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Revealing galactic scale bars with the help of Galaxy Zoo

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Abstract. We use visual classifications of the brightest 250,000 galaxies in the Sloan Digital Sky Survey Main Galaxy Sample provided by citizen scientists via the Galaxy Zoo project (www.galaxyzoo.org, Lintott *et al.* 2008) to identify a sample of local disc galaxies with reliable bar identifications.

These data, combined with information on the atomic gas content from the ALFALFA survey (Haynes *et al.* 2011) show that disc galaxies with higher gas content have lower bar fractions.

We use a gas deficiency parameter to show that disc galaxies with more/less gas than expected for their stellar mass are less/more likely to host bars. Furthermore, we see that at a fixed gas content there is no residual correlation between bar fraction and stellar mass. We argue that this suggests previously observed correlations between galaxy colour/stellar mass and (strong) bar fraction (e.g. from the sample in Masters *et al.* 2011, and also see Nair & Abraham 2010) could be driven by the interaction between bars and the gas content of the disc, since more massive, optically redder disc galaxies are observed to have lower gas contents.

Furthermore we see evidence that at a fixed gas content the global colours of barred galaxies are redder than those of unbarred galaxies. We suggest that this could be due to the exchange of angular momentum beyond co-rotation which might stop a replenishment of gas from external sources, and act as a source of feedback to temporarily halt or reduce the star formation in the outer parts of barred discs.

These results (published as Masters *et al.* 2012) combined with those of Skibba *et al.* (2012), who use the same sample to show a clear (but subtle and complicated) environmental dependence of the bar fraction in disc galaxies, suggest that bars are intimately linked to the evolution of disc galaxies.

Keywords. galaxies: evolution, galaxies: spiral, galaxies: fundamental parameters, galaxies: statistics, galaxies: structure, surveys, ISM: atoms, radio lines: galaxies

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