This is me. If you have questions please do not hesitate to ask me.

Chemical evolution of galaxies at z<1.5

C. Maier[1], S.J. Lilly[1], C.M.Carollo[1], K. Meisenheimer[2], H. Hippelein[2] & A. Stockton[3]
[1]ETH Zurich, [2]MPIA Heidelberg, [3]Institute for Astronomy Hawai'i

Abstract

We report VLT-ISAAC and Keck-NIRSPEC near-infrared spectroscopy for a sample of 5 [OII] - selected galaxies at z~1.4, and 30 CFRS galaxies at 0.5<z<0.9.

We derive the extinction and oxygen abundances for the sample using a method based on a set of ionization parameter and oxygen abundance diagnostics, simultaneously fitting the [OII], Hβ, [OIII], Hα, and [NII]λ6584 line fluxes.

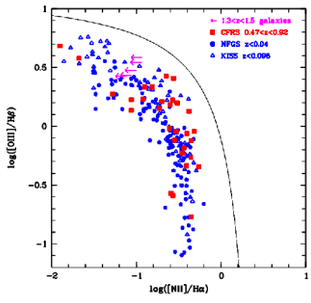
We find that about 1/3 of the 0.5<z<0.9 CFRS galaxies in our sample have substantially lower metallicities than local galaxies with similar luminosities and SFRs. Comparison with a chemical evolution model indicates that these low metallicity galaxies are unlikely to be the progenitors of metal-poor dwarf galaxies at z ~ 0, but more likely the progenitors of massive spirals.

The z ~ 1.4 galaxies have high [OIII]/[OII], low extinction and low metallicity, typical of lower luminosity 0.4<z<0.7 CADIS galaxies, and of more luminous LBGs at z ~ 3.1, but not seen in 0.5<z<0.9 CFRS galaxies. Our analysis of the z<1.5 metallicity-luminosity relation suggests that the period of rapid chemical evolution may take place progressively in lower mass systems as the universe ages. Our results are consistent with a "downsizing" type picture in the sense that particular signatures (e.g., high [OIII]/[OII] or low [O/H]) are seen in progressively more luminous (massive) systems at higher redshifts.

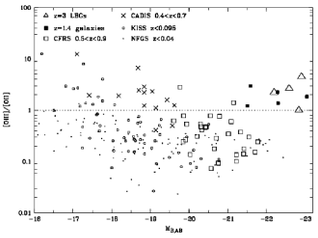
Finally, preliminary results on metallicities of (z)COSMOS galaxies at z<1 are presented.

For more details see Maier et al. 2005, ApJ, 634, 849
Maier et al. 2006, ApJ, 639, 858

Diagnostic diagrams

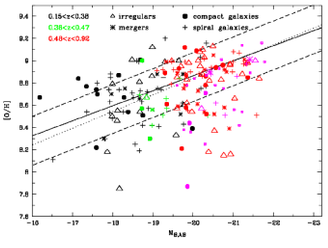


Diagnostic diagram to disentangle star-formation dominated galaxies from AGNs. The position of the five galaxies at z ~1.4 is shown by the magenta arrows, since only upper limits for [NII]λ6584 could be derived. Also plotted are 30 0.47<z<0.92 CFRS galaxies (red filled squares), 108 local NFGS galaxies from Jansen et al. (2000, blue filled circles), and 70 local KISS galaxies from Melbourne & Salzer (2002, blue open triangles). All the plotted galaxies, including the z~1.4 galaxies, lie below the solid line, i.e., the theoretical threshold computed by Kewley et al. (2001) above and to the right of which galaxies are dominated by an AGN. In all plotted galaxies the emission is thus dominated by star formation.

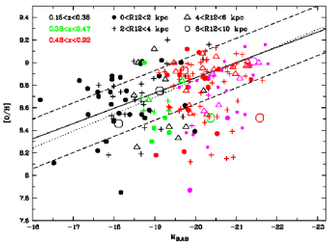


The basic trends in our data are consistent with a ``downsizing" picture (Cowie et al. 1996) in the sense that a given type of spectrum, high [OIII]/[OII], is found almost exclusively below a luminosity threshold which is low at zero redshift ($M_{B,AB}$~ -18.5), increases to $M_{B,AB}$~ -20.5 at z~0.7, and has evidently increased to above $M_{B,AB}$ ~ -23 at z ~ 1.4.

