

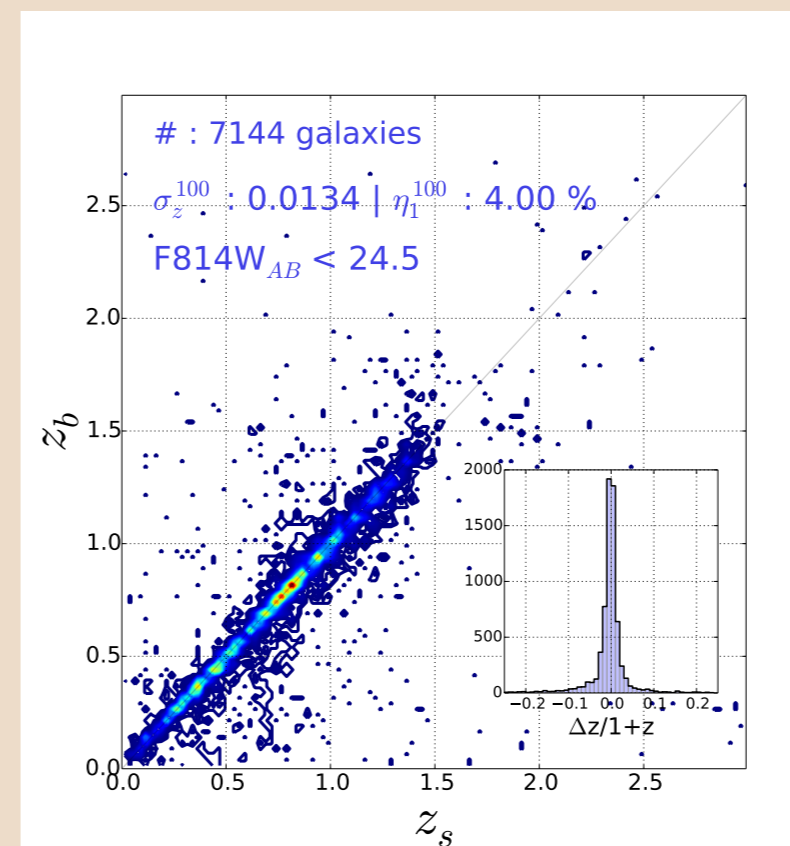
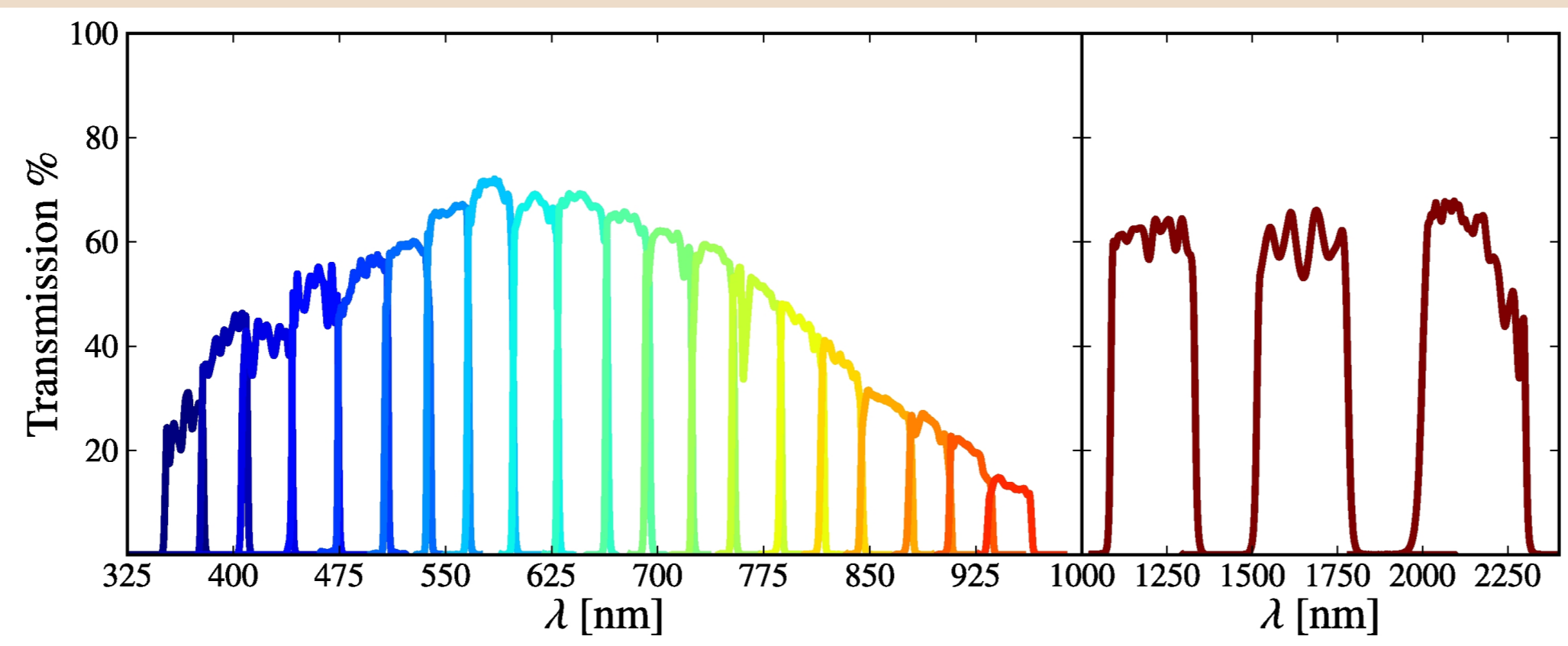
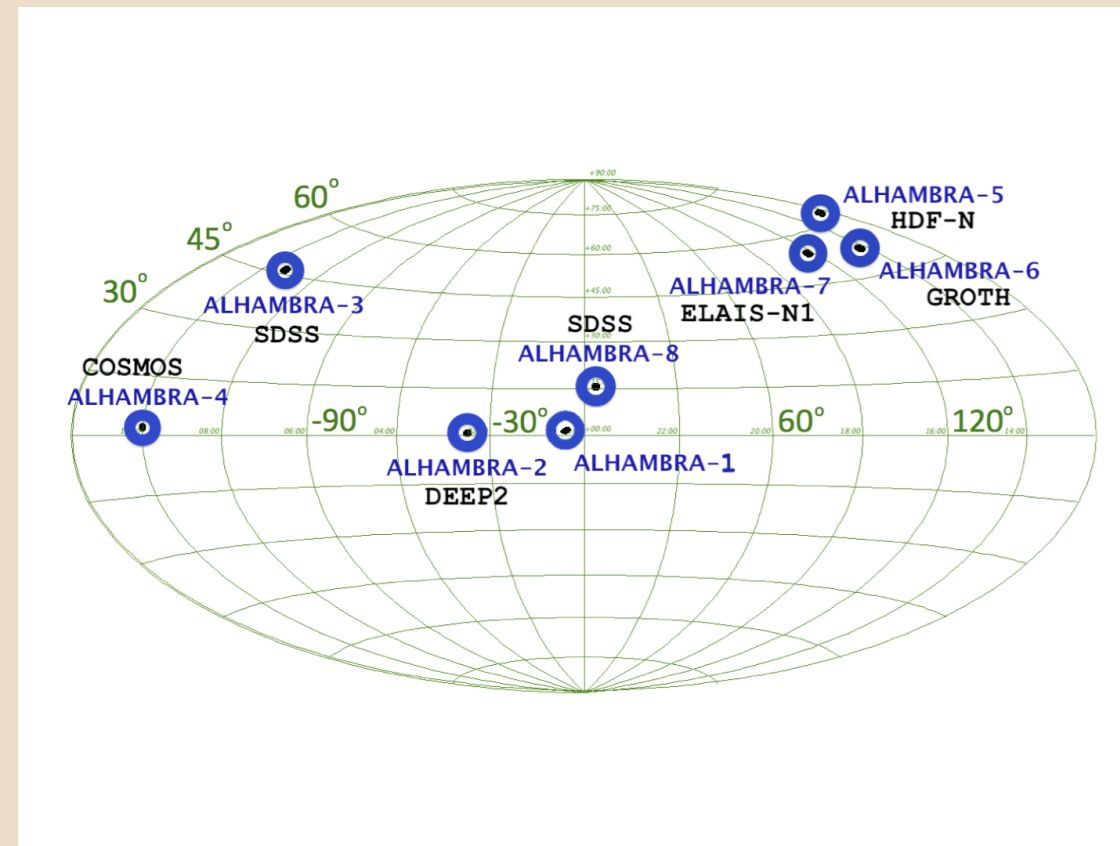
The ALHAMBRA survey: B–band luminosity function of blue and red galaxies at $0.2 \leq z < 1$ by PDF analysis

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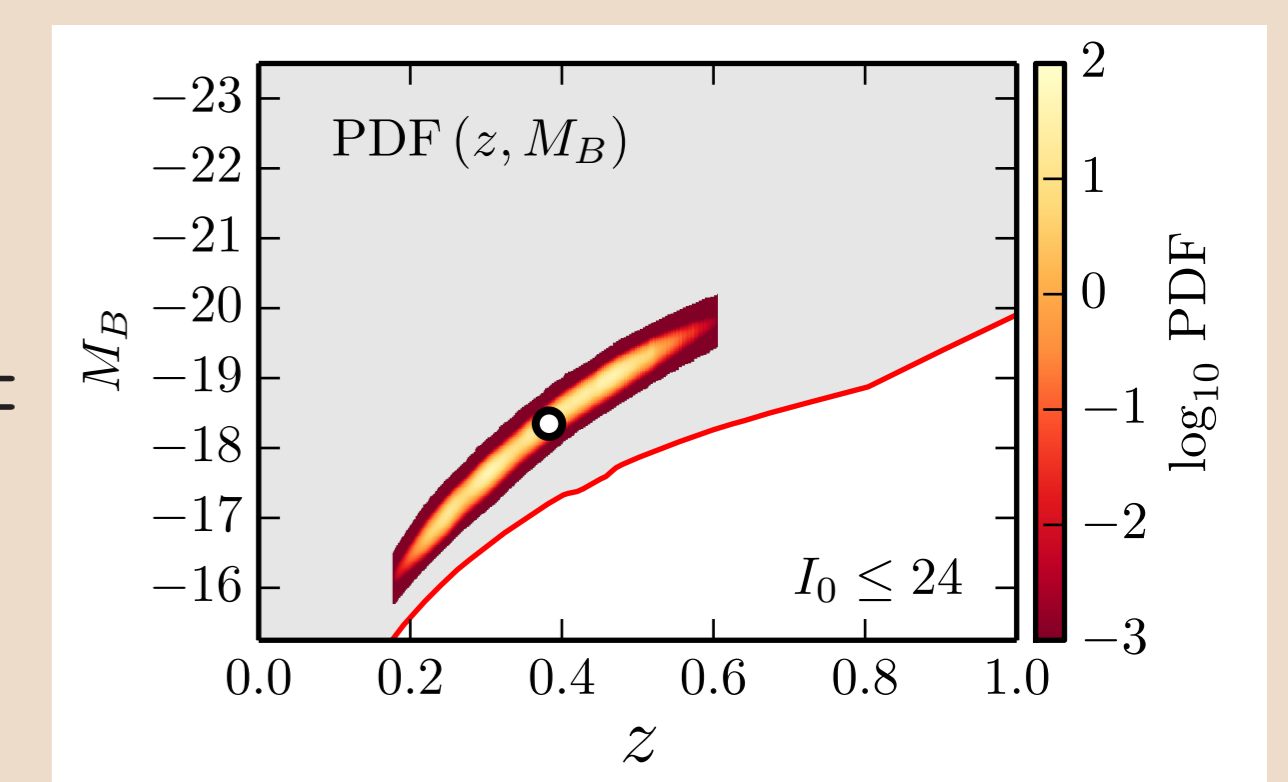
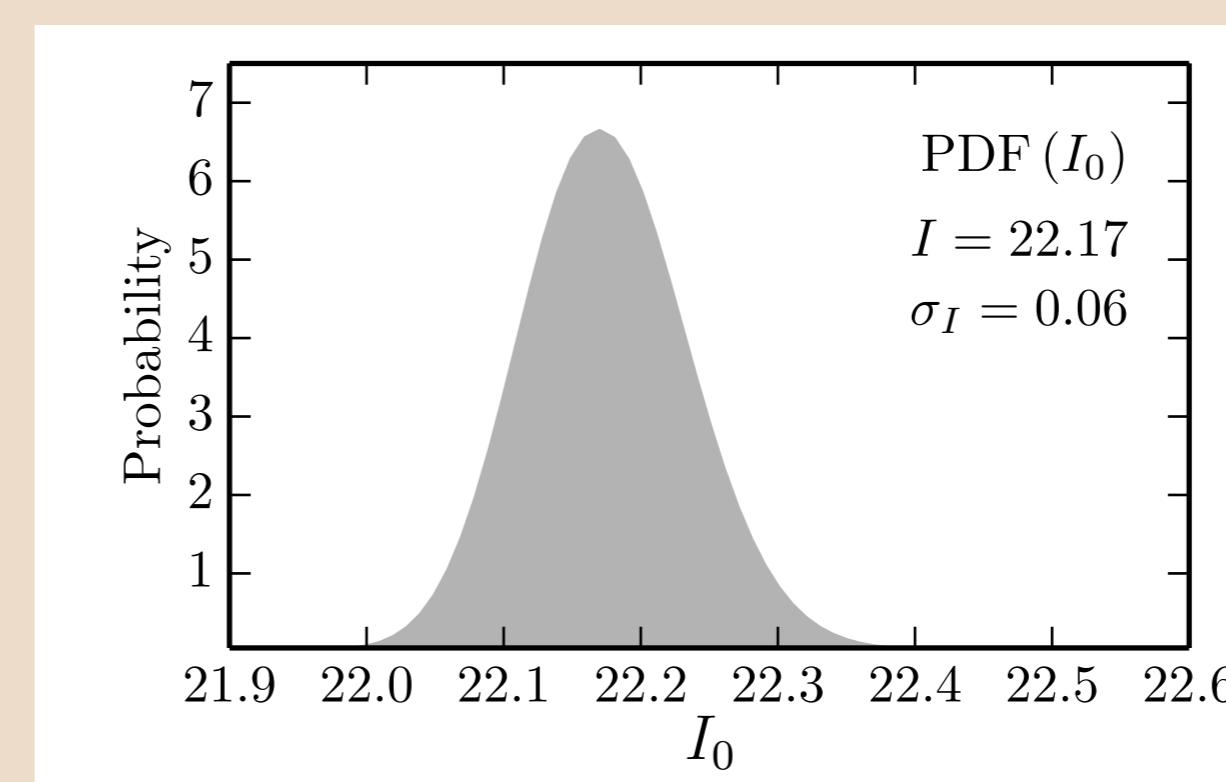
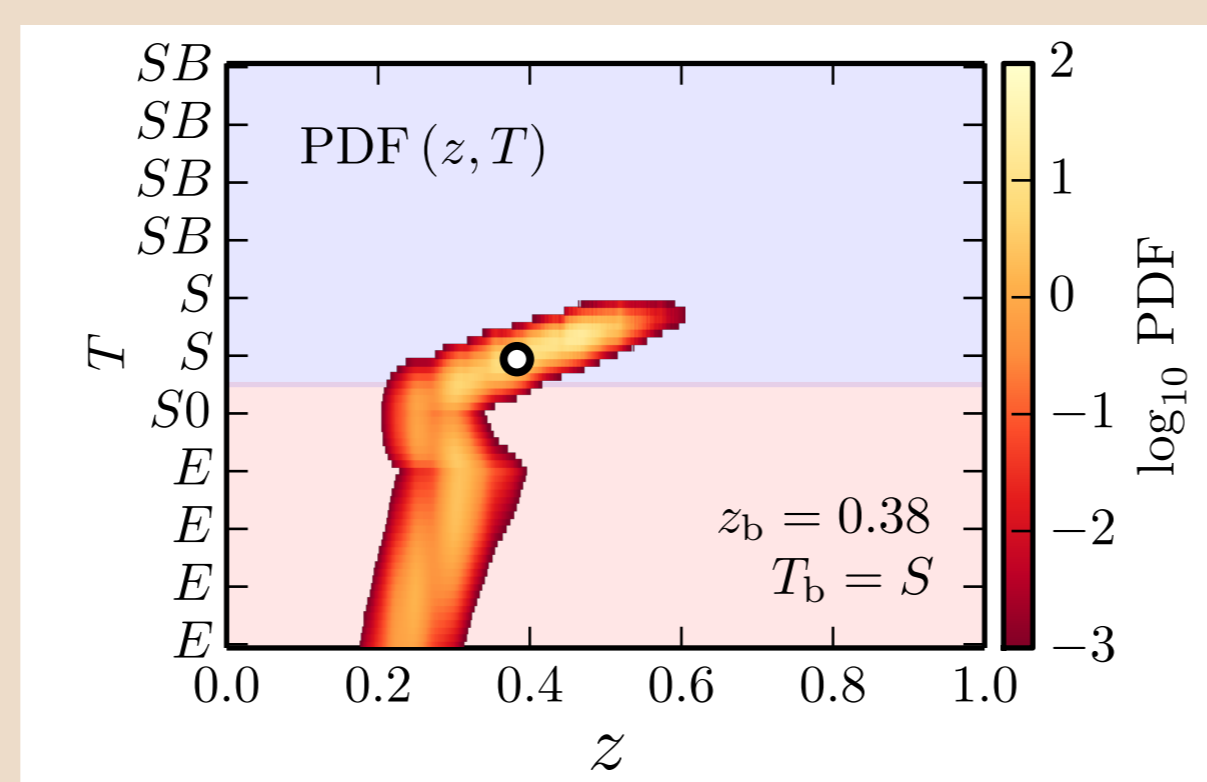
The ALHAMBRA Survey



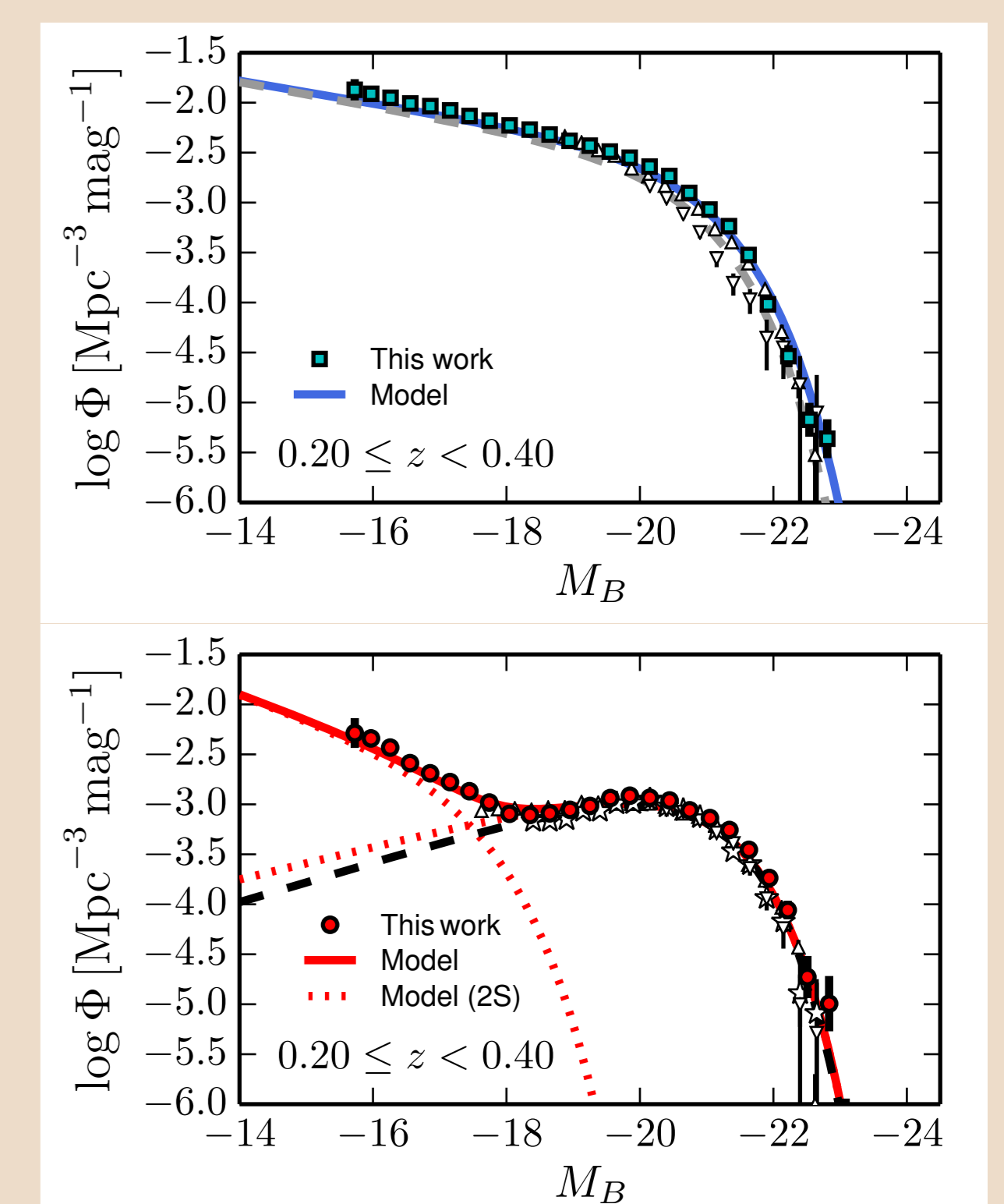
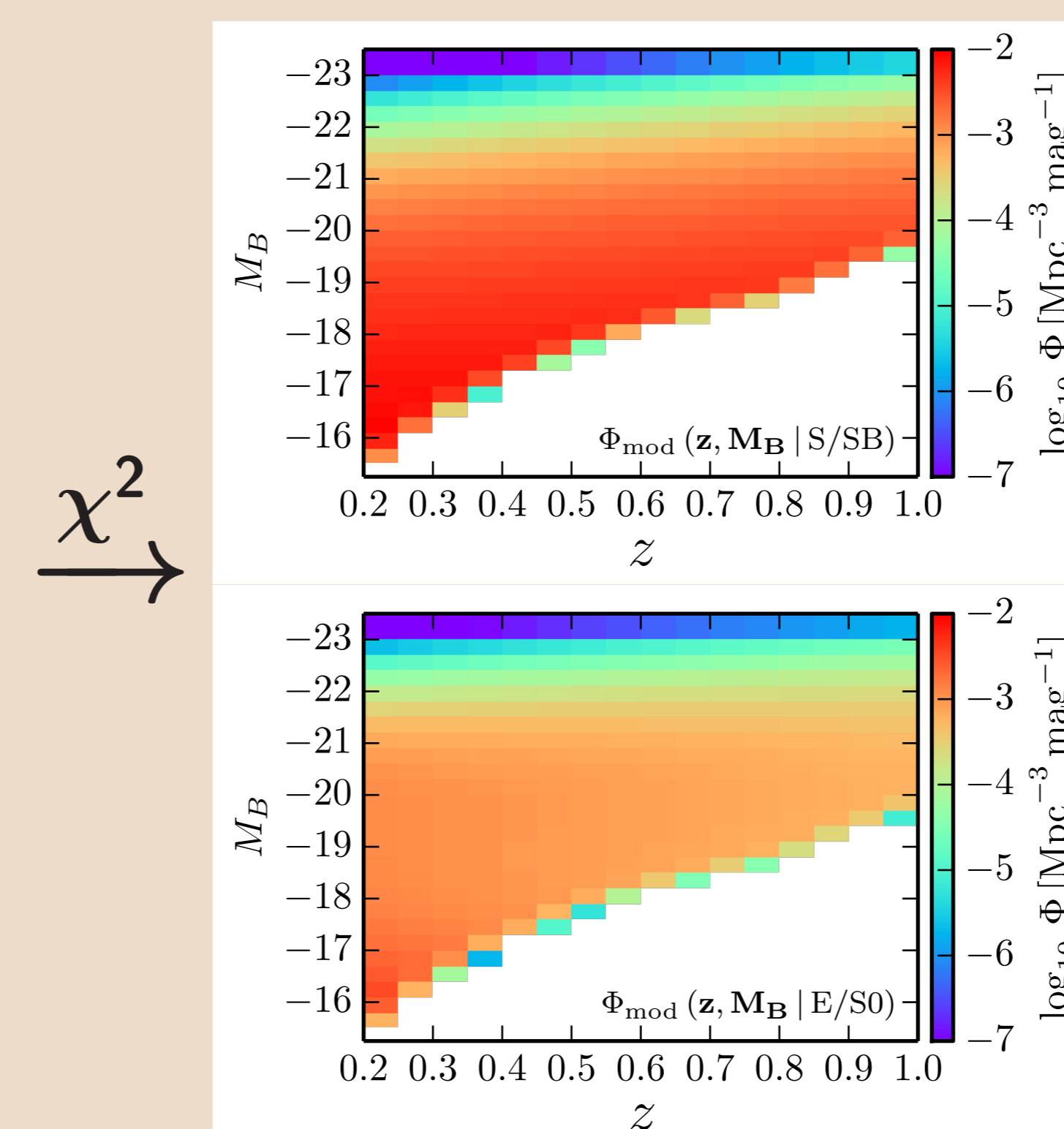
