

# Interacting Galaxies in SDSS DR4 plus

**Do-Gyun Kim** <sup>1,2</sup>

**Changbom Park** <sup>1</sup>

**Yun-Young Choi** <sup>3</sup>

<sup>1</sup> Korea Institute for Advanced Study, Seoul, Korea,

<sup>2</sup> Yonsei University, Seodaemun-Gu, Seoul, Korea,

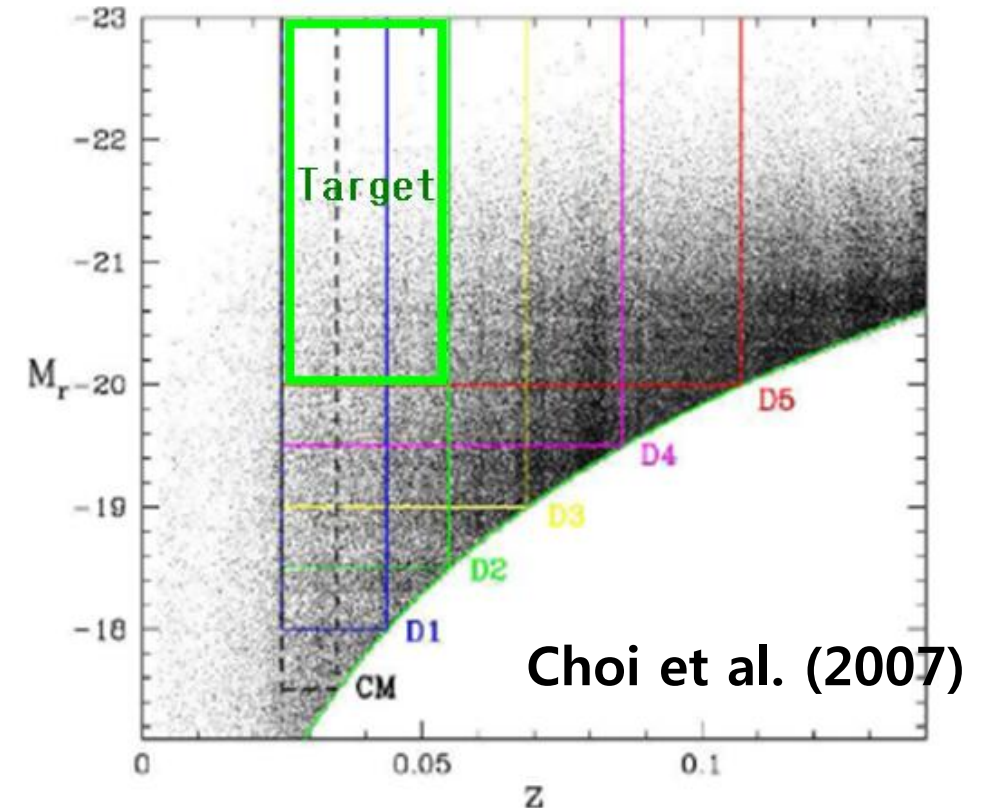
<sup>3</sup> ARCSEC, Sejong University Seoul, Korea

# Scientific Objectives

1. Identify merging / interacting galaxies in SDSS
2. Find relations between fraction of disturbed galaxies and environmental parameters.
3. Measure current galaxy interacting rate (GIR) from this relation

