The predicted UV colours of LBGs.

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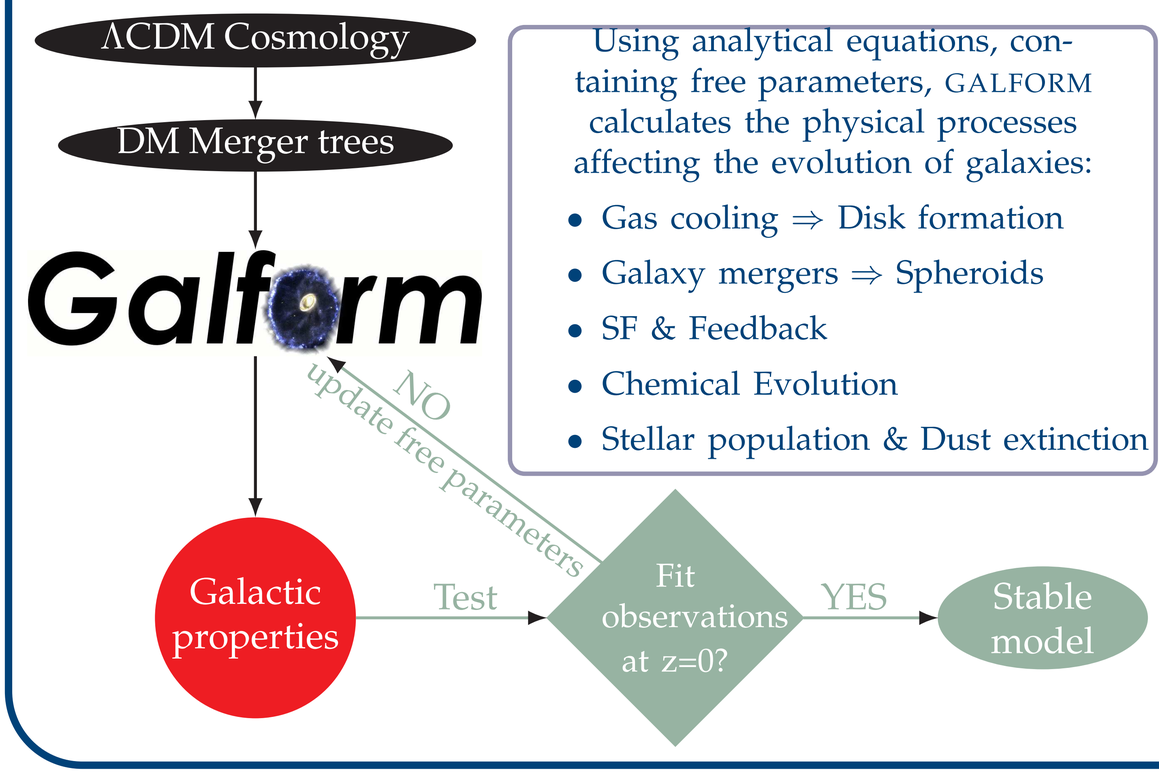
Abstract

Using GALFORM, a semi-analytical model of galaxy formation, we have studied the UV colours of Lyman-break galaxies (LBGs), in the range 2.5<z<10. Our model produces galaxies with UV colours consistent with the observed ones. We have investigated the impact that different parameters from the model have over the UV colours, finding that they are most sensitive to dust and, in particular, to the extinction curve assumed initially. The predicted UV-continuum (UVC) slope is in agreement with observations of faint galaxies. Observationally, the UVC slope varies with the UV magnitude, a trend that we do not find for the modelled galaxies. Using the Milky Way (MW) dust extinction law, the predicted UVC slopes are, in general, bluer than observations. The opposite happens when using the Small Magellanic Cloud (SMC) dust extinction law: the predicted UVC slopes get redder. This shows the strong dependency of UV colours with dust properties and the difficulty to use the UVC slope as a tracer of dust.