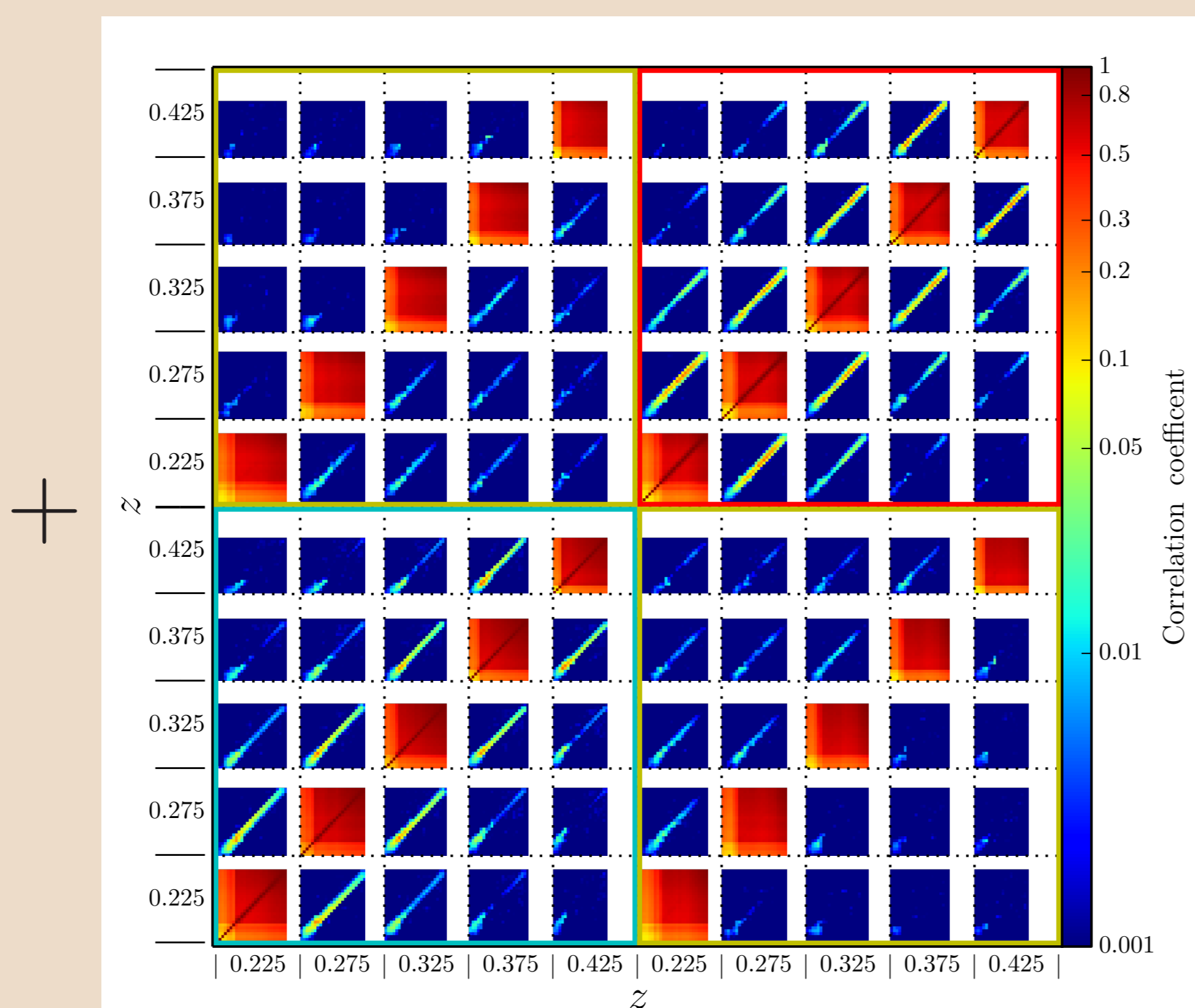
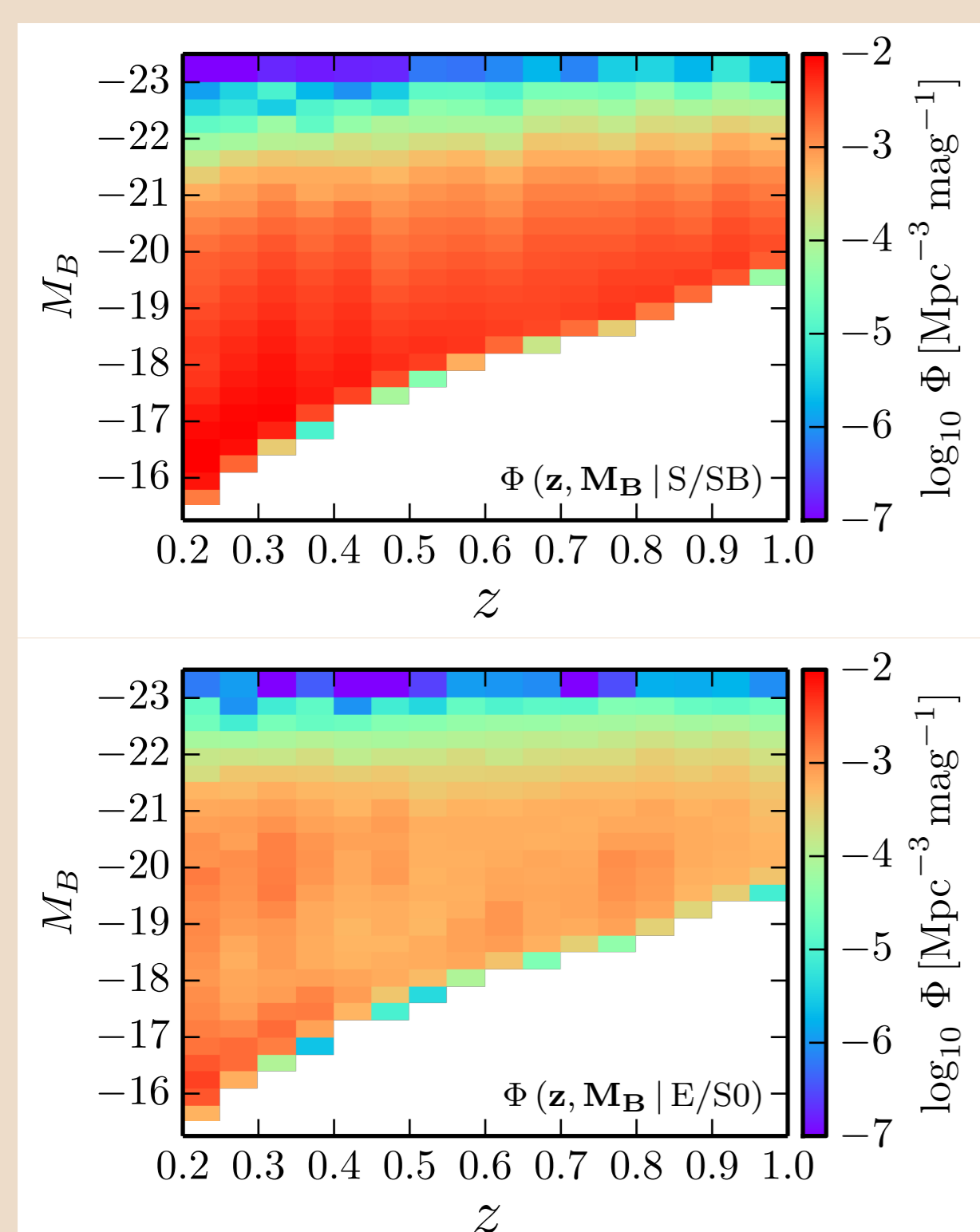
The ALHAMBRA survey (Moles et al. 2008) has observed 8 independent fields (*left panel*, 2.4 high-quality sq. degs.) with 20 optical medium-bands ($\sim 300\text{\AA}$) + JHK_s in the near-infrared (*central panel*) to achieve a photometric redshift precision of $\sigma_z/(1+z) \sim 1.3\%$ (*right panel*) for $\sim 450\text{k}$ galaxies selected with $I \leq 24.5$ (see Molino et al. 2014, for details).

The $z - M_B$ probability distribution function (PDF)