# Target Selection

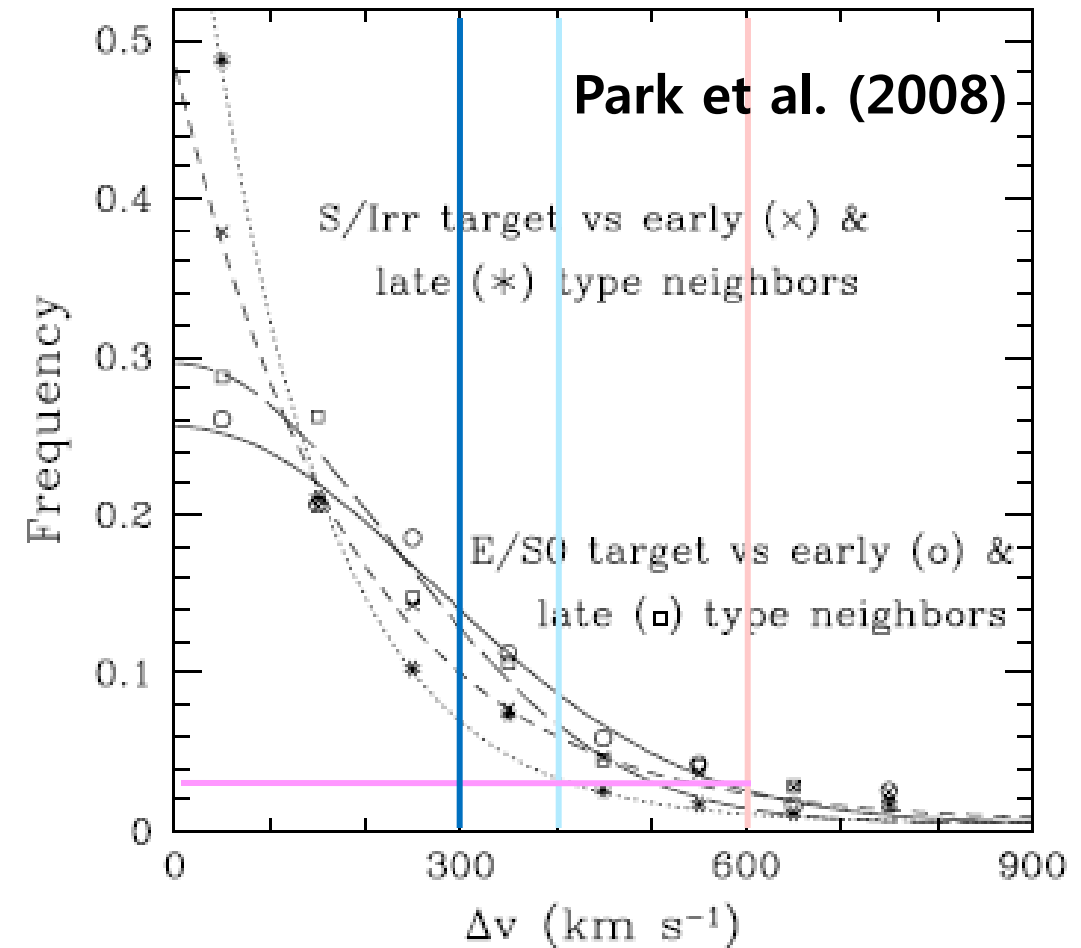
The data set used in this study is a volume limited sample (Choi et al. 2007) with  $M_r < -18.5$ . The targets to be investigated are 8991 galaxies brighter than  $M_r = -20$ . Their neighbors are found among those with  $M_r < -18.5$ , allowing 1.5 mag difference.



Name	Absolute Magnitude	Redshift	Distance <sup>a</sup>	Galaxies( $N_E$ <sup>b</sup> )	$\bar{d}^c$
CM	$-17.5 > M_r$	$0.025 < z < 0.03484$	$74.6 < R < 103.7$	11756 (3467)	3.00
D1	$-18.0 > M_r$	$0.025 < z < 0.04374$	$74.6 < R < 129.9$	20288 (6256)	3.41
D2	$-18.5 > M_r$	$0.025 < z < 0.05485$	$74.6 < R < 162.6$	32550 (11341)	3.78
D3	$-19.0 > M_r$	$0.025 < z < 0.06869$	$74.6 < R < 203.0$	49571 (19270)	4.18
D4	$-19.5 > M_r$	$0.025 < z < 0.08588$	$74.6 < R < 252.9$	74688 (33039)	4.58
D5	$-20.0 > M_r$	$0.025 < z < 0.10713$	$74.6 < R < 314.0$	80479 (39333)	5.56

# Finding Interacting Galaxies

- $\Delta v < 300 \text{ km/s}$  (to be conservative)
- Perturbed features
  1. Non-Axisymmetric body
  2. Off-centered core
  3. Bridge & Tail
  4. Shell
- Iterative visual inspection
- Consideration of morphology of each galaxy (as Early and Late type)



