Bivariate Luminosity Function of Galaxy Pairs

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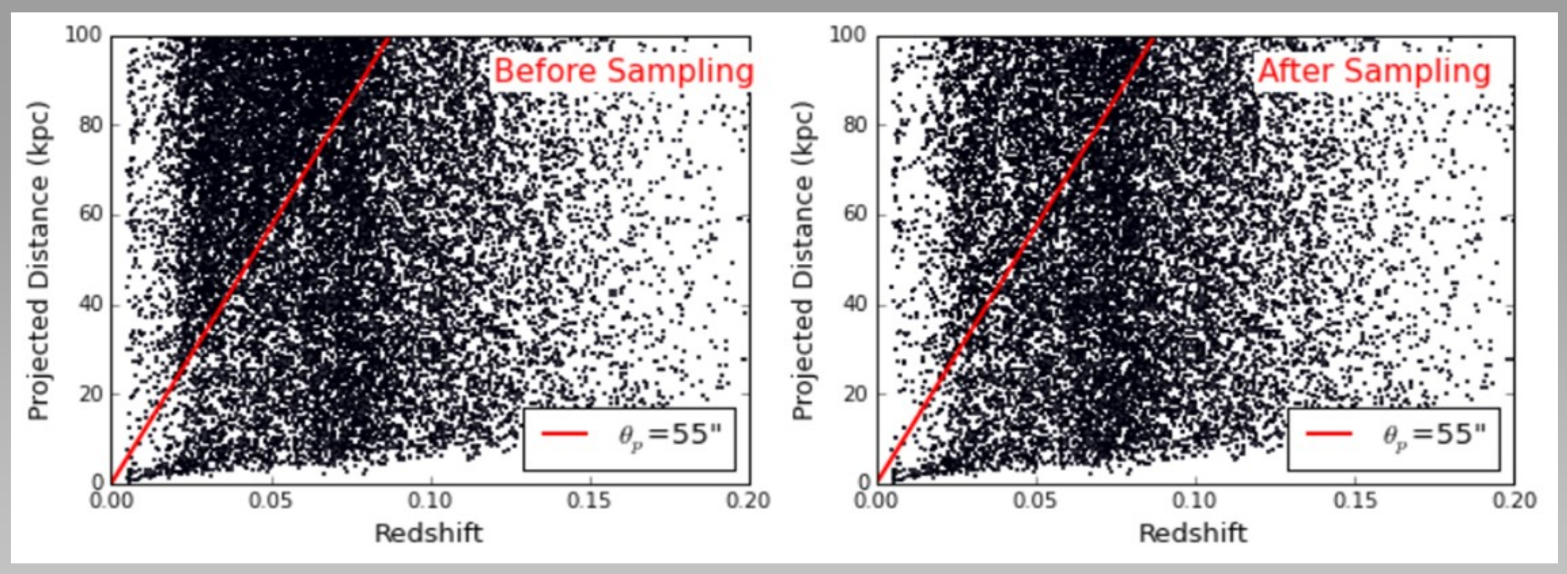
Introduction