We combine the redshift - spectral type ($z - T$) PDF provided by BPZ (Benítez 2000, *left panel*) with the I–band magnitude posterior (*central panel*) to estimate the $z - M_B$ PDF (*right panel*). The integration over $T = E/S0$ and $T = S/SB$ define red and blue galaxies, respectively. The white dots mark point-like estimates. We study galaxies with $I_0 \leq 24$ (red line at *right panel*).

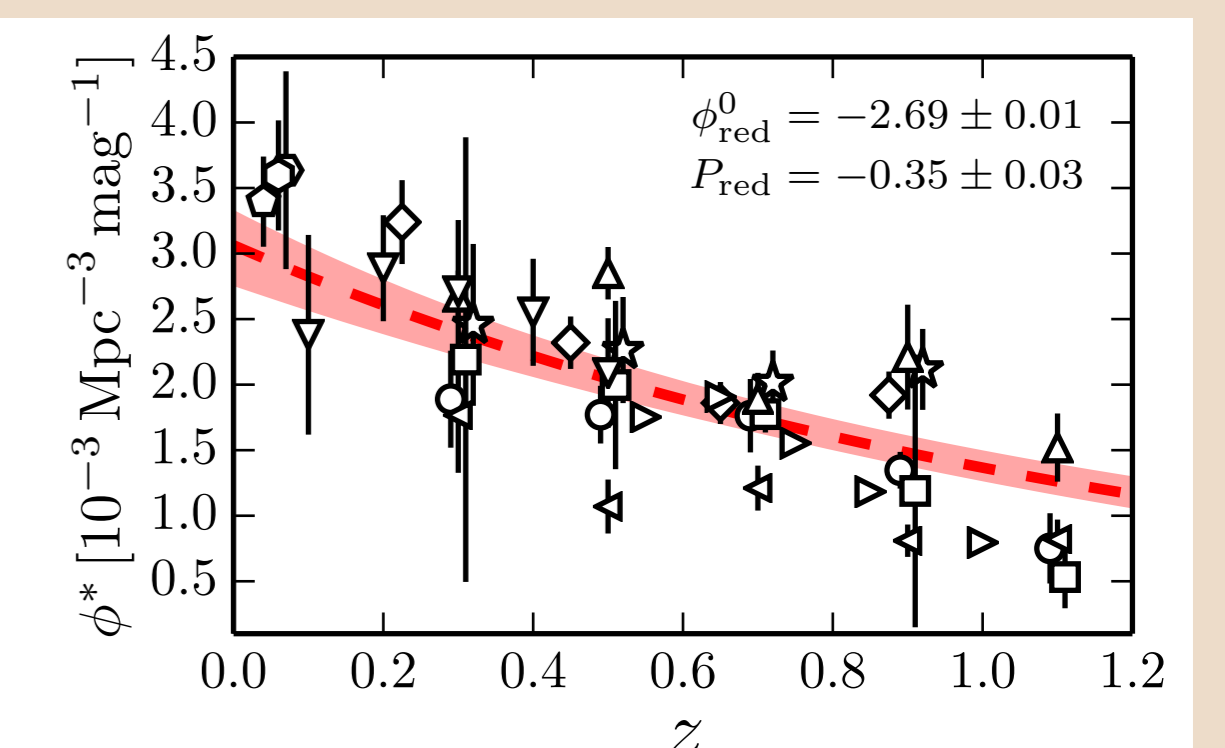
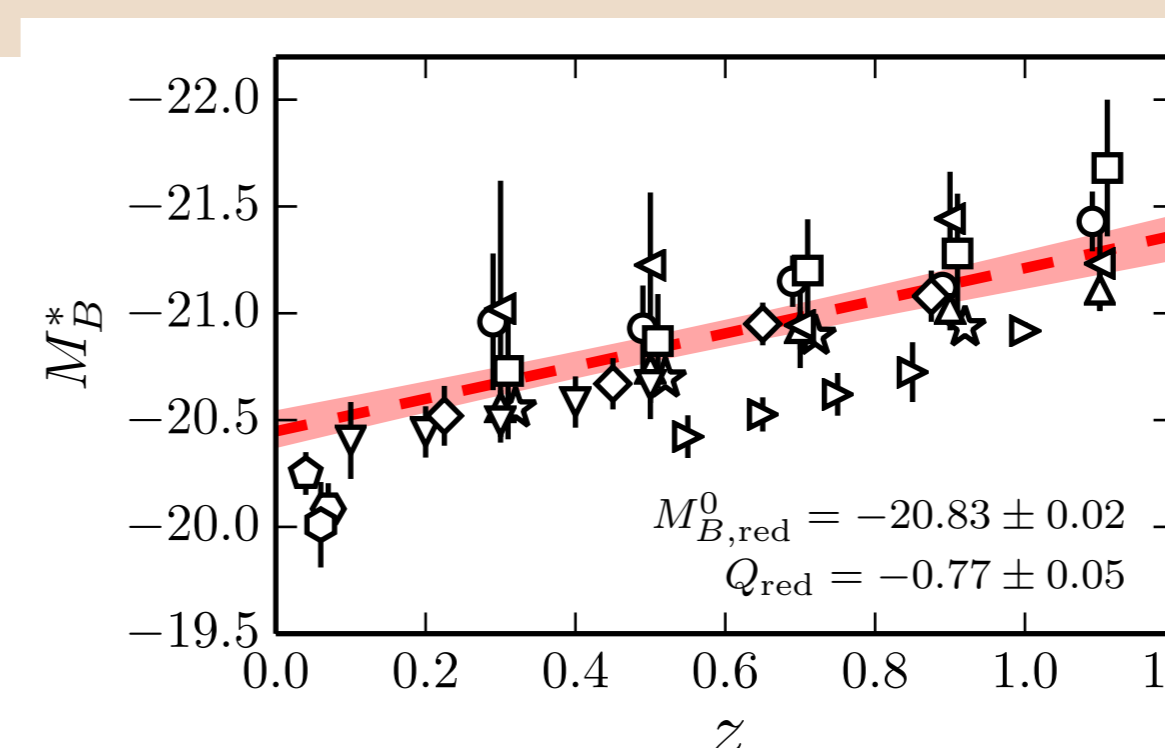
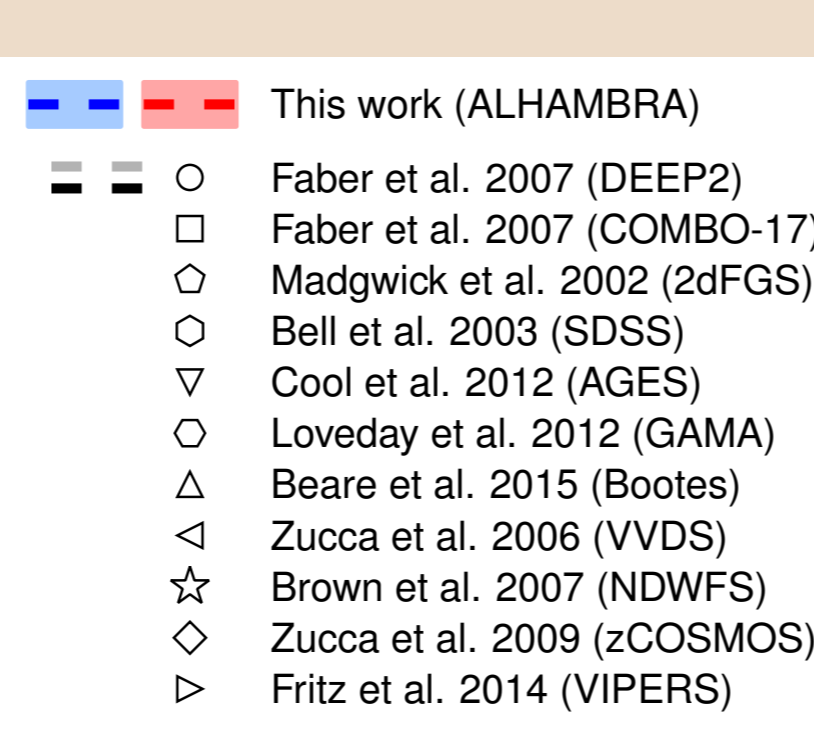