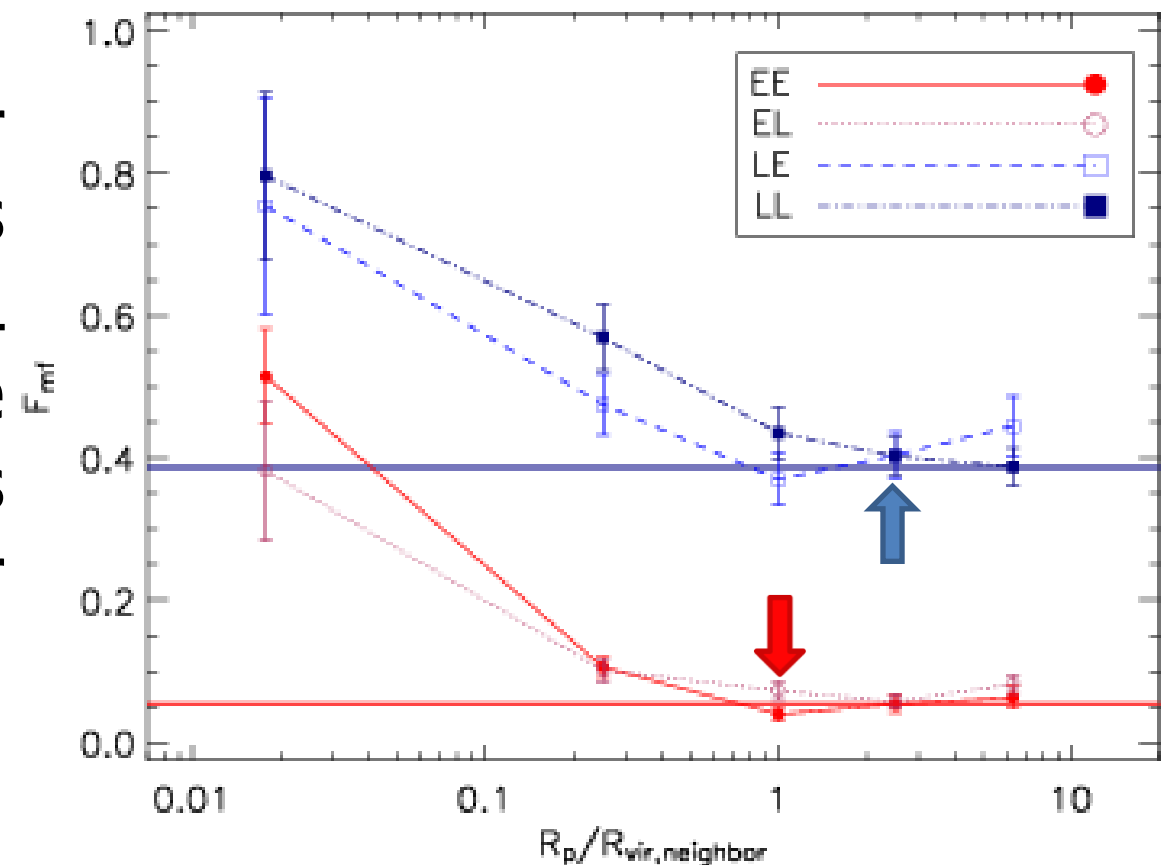