The semi-analytical approach for modelling the evolution of galaxies: Because galaxies are not only shaped by gravity



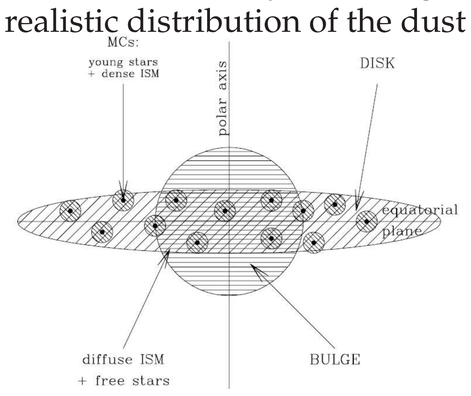
Using analytical equations, containing free parameters, GALFORM calculates the physical processes affecting the evolution of galaxies:

- Gas cooling ⇒ Disk formation
- Galaxy mergers ⇒ Spheroids
- SF & Feedback
- Chemical Evolution
- Stellar population & Dust extinction

For this study we use the **Baugh et al. 2005**[1] model:

Ω_0	0.3
Λ_0	0.7
Ω_b	0.04
σ_8	0.93
h	0.7
Dark Matter halos merger trees	Monte Carlo
Quenching of star formation	Superwinds
Dynamical scale for quiescent star formation	Independent of time
Bursts triggered by	Mergers
Burst IMF	Top heavy

The dust extinction is calculated in a self consistent way assuming a realistic distribution of the dust



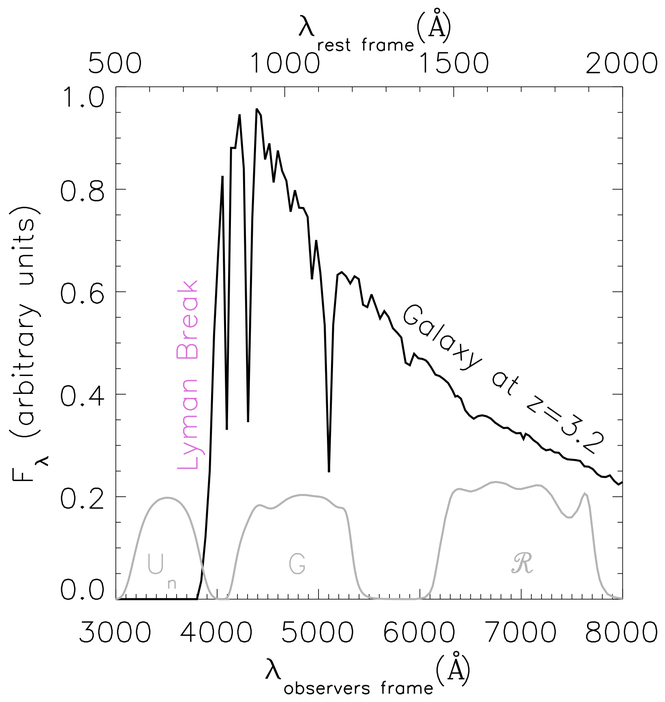
and using the results from a radiative transfer model[4] to process the starlight.

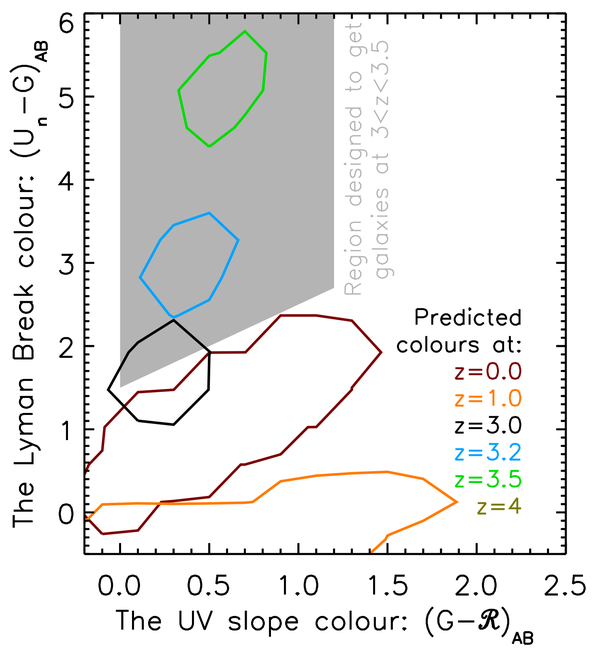
No parameters have been re-tuned here!!

