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Galaxy Pairs in the Sloan Digital Sky Survey - III: Evidence of Induced Star Formation from Optical Colours

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We have assembled a large, high quality catalogue of galaxy colours from the Sloan Digital Sky Survey Data Release 7, and have identified 21,347 galaxies in pairs spanning a range of projected separations ($r_p < 80 h_{70}^{-1}$ kpc), relative velocities ($\Delta v < 10,000$ km/s, which includes projected pairs that are essential for quality control), and stellar mass ratios (from 1:10 to 10:1). We find that the red fraction of galaxies in pairs is higher than that of a control sample matched in stellar mass and redshift, and demonstrate that this difference is likely due to the fact that galaxy pairs reside in higher density environments than non-paired galaxies. We detect clear signs of interaction-induced star formation within the blue galaxies in pairs, as evidenced by a higher fraction of extremely blue galaxies, along with blueward offsets between the colours of paired versus control galaxies. These signs are strongest in close pairs ($r_p < 30 h_{70}^{-1}$ kpc and $\Delta v < 200$ km/s), diminish for more widely separated pairs ($r_p > 60 h_{70}^{-1}$ kpc and $\Delta v < 200$ km/s) and disappear for close projected pairs ($r_p < 30 h_{70}^{-1}$ kpc and $\Delta v > 3000$ km/s). These effects are also stronger in central (fibre) colours than in global colours, and are found primarily in low- to medium-density environments. Conversely, no such trends are seen in red galaxies, apart from a small reddening at small separations which may result from residual errors with photometry in crowded fields. When interpreted in conjunction with a simple model of induced starbursts, these results are consistent with a scenario in which close peri-centre passages trigger induced star formation in the centres of galaxies which are sufficiently gas rich, after which time the galaxies gradually redden as they separate and their starbursts age.

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