MORPHOLOGY DRIVEN EVOLUTION OF BARRED GALAXIES IN CLUSTERS AND THE CASE OF BARRED JELLYFISH GALAXIES

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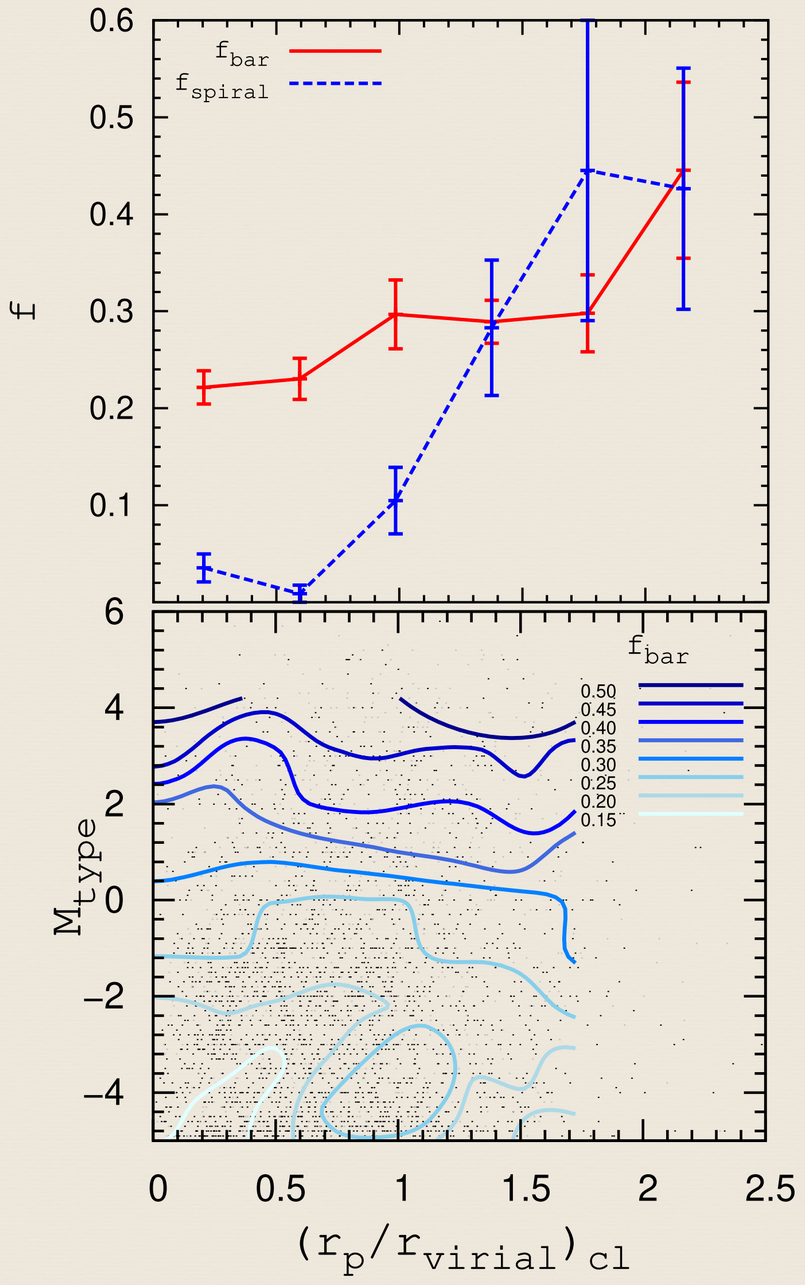
Abstract

The fraction of barred galaxies decreases with increasing cluster mass and with decreasing clustercentric distance, a dependence that vanishes once we control for morphological type, which indicates that the likelihood of a galaxy hosting a bar in the cluster environment is determined by its morphological transformation. At large clustercentric distances, we detect a dependence on the distance to the nearest neighbor galaxy, suggesting that tidal forces with close companions are able to suppress the formation of bars or even destroy them. Barred galaxies in our sample are either early-type, star-forming galaxies located within the virial radii of the clusters or late-type quenched galaxies found beyond the virial radii of the clusters. We propose a scenario in which already quenched barred galaxies that fall into the clusters are centrally rejuvenated by the interplay of the perturbed gas by ram pressure and the bar, in galaxies that are undergoing a morphological transformation. We found an increase in central SFR in ram- pressure-affected galaxies when compared with unperturbed ones. The most extreme cases of increased SFR and central rejuvenation occur in barred galaxies that are at advanced stages of ram pressure stripping.

1. Bar fraction, environment and morphology

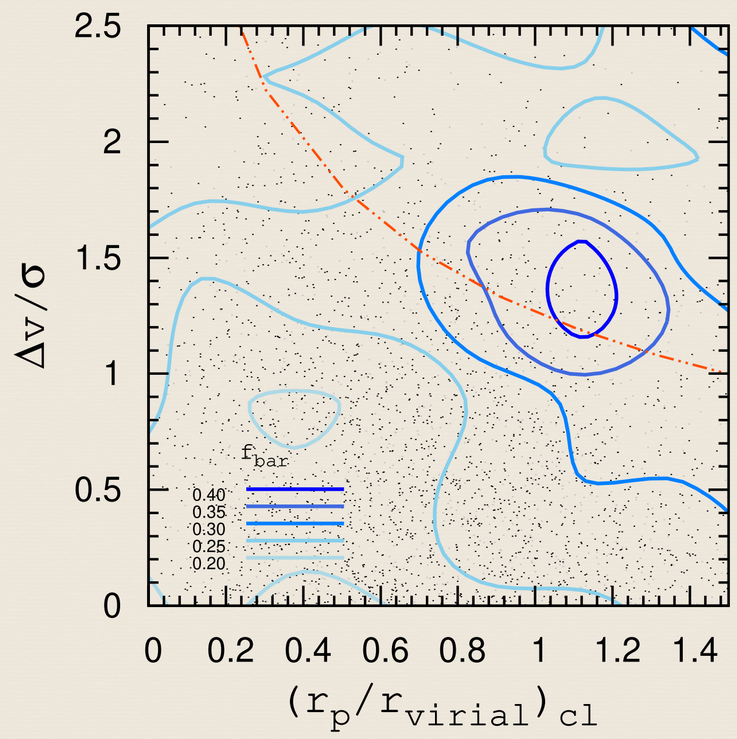
Top panel. The fraction of barred galaxies shows a decrease with decreasing clustercentric distance, with a drastic drop once we cross the virial radius of the clusters. The corresponding morphology-density relation is shown, with the expected decline of spiral galaxies to the center of the clusters, a possible explanation for the decreasing bar fraction.