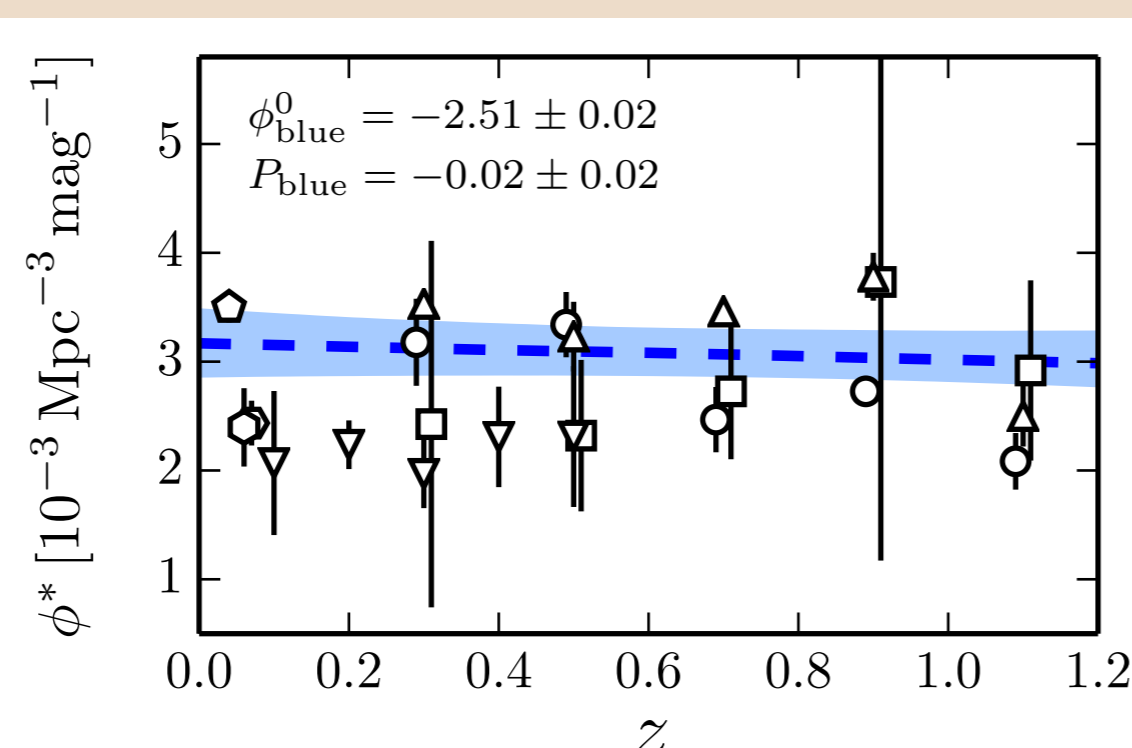
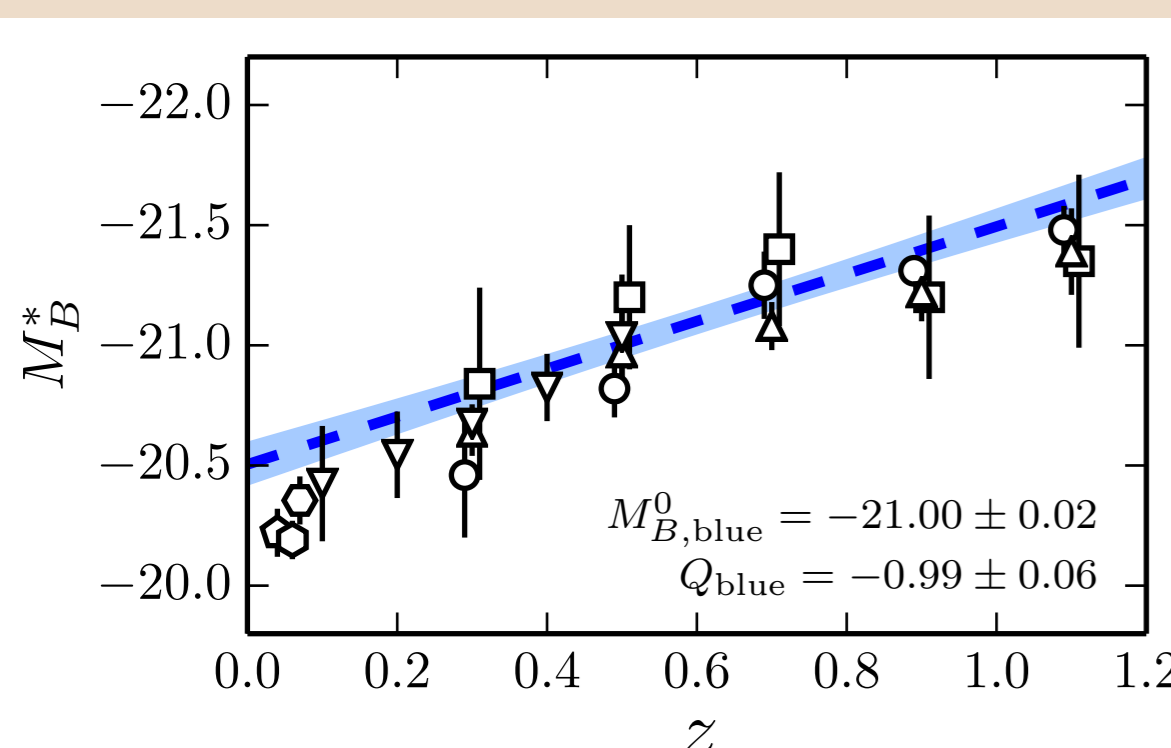


The ALHAMBRA B–band luminosity function



The ALHAMBRA luminosity function is $\Phi(z, M_B | T) \propto \sum_i \text{PDF}_i(z, M_B | T)$, computed for blue (*left top panel*) and red (*left bottom panel*) galaxies in 16 redshift bins ($\Delta z = 0.05$). The covariance matrix in redshift - magnitude - type includes shot noise and cosmic variance (*large central panel*, only the first 5 redshift bins are shown). We performed a χ^2 fit