Preliminary results on oxygen abundances of (z)COSMOS galaxies at 0<z<1

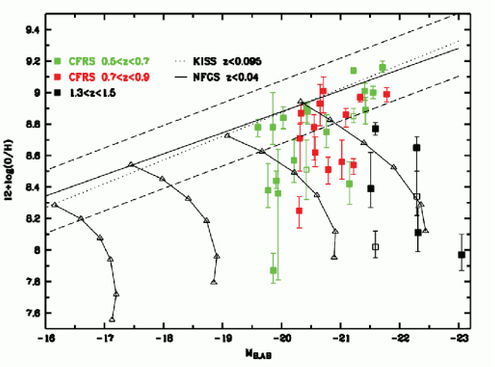


Preliminary metallicity-luminosity diagram using VLT spectra of ~170 galaxies at z<1 from the (z)COSMOS survey as a function of morphologies determined by eye from HST ACS images. The pink symbols are the [O/H] measurements for the 30 CFRS galaxies at 0.47<z<0.92.



Preliminary metallicity-luminosity diagram as a function of half-light radius $r_{1/2}$ determined from HST ACS images (see poster of Sargent et al). The pink symbols are the [O/H] measurements for the 30 CFRS galaxies at 0.47<z<0.92.

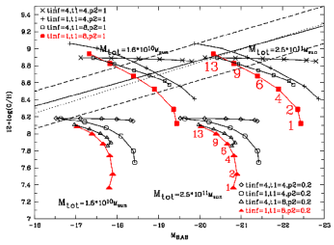
The metallicity-luminosity relation at 0<z<1.5



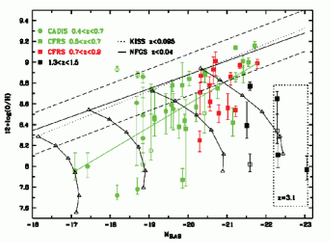
Oxygen abundance vs. $M_{B,AB}$ for the z~1.4 galaxies (black filled squares). Plotted are also the CFRS galaxies, split in two redshift bins: CFRS galaxies at 0.5<z<0.7 are plotted as green filled squares, while CFRS galaxies at 0.7<z<0.9 are plotted as red filled squares. Open squares and circles are the alternative (but less probable) oxygen abundance solutions. The nearby NFGS and KISS galaxies have [O/H] lying between the dashed lines (with the solid and dotted lines indicating the mean local relation for NFGS and KISS galaxies, respectively). All oxygen abundances were uniformly measured using the code based on the Kewley and Dopita (2002) models. The tracks show a subset of theoretical Pegase2 models which are consistent with the local metallicity-luminosity relation.

There is an age-redshift relation along a given Pegase2 track. The z~1.4 galaxies appear "younger" than the 0.7<z<0.9 galaxies (red filled squares), in the sense that they lie towards the beginning of the luminosity-metallicity track. The latter appear in turn to be on average younger than most 0.5<z<0.7 galaxies (green filled squares), which themselves actually overlap significantly on the metallicity-luminosity relation traced by nearby galaxies.

The lower metallicity CFRS galaxies are consistent with evolving into NFGS and KISS galaxies with slightly (0.5-0.9 mag) lower luminosities and higher metallicities (factor ~2).



Several Pegase2 models for different t_1, p_2, t_{infall}, and M_{tot}, compared to the local metallicity-luminosity relation. The nearby NFGS and KISS galaxies have oxygen abundances lying between the dashed lines (with the solid and dotted lines indicating the mean local relation for NFGS and KISS galaxies, respectively).



Oxygen abundance vs. $M_{B,AB}$ for galaxies at 0<z<1.5. Adding the lower luminosity CADIS galaxies from Maier et al. (2004, green filled circles) to the diagram, it seems that the rate of evolution of galaxies along their tracks appear to depend on luminosity (mass): at the look-back time of about 6 Gyrs (z~0.6), at which a significant fraction of more massive $M_{B,AB}$<-20 galaxies are still close to the zero redshift metallicity-luminosity relation, the lower luminosity objects with $M_{B,AB}$>-19 sampled by CADIS are already quite far from the local metallicity-luminosity relation. Moreover the metallicity-luminosity relation of the combined CFRS+CADIS sample (green solid line) shows a change in slope compared to the local relation, which may be due to the fact that lower luminosity (mass) galaxies began their most rapid evolution later than high-luminosity galaxies.

As we look further in time, we find signs for departures from the z=0 metallicity-luminosity relation occuring at progessively higher luminosities (masses).

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ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich
Institut für Astronomie