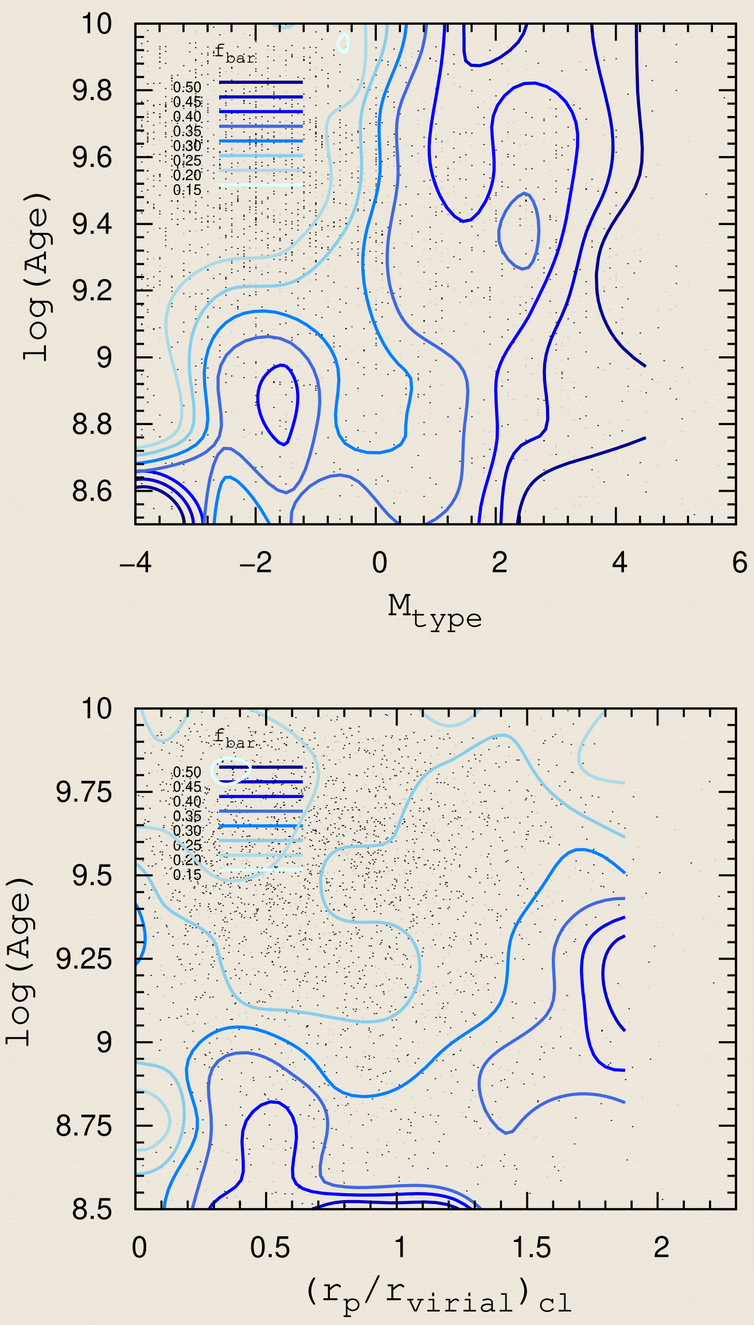
Bottom panel. Looking at the bar fraction in the morphological type vs clustercentric distance space, we can clearly see that for late-type galaxies, at fixed morphological type there is no dependence with clustercentric distance, indicating that the likelihood of a galaxy hosting a bar in the cluster environment is determined by its morphological transformation.



2. Barred galaxies in infall to galaxy clusters.

A more complete picture of a possible environmental cluster effect can be gained by analyzing the occurrence of bars in a phase-space diagram, where the highest occurrence of bars is at large clustercentric distances and high velocities, with a peak of the bar fraction just above the escape velocity demarcation line, an indication that barred galaxies are recent infallers.





3. Star formation history of infalling barred galaxies.

Barred galaxies in our sample are either early-type, star-forming galaxies located within the virial radii of the clusters or late-type quenched galaxies found beyond the virial radii of the clusters. We propose a scenario in which already quenched barred galaxies that fall into the clusters are centrally rejuvenated by the interplay of the perturbed gas by ram pressure and the bar, in galaxies that are undergoing a morphological transformation.

References

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4. The case of barred jellyfish galaxies

Galaxies that are going through ram pressure have a greater increase in star formation activity in the central region compared to galaxies that are not affected by this process. The most extreme cases of increased central star formation activity and rejuvenation of the stellar population that we find are in jellyfish barred galaxies.