GOYA Survey: mergers up to z = 1 in B- and Ks-selected samples
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SUMMARY

The evolution of the galaxy merger rate holds the promise of providing an important test for galaxy formation models. However, progress is hampered by large discrepancies between different determinations of the merger fraction, even to moderate redshifts, z<1.

Sources for the discrepancies include differences in (1) merger fraction definition; (2) sample selection criteria, both in luminosity and morphology; (3) treatment of waveband shifting effects.

Given that mergers are seen today as key contributors to the growth of massive, red-sequence galaxies, we wish to know the dependency of the merger fraction with K-band luminosity.

Here we present merger fractions from galaxy samples selected by either Ks-luminosity, or B-band luminosity, from the GOYA photometric survey of the Groth strip. See Section 3 for the details on the sample selection. Asymmetry indices A<0.35 are used to identify merging galaxies, see Section 2. We have developed a maximum likelihood method to take into account the errors in redshift and asymmetry index. See Section 3.

The merger fraction in B-band (Fig. 4) can be expressed by the standard power-law form, which yields F<0.006·(1+z)³. The merger fraction in Ks-band (Fig. 5) is not monotonic with z, but has a minimum at z = 0.6, and is slightly higher in more massive galaxies.

The merger fraction in the Ks-selected sample can be seen in Figure 5. We can observe a merger drop at z = 0.6, drop that has also been measured by Bundy et al. (2004).

Bundy's inclusion of a K-correction slightly reduces the merger fraction in the Ks-band selected samples.

This work helps to clarify the dependencies of the merger fraction with K-band luminosity.

For our study we have selected three samples in the B-band. We select a Ks < -22 (495 objects) and two in Ks-band, M< -22 (762) and M< -23 (610) objects. The sample is having a x<1.3. Figure 1 shows examples of merging objects from the GOYA catalog.

4. Results

4.1. Results: The GOYA Groth Strip Catalog

The merger fraction in the Ks-selected sample can be seen in Figure 5. We can observe a merger drop at z = 0.6, drop that has also been measured by Bundy et al. (2004).

The infrared bands trace the stellar mass of the galaxies more accurately than the optical, the brightest galaxies in Ks band are more massive. The merger fraction in the M< -23 sample is slightly higher than in the M< -22 sample. Extension of this study to more extreme samples will clarify if massive galaxies continue to grow via mergers at z < 1.

2. CAS Indices

The GOYA catalog includes the automatic CAS morphological indexes (Concentration, Asymmetry and Clumpiness; Consolata et al. 2003a). This indices were obtained from the image sum F606W+F814W from HST/WFPC2 and the signal to noise.

One of the important characteristics of the CAS system is that give Hubble galaxy types occupy well defined volumes in the CAS space. Due to this, we can use the CAS indices to morphologically classify the galaxies.

4.3. Merger Fraction: The ML Method

The merger fraction in a redshift bin is defined as the number of mergers divided by the total number of galaxies in the redshift bin.

We can represent the values of the redshift and the asymmetry. If we define in this way the bidimensional histogram, the merger fraction in the Ks-band selected samples is lower than in the M< -23 sample. The extension of this study to more extreme samples will clarify if massive galaxies continue to grow via mergers at z < 1.

References

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