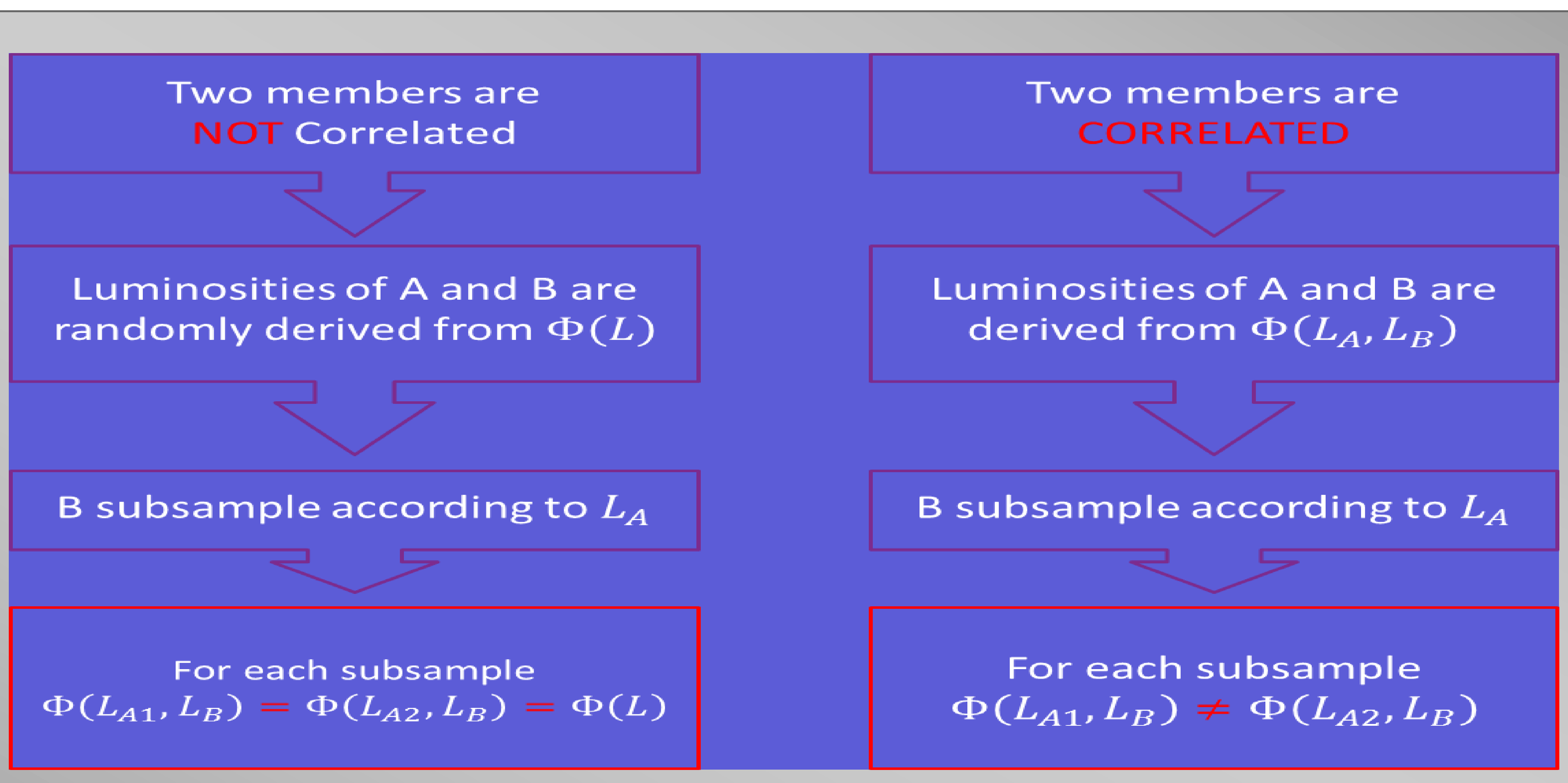
- Interactions is a key physical process which very dearly affect evolution of galaxies. There are a number of observational studies of galaxy pairs have revealed that many physical properties in interacting galaxies have clear difference than the normal galaxies, such as enhancement of star formation rate, blue nuclear colors, diluted nuclear gas-phase metallicities, and an overabundance of active galactic nuclei and luminous infrared galaxies.

- Projected distance is a key parameters of describe strength of galaxy-galaxy interaction. And in far more detail studies, some results indicate that enhancement of SFR and AGN depends on the projected distance. Close pairs with smaller projected distance which indicates stronger interaction, trends to have stronger enhancement.
- Recently, some research found that mass ratio is another key parameters of affecting pair observational properties. In minor merger pair, the SFR of smaller member will be suppressed, rather than enhanced in major merger.
- Besides interaction changing intrinsic physical properties, there are some evidences indicating material transform between two close galaxies.
- Our main goal is to study whether luminosities of physically linked pair members are linked. If it is true, how can we describe that phenomenon and understand the related physical process.

