The high-z mass-metallicity relation

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The Mass-Metallity relation in z≈0.1 galaxies
The Luminosity-Metallity relation at 0.3<z<1.0 galaxies

TKRS (Kobulnicky & Kewley 2004)
Sample selection in GDDS

- Four 5.5’×5.5’ fields $K<20.6$ complete
- $0.4 < z < 1.0$
- Hβ, [OII] & [OIII]
  (Kobulnicky&Kewley 04 $R_{23}$)
- 14 $K<20.6$ galaxies ($VIzK$), 15 $K>20.6$ ($VIz$)
- Combine with 66 $K<20.2$ CFRS galaxies
  (metallicities from: Lilly et al. 2003)
Sample selection in GDDS

Selected sample

\[ I_{AB} \] vs. redshift
GDDS Star-forming galaxies at 0.4<z<1.0

[Diagram showing spectral lines with rest wavelengths and flux values for various redshifts: z=0.913, z=0.791, z=0.7865, z=0.567. Each line is labeled with its corresponding element ([OII], [NeIII], Hγ [OIII], Hβ, [OIII]).]
GDDS Star-forming galaxies at 0.4<z<1.0

Graph showing emission lines for different redshifts (z=0.818, z=0.918, z=0.4705, z=0.4696) with rest wavelength in Angstroms (Å) on the x-axis and flux density in $10^{-16}$ ergs s$^{-1}$ cm$^{-2}$ Å$^{-1}$ on the y-axis.
GDDS Star-forming galaxies at 0.4<z<1.0
Balmer absorption correction $\text{EW}(\text{H} \beta) = 3-5 \ \text{Å}$

Mean optical extinction $A_\nu = 2.19 \pm 0.32 \ \text{mag}$

$12 + \log (\text{O}/\text{H})_{K\&K04} \approx 12 + \log (\text{O}/\text{H})_{\text{McG91}} + 0.1$
The Luminosity-Metallity relation at 0.3<z<1.0 galaxies

Kobulnicky & Kewley (2004)
Star-forming galaxies at 0.4<z<1.0
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Time evolution of the mass-metallicity relation
Time evolution of the mass-metallicity relation

\[ \Delta \log M^* = -3.038 \log t_h + 3.223 \]
Time evolution of the mass-metallicity relation

Graphs showing the relationship between the mass of a galaxy (log M [M_☉]) and the metallicity (12+log(O/H)) at different redshifts (z). The graphs are plotted against the age of the Universe (Gyr) and the mass of the galaxy (M*).

Key points:
- At z=0.1:
  - M* = 10^{11}
- At z=0.71:
  - M* = 10^{9.5}
- At z=2.31:
  - M* = 10^8
Time evolution of the mass-metallicity relation

\[ y = \log M^* + 3.038 \log t_H - 3.223 \]

\[ 12 + \log (O/H) = -1.492 + 1.847y - 0.08026y^2 \]
Metal absorption in the neutral ISM

30 GDDS 1.2<z<2.0 galaxies

EW_{FeII} (\AA)

log M_\ast [M_\odot]

slope = 4.56±1.38

\langle GDDS \rangle z\sim1.6

\langle LBGs \rangle z\sim3

\langle HST dwarf \rangle z\sim0
Mass and Metallicities for 67 0.4<z<1.0 galaxies

Mass-metallicity unambiguous correlation

Redshift evolution of mass-metallicity relation

Mean dust extinction is $A_v \approx 2$

Mass-metallicity relation from cold ISM?