This model reproduces the observed numbers and redshift distribution of submm galaxies, $z \sim 2$, and the observed luminosity functions of LBGs[5], $3 \leq z < 10$.

Selecting galaxies at $z > 2.5$

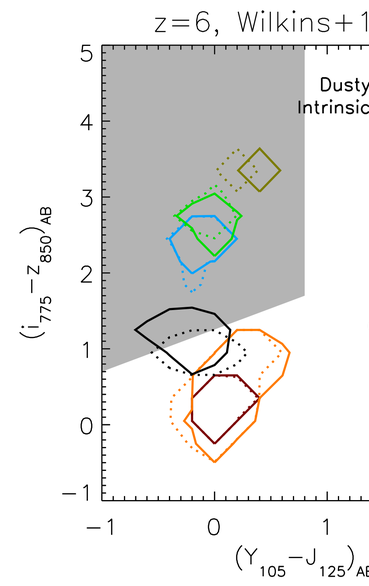
Observationally, the most extended way to select galaxies at $z > 2.5$ is to make use of the drop-out technique, which selects star forming galaxies by using a colour sampling their Lyman Break:

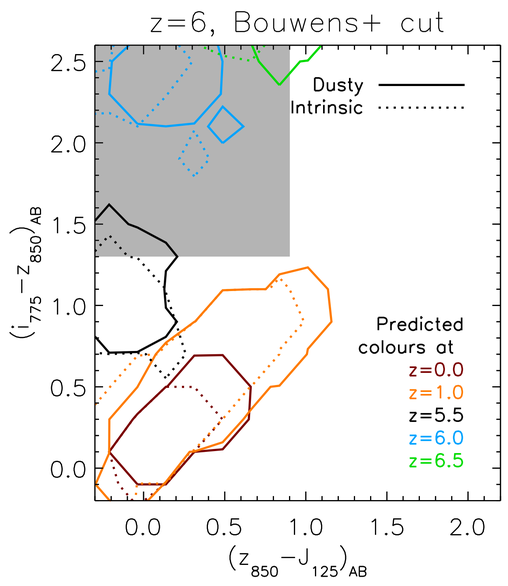


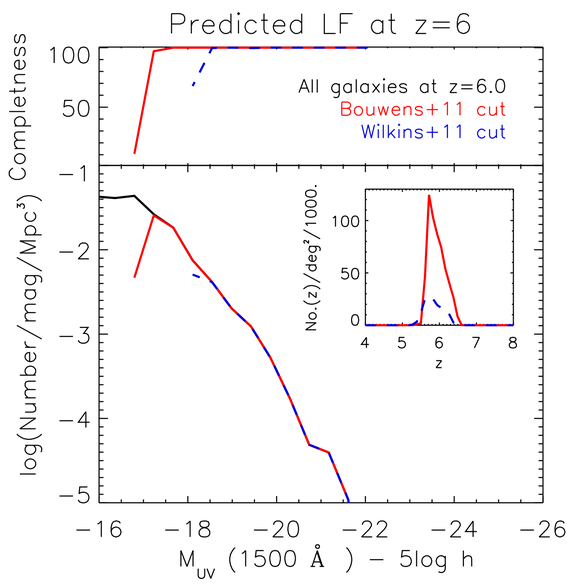


The predicted UV colours are in agreement with those observed

We have selected modelled galaxies at different redshifts using similar magnitude and colour cuts as those used observationally for the drop-out technique (see the left panel). By doing this, we find that the modelled galaxies at $2.5 < z < 10$ have colours within the observationally expected regions (see figures below and in the left panel). As it is shown in ↘ the plot with the predicted luminosity function (**LF**), we also find that by applying the observational colour cuts to the modelled galaxies we obtain a **redshift distribution** centred in the expected redshift and that, at this redshift, we are recovering most of the bright galaxies.

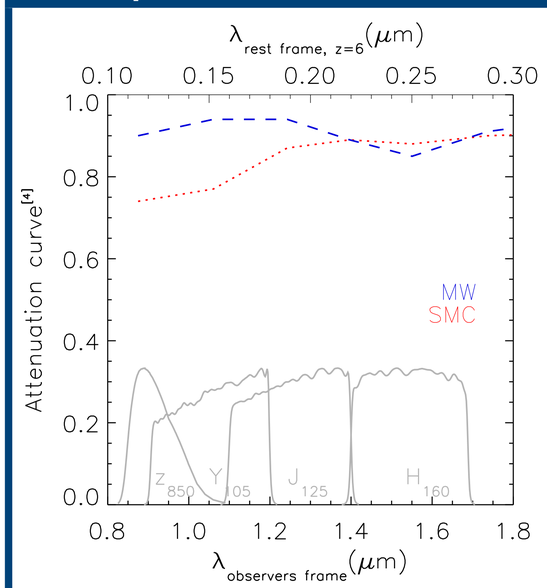


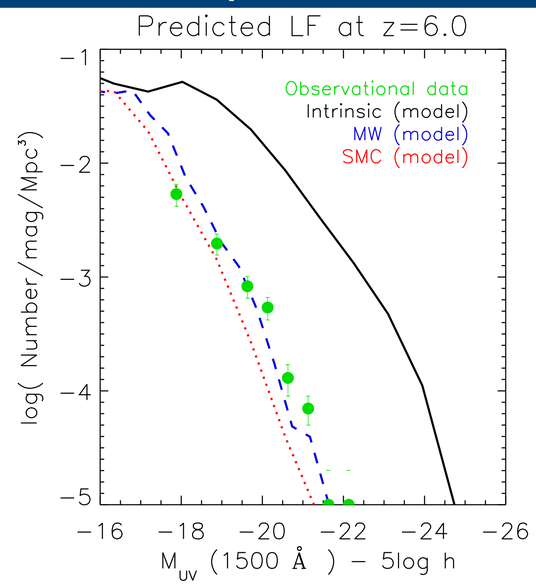


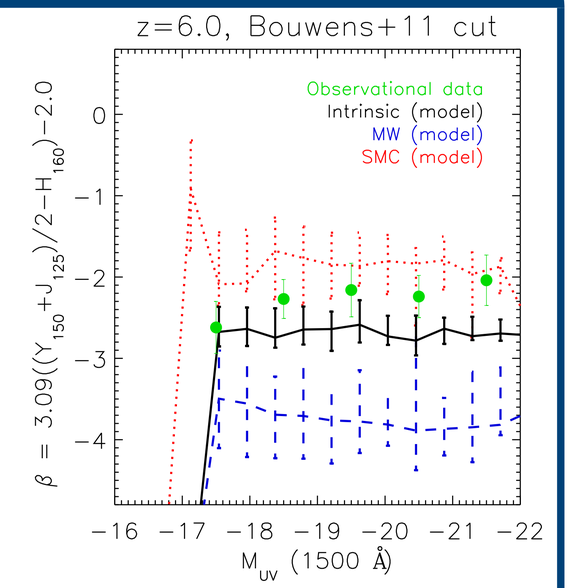


Changing the prescription for the intergalactic absorption of starlight or that for the evolution of stars does not affect the predicted UV colours, which are most sensitive to the treatment of dust.

The predicted UV-continuum slope and the different dust extinctions







↑ The attenuation curves coming from the radiate transfer model[4] depend on the input extinction curve. Changing this has an impact on both the predicted UV LF ↑ and UV colours. Observationally, the UVC slope is measured by a UV colour. At most redshifts, huge differences are found for the UVC slope calculated with different initial extinction curves ↑.

References

[1] Baugh et al., 2005, MNRAS, 356, 1191.
[2] Bouwens et al. 2011, ApJ, in press.
[3] Cole et al., 2000, MNRAS, 319, 168.
[4]Ferrara et al., 1999, ApJS, 123, 437.
[5] Lacey et al., 2011, MNRAS, 412, 1828.
[6] Steidel et al., 1995, AJ, 110, 6.
[7] Wilkins et al., 2011, MNRAS, 417, 717.