Pair Samples

- **Parent Sample**
  - The parent sample we adopted is the Main Galaxy Sample (MGS) in SDSS DR7.
  - Because of fiber collision effect that two sources with separation smaller than 55arcsec can not be arranged fibers in one plate, the redshifts of MGS is not complete. So we match MGS to new SDSS DR13 data and LAMOST DR4 data to add some supplement redshifts
    - SDSS DR13: 27146 new redshifts; LAMOST DR4: 10285 redshifts
- **Pair Sample**
  - Our galaxy pair criteria is
    - Projected separation: 10kpc ~ 100kpc
    - Radial velocity separation: Δv<500km/s
  - Finally, we got 16477 galaxy pairs whose two members have redshift measurements.
- **Correct fiber collision effect**
  - Due to fiber collision effect, 82% close pairs (angular separation < 55 arcsec) will be missed in our sample, which will .
  - For wider pairs (angular separation > 55 arcsec) which have no that bias, we randomly select 82% of them into our final sample.
  - By this way, the incomplete final pair sample is no biased.
  - 16477 pairs ==> 15490 pairs

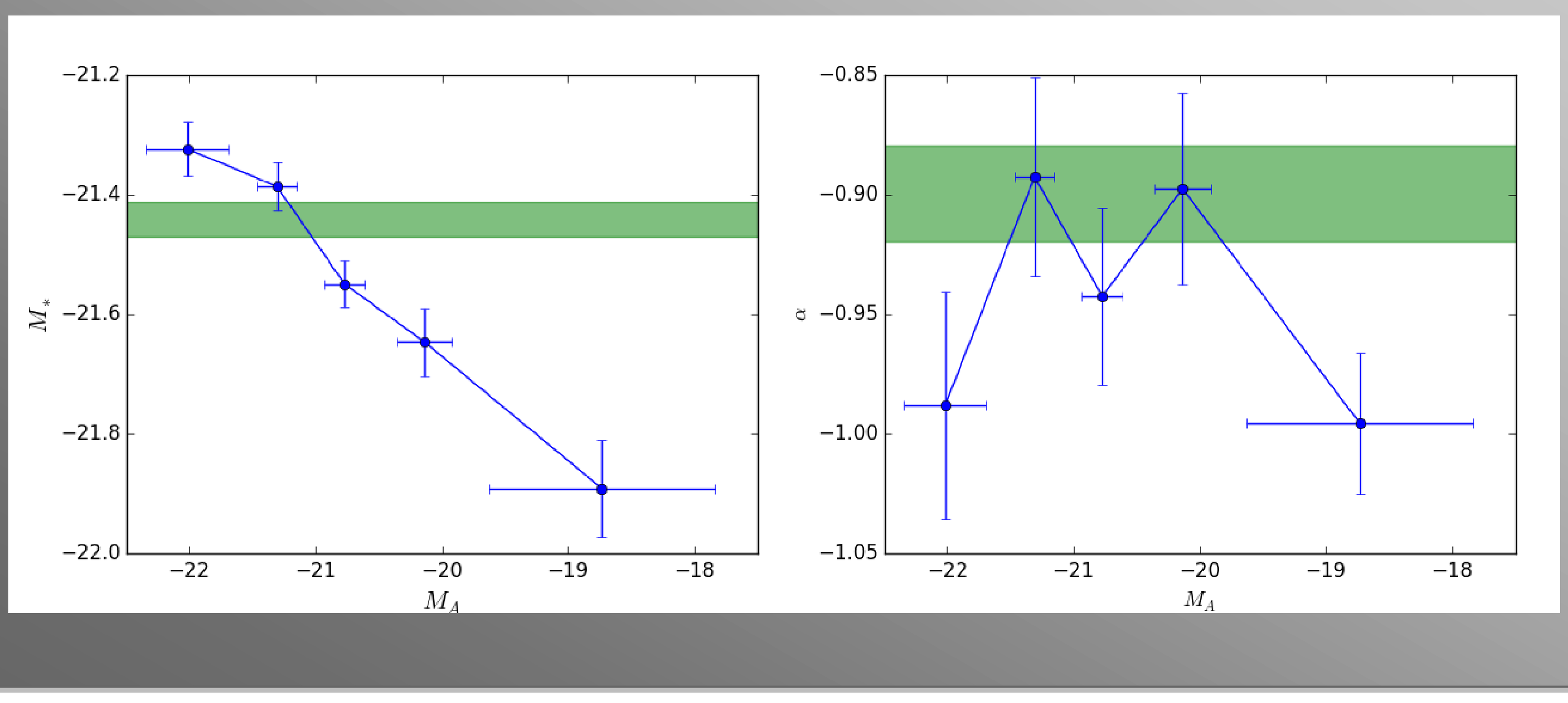




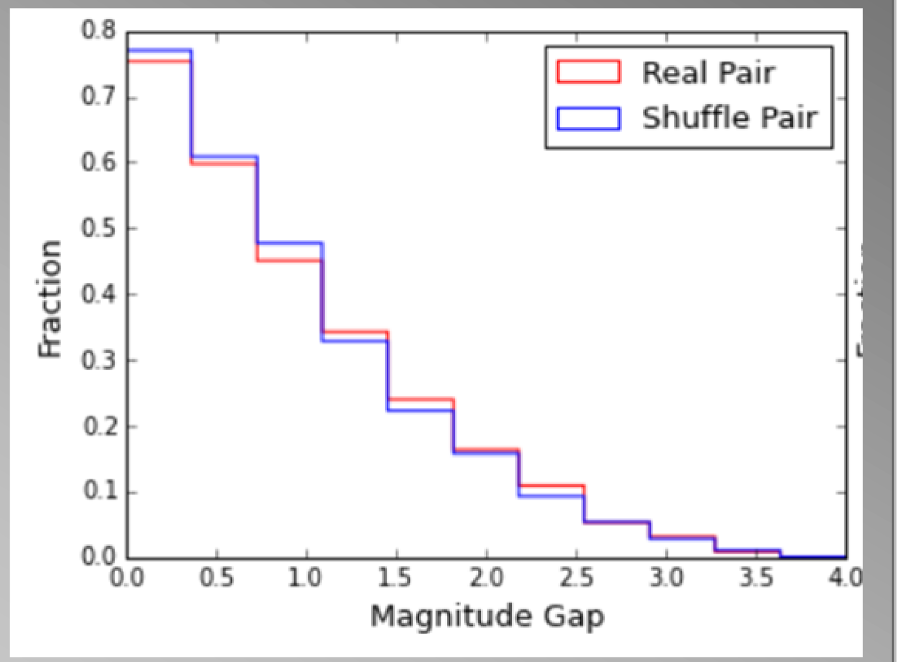
Results

- Luminosity function can be well fitted by Schechter function

$$\phi(L)\,\mathrm{d}L = \phi^*\left(\frac{L}{L^*}\right)^{\alpha}\exp\left(-\frac{L}{L^*}\right)\mathrm{d}\left(\frac{L}{L^*}\right),$$



- The results show that luminosity of pair members are correlated. Further more, there is a clear trend that brighter galaxies prefer to have a fainter counterparts and vice versa.
- We shuffled the all paired galaxy within the same redshift intervals to construct control sample. By comparing with control sample, it is obvious that galaxies in pairs have a wider magnitude gap.
- Because pair sample and control sample have the same environment, this discrepancy should be caused by the influence of member galaxy.



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