with one (two) redshift-evolving Schechter function(s) for blue (red) galaxies. The model has 12 parameters and is affected by the same selection effects than the data. The median model $\Phi_{\text{mod}}(z, M_B | T)$ is presented in the *two central panels*. To illustrate our results, the projected luminosity function at $0.2 \leq z < 0.4$ is presented in the *right panels* with values from the literature (legend in the *central panel* below). The faint-end upturn is evident in the red population (e.g. Madgwick et al. 2002, Drory et al. 2009), imposing the need of a second, faint Schechter function.

The evolving Schechter parameters in ALHAMBRA



The redshift evolution of the modelled Schechter function parameters $M_B^* \propto Qz$ and $\phi^* \propto 10^{Pz}$ for blue (*left panels*) and red (*right panels*) galaxies is presented. We find good agreement with the values from the literature (labelled in the *central panel*). The shown areas and error bars represent 2σ intervals. The faint-end slope is $\alpha_{\text{blue}} = -1.28 \pm 0.02$ for blue galaxies and $\alpha_{\text{red}} = -0.59 \pm 0.02$ for red ones. The second Schechter function of red galaxies has a fainter characteristic luminosity $M_f = -17.27 \pm 0.05$ and a steeper faint-end slope $\beta = -1.59 \pm 0.07$. The contribution of the faint red population to the luminosity density increases from $\sim 6\%$ at $z = 1$ to $\sim 11\%$ at $z = 0$. This methodology will be applied in the future to J-PAS (Benítez et al. 2014).

References

Beare et al. 2015, ApJ, 815, 94; Benítez 2000, ApJ, 608, 752; Benítez et al. 2014, [ArXiv:1403.5237]; Bell et al. 2003, ApJS, 149, 289; Brown et al. 2007, ApJ, 654, 858; Cool et al. 2012, ApJ, 748, 10; Drory et al. 2009, ApJ, 707, 1595; Faber et al. 2007, ApJ, 665, 265; Fritz et al. 2014, A&A, 563, A92; Loveday et al. 2012, MNRAS, 420, 1239; Madgwick et al. 2002, MNRAS, 333, 133; Moles et al. 2008, AJ, 136, 1325; Molino et al. 2014, MNRAS, 441, 2891; Zucca et al. 2006, A&A, 455, 879; Zucca et al. 2009, A&A, 508, 1217.

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