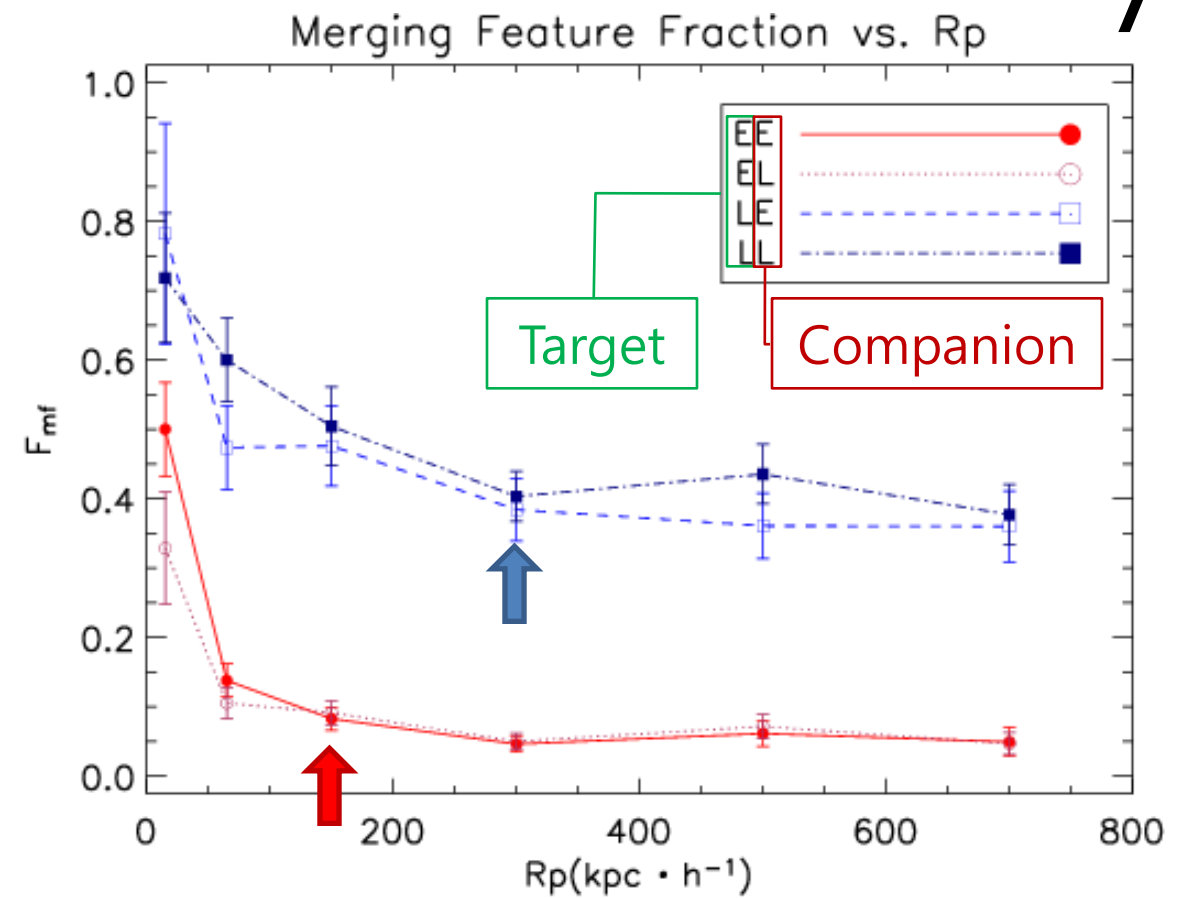
# Result

