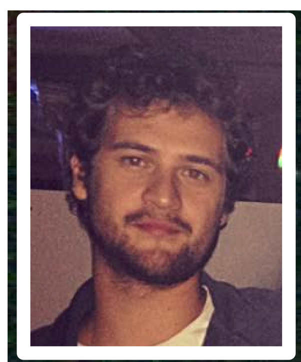

The origin of the silicon and iron dust depletions in DLA systems

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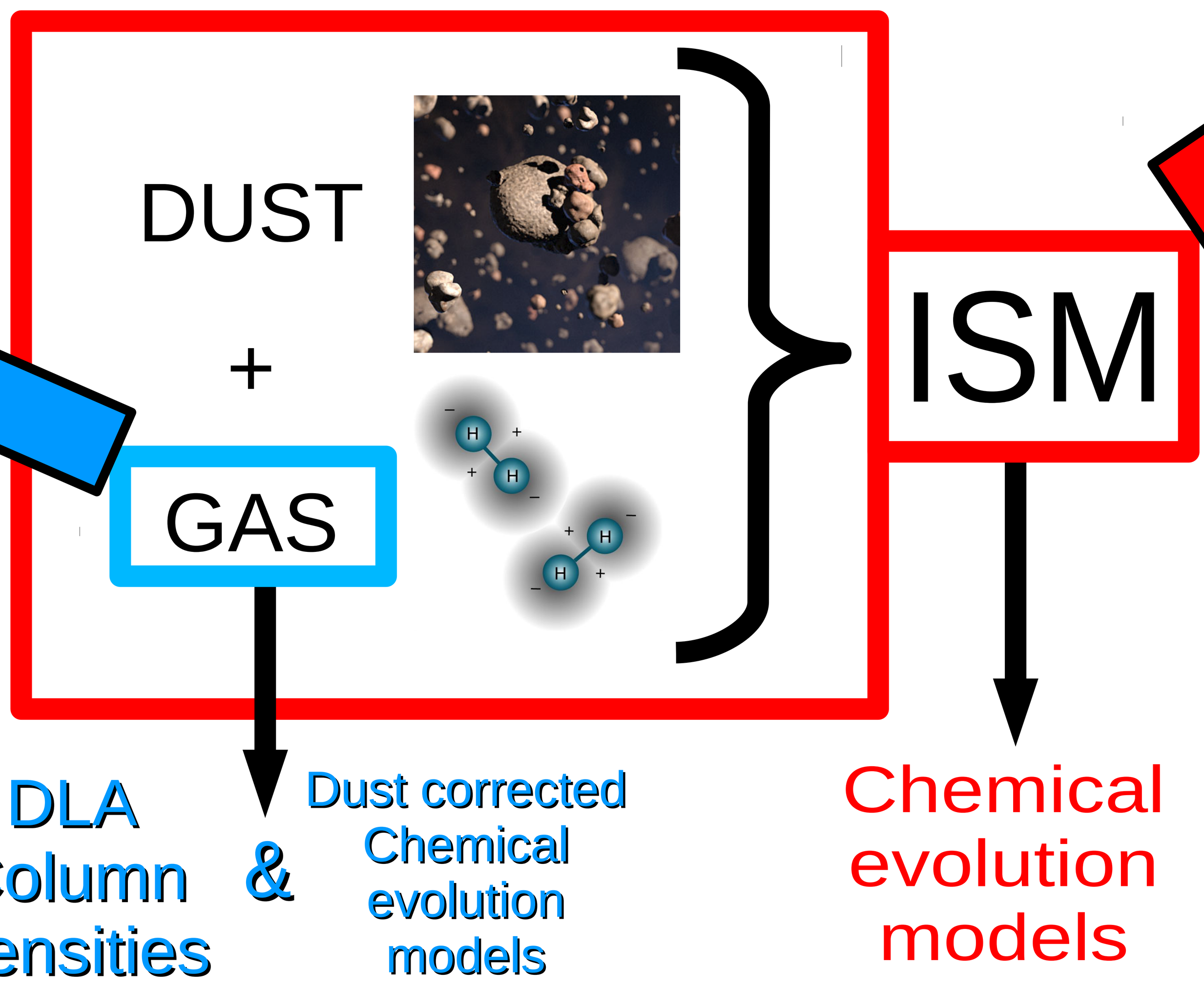
Introduction
chemical evolution model with dust and DLA systems

Column densities measured in DLAs only reveal the elemental abundances of the gas-phase of the interstellar medium (ISM). Dust abundances, instead, cannot be detected.
In this work, we compared DLA observations to a new chemical evolution model which takes into account the presence of dust (Gioannini et al. 2017). We consider dust production by Type II supernovae (SNe) and AGB stars, dust accretion and destruction in the ISM, dust astration and dust outflow caused by galactic wind.
We take advantage of characteristics of **volatile** and **refractory** elements to investigate and explain the origin of Si and Fe depletion patterns.



Chemical evolution models study the evolution of the chemical abundances in galaxies. Our model reproduces physical properties of dwarf irregular galaxies, which are associated to DLA-host ones.

Characteristics:
- Low and continuous star formation rate (SFR), moderate galactic wind
- Low mass and low luminosity galaxies with on-going SF.

