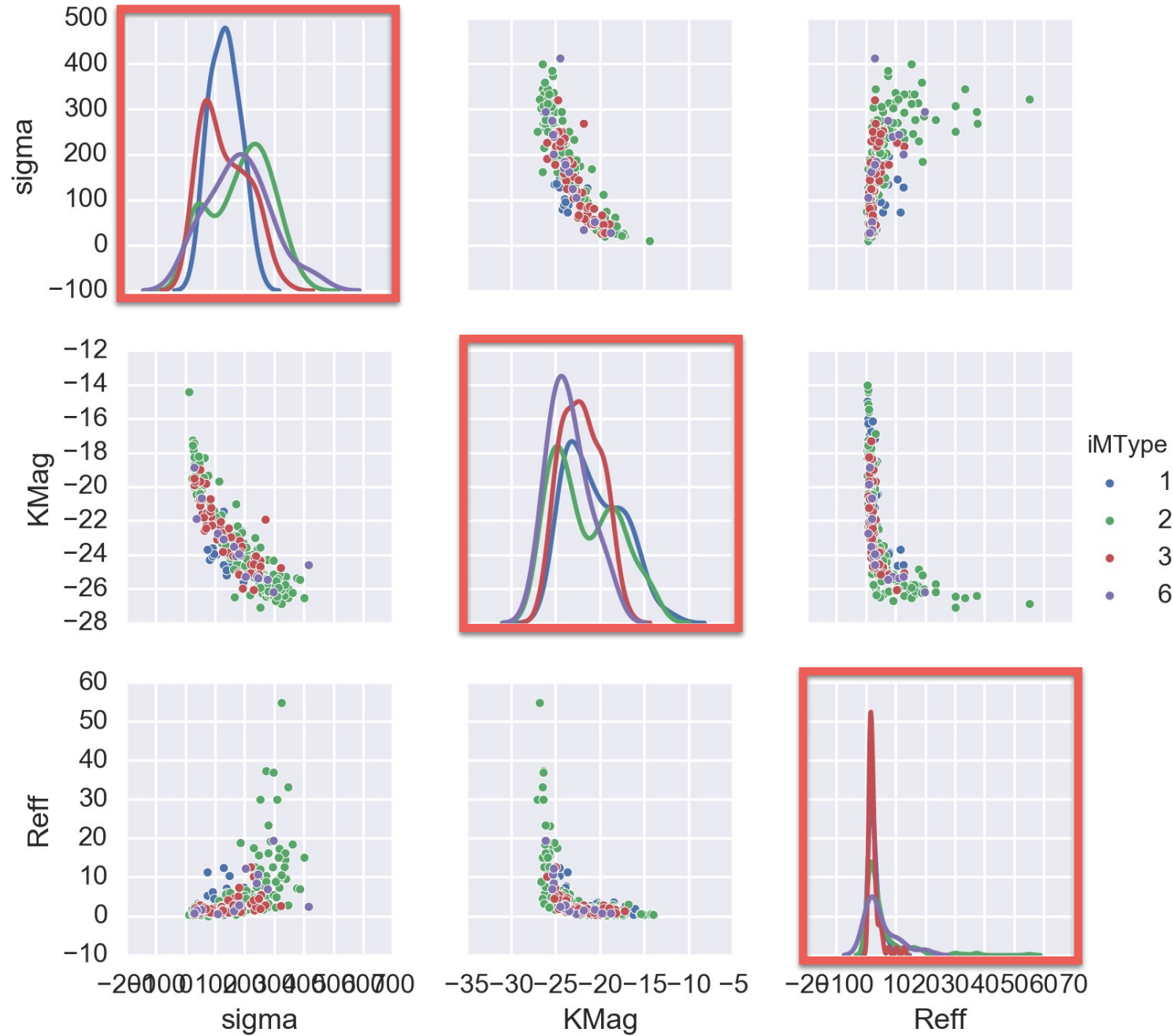


Joint Galaxies in Harris & White: 197



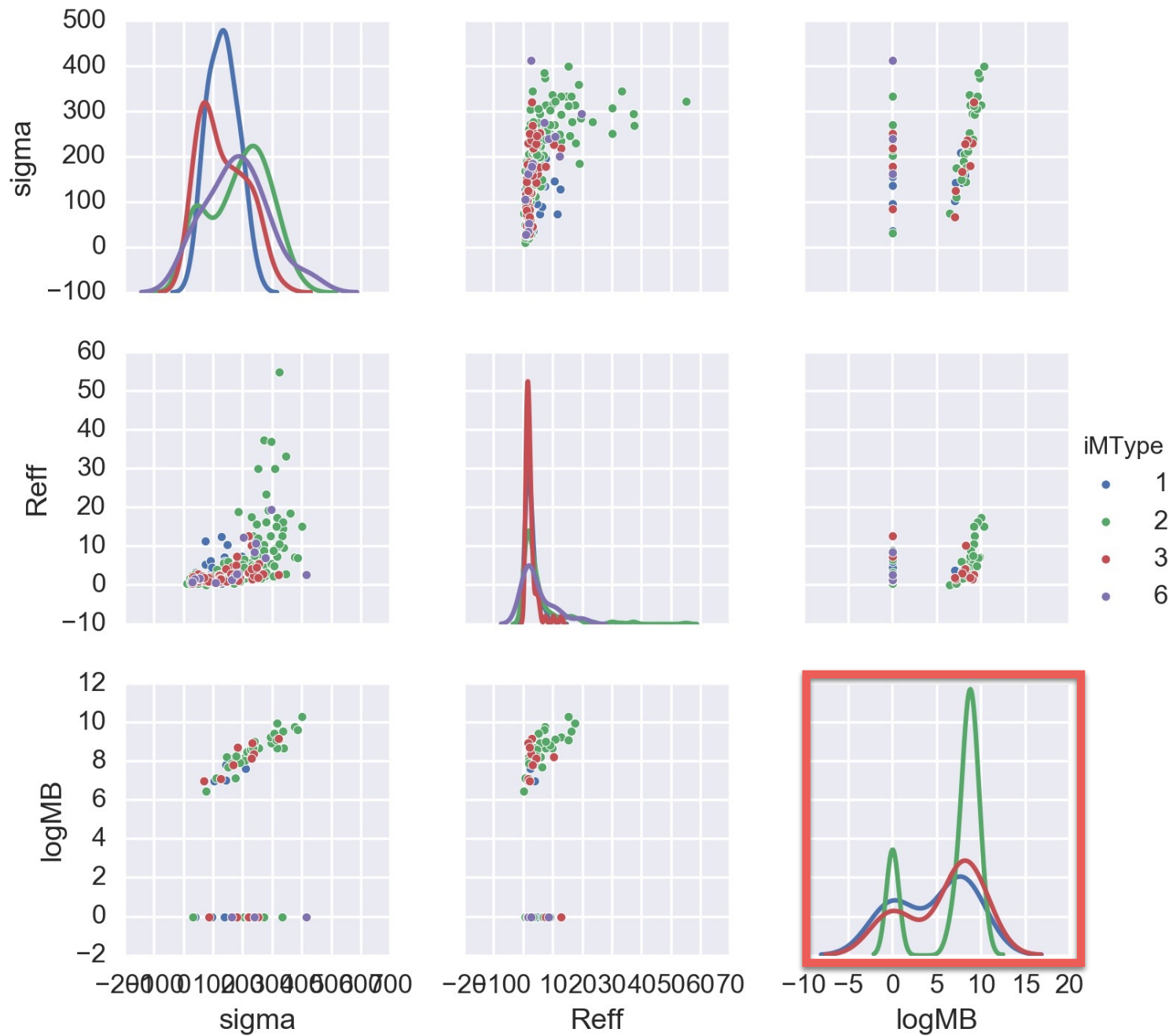
Morphology Correlation I

MType	iMType
Spiral/Irr	1
E	2
S0	3
S/E0	6



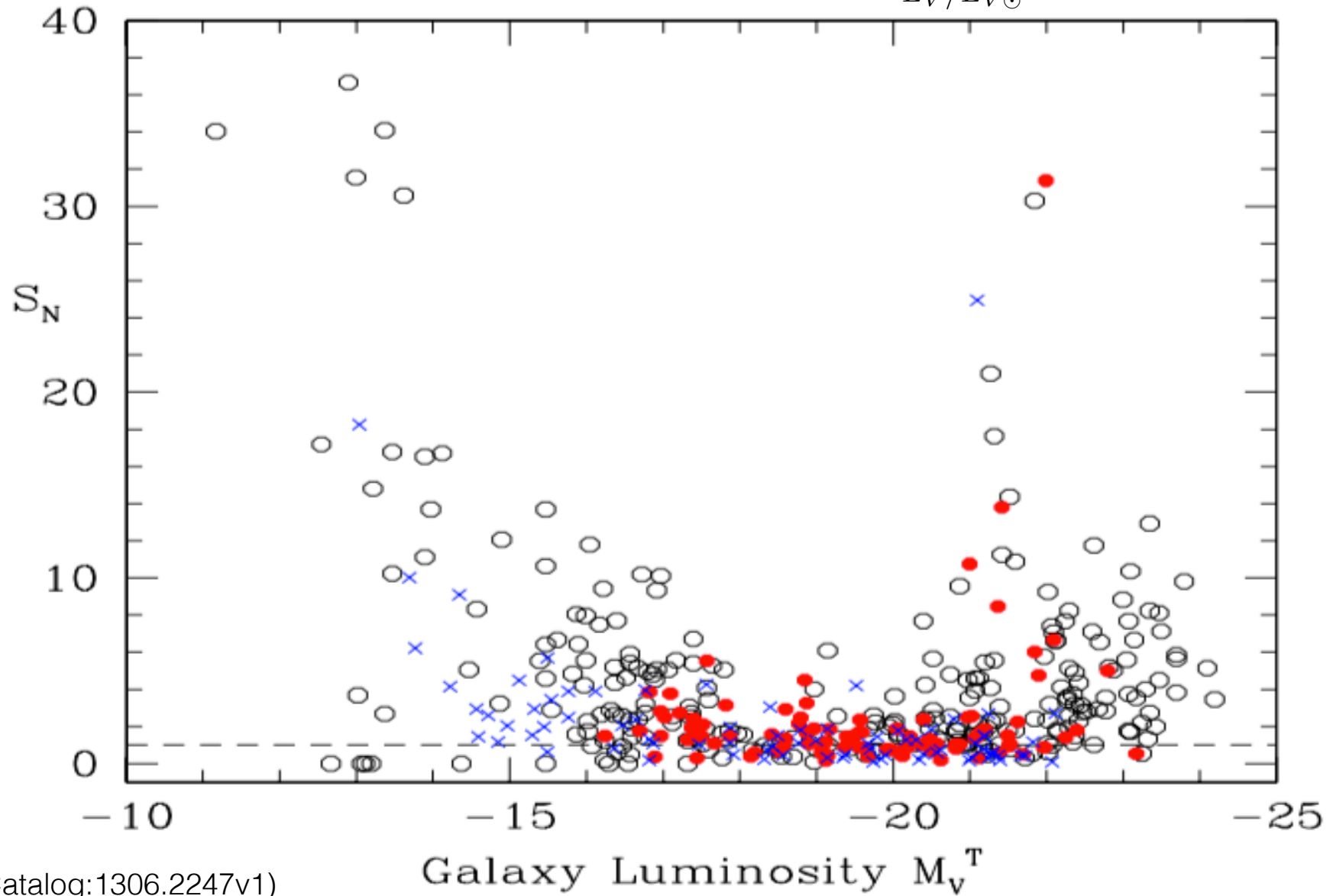
Morphology Correlation II

MType	iMType
Spiral/Irr	1
E	2
S0	3
S/E0	6



GC Specific Number

$$S_N \equiv N_{GC} \times 10^{0.4(M_T^V + 15)} = (8.51 \times 10^7) \frac{N_{GC}}{L_V/L_{V\odot}}$$



GC Specific Number

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Summary

1. GC populations in different hosting Galaxies
2. Estimation of GCs inside Galaxies within 30 Mpc
3. General collection of GCs simulated by MOCCA
4. Prospect of GW events by space-borne detector