Projected Distance(kpc)	15		65		150		300		500		700		Total	
	E	L	E	L	E	L	E	L	E	L	E	L	E	L
Non-axisymmetric	102	143	51	243	47	214	31	266	27	219	14	165	272	1250
Off-centered	65	107	17	94	10	81	8	81	4	46	4	37	108	446
Bridge & tail	24	50	18	26	9	10	6	16	3	11	2	5	62	118
Shell	1	0	9	1	6	5	5	2	3	0	1	1	25	9
Total	104	145	63	246	55	218	36	276	31	227	15	169	304	1281

- $\sim 3000$  galaxies have interacting features.
- Most galaxies with perturbing features are non-axisymmetric.
- Shell tend to appear much more frequently in E type target as expected.
- L type showed much more fraction in Off-centered core category

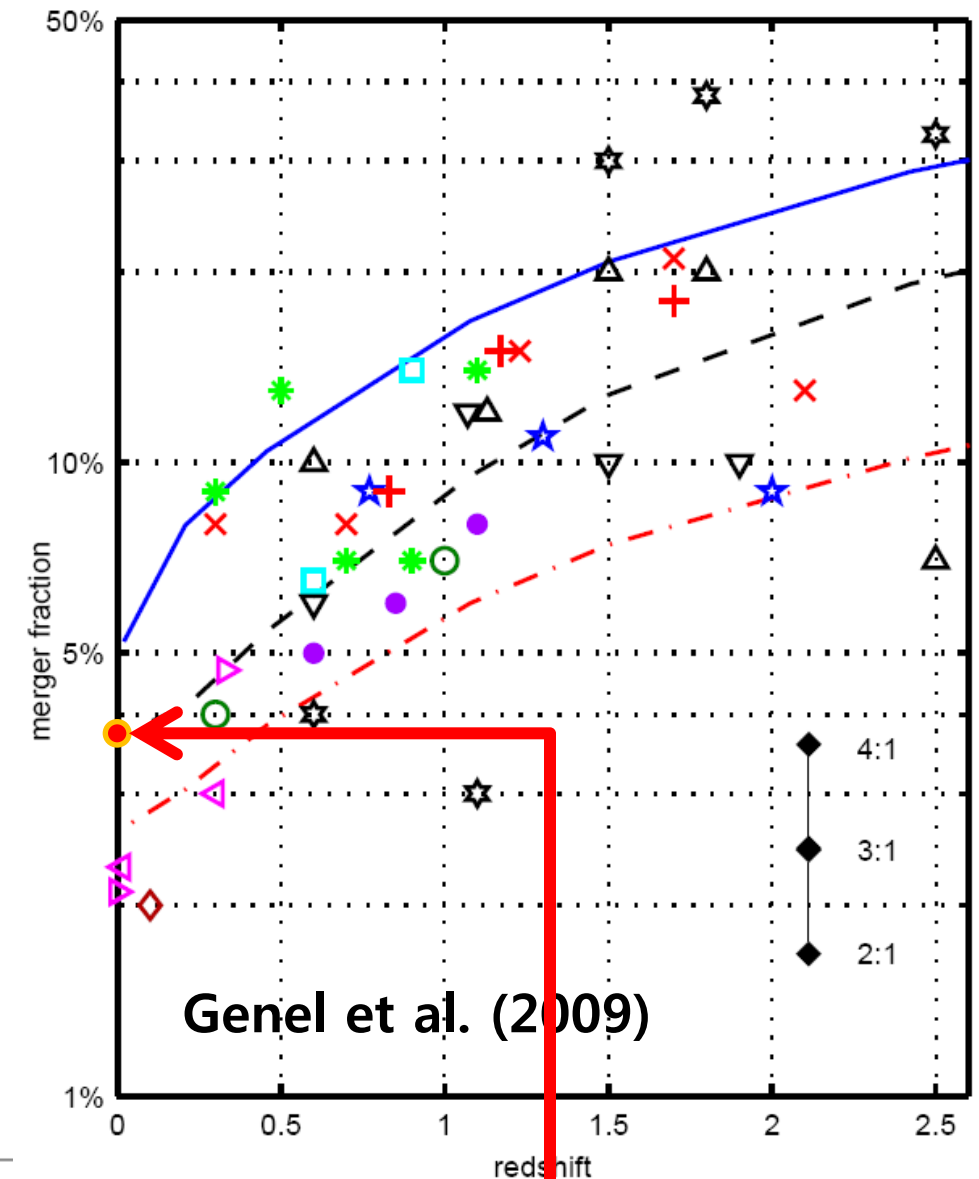
# Result

- The GIR increases when two galaxy approaches to each other.
- There are basic levels of GIR. This indicates that some galaxies already have interacting feature in spite of the big spatial separation.
- The GIR of Late type target start to increase at about  $R_p=400\text{kpc}$  while that location of Early type target is about  $R_p=200\text{kpc}$ .
- When we see GIR as a function of pair separation normalized by the virial radius of companion, particularly the GIR of LL pair starts to increase when the companion come inside a few times of its virial radius. For the case of the other pair types, virial radius is the starting point of increment of GIR.



# Current Galaxy Interacting Rate

- After subtracting the basic level of GIR, we derived current GIR. This value is 3.73% and shows good agreement with previous researches.



Pair type	EE	EL	LE	LL	E(target)	L(target)	total
with MF	105	42	58	130	147	188	335
all	1971	2270	1812	2936	4241	4748	8991
ratio of MFG to all galaxies in that category	0.0533	0.0185	0.0320	0.0443	0.0347	0.0396	0.0373

MFG is Merging Feature Galaxy

# References

- Choi, Y. Y., Park, C., & Vogeley, M. S. 2007, *ApJ*, 658, 884
- Genel, S., Genzel, R., Bouché, N., Naab, T., & Sternberg, A. 2008, [arXiv:0812.3154](https://arxiv.org/abs/0812.3154)
- Park, C., & Choi, Y.-Y. 2008, [arXiv:0809.2156](https://arxiv.org/abs/0809.2156)
- Toomre, A., & Toomre, J. 1972, *ApJ*, 178, 623