THE MIDLIFE CRISIS OF THE MILKY WAY & M31

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ARE THE MILKY WAY & M31 TYPICAL L* SPIRAL GALAXIES?

Our host galaxy, the Milky Way, and our nearest neighbour, M31, are two of the most closely studied galaxies in the universe.

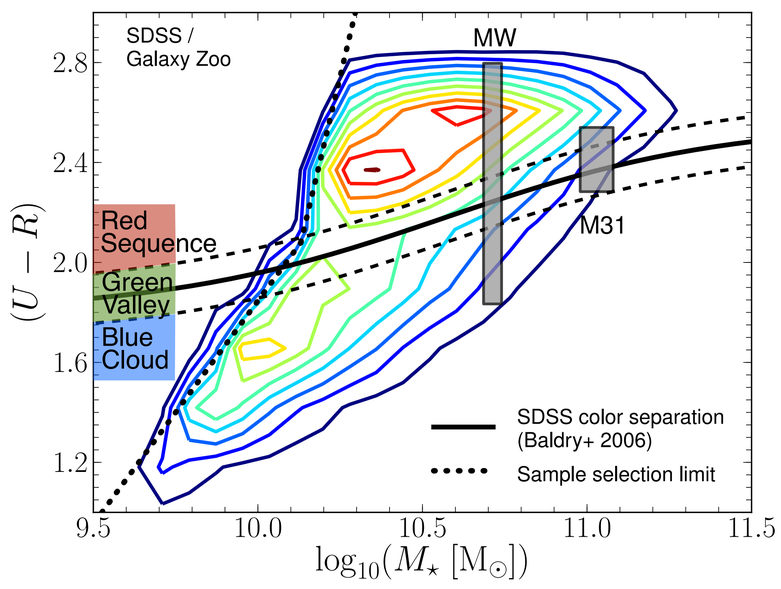
What will next generation galactic surveys focused on the Milky Way teach us about the broader evolution of massive spiral galaxies in the local and high redshift universe?

Is the Milky Way representative enough to use as a template for L* spiral galaxy formation?

Test 1 - Global colours

The position of the Milky Way and M31 on the colour vs. stellar mass plane.

The coloured contours indicate the distribution of observed galaxies from Galaxy Zoo/ SDSS data. [1] The solid black and dashed lines show the location of the green valley. [2]

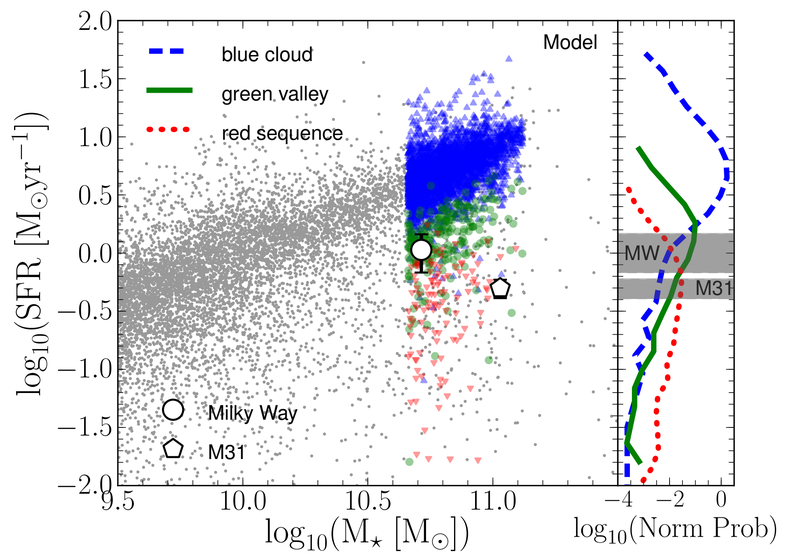


If we select only Milky Way/M31-type galaxies from the SDSS data, we find that 1 in 6 lie on the green valley or red sequence. The position of the Galaxy and M31 relative to this is suggestive.

Test 2 - Star Formation Rates

The *observed positions* of the Milky Way and M31 on the star formation rate vs. stellar mass plane of a sample of *theoretical* galaxies generated from a semi-analytic galaxy formation model [3].

The coloured points show a sample of theoretical Milky Way/M31 analogue galaxies. The right hand panel shows the normalised probability distribution of star formation rates for these objects.



The global colours, coupled with the low measured star formation rates of both galaxies, indicate that the Milky Way and M31 may both be "green valley" members...

Such "green" galaxies are typically thought to be transition objects, whose star formation rates are in a state of decline.

WHAT CAN TURN A MASSIVE SPIRAL GREEN?

AGE?

In our model Milky Way/M31 analogue sample, the distribution of formation times for red, green & blue galaxies are almost identical...

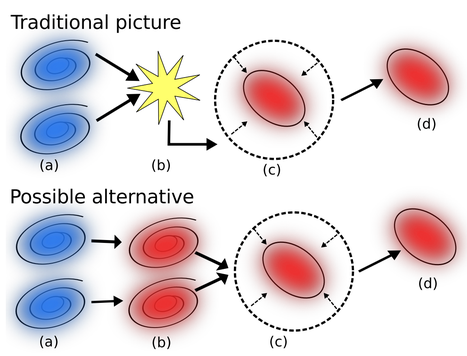
COLD GAS DEPLETION?

Cold gas is the fuel for star formation.
Red model analogue galaxies posses, on average, 1.8 times less cold gas than their blue counterparts.

but WHY...?

In our model, AGN radio-mode activity is responsible for cutting off the supply of fresh cold gas to these galaxies.
Although we do not claim that this is true in the real life Milky Way and M31, possible evidence does exist for recent low level activity of Sgr A* (the central black hole of our Galaxy). c.f. the recently detected Fermi-bubbles above and below the galactic plane [4].

IMPLICATIONS FOR SPIRAL GALAXY EVOLUTION...



[Upper] **Illustration of the standard paradigm for galaxy evolution in a hierarchical universe.**

[Lower] **The alternative evolution suggested by a green, passively evolving population of spiral galaxies.**

In this alternative scenario there is a depletion of cold gas, and an associated reddening of the stellar populations, which has already occurred in both galaxies before the merger event. With insufficient cold gas to act as fuel, no powerful quasar mode burst occurs.

This may well be the fate of both the Milky Way and M31 which are expected to merge some time within the next 5 Gyr [5] ...

ABOUT THE AUTHOR

Simon Mutch: I'm a 2nd year PhD student working on galaxy formation & evolution, predominantly with semi-analytic galaxy formation models.

REFERENCES

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Check out the paper!...

http://goo.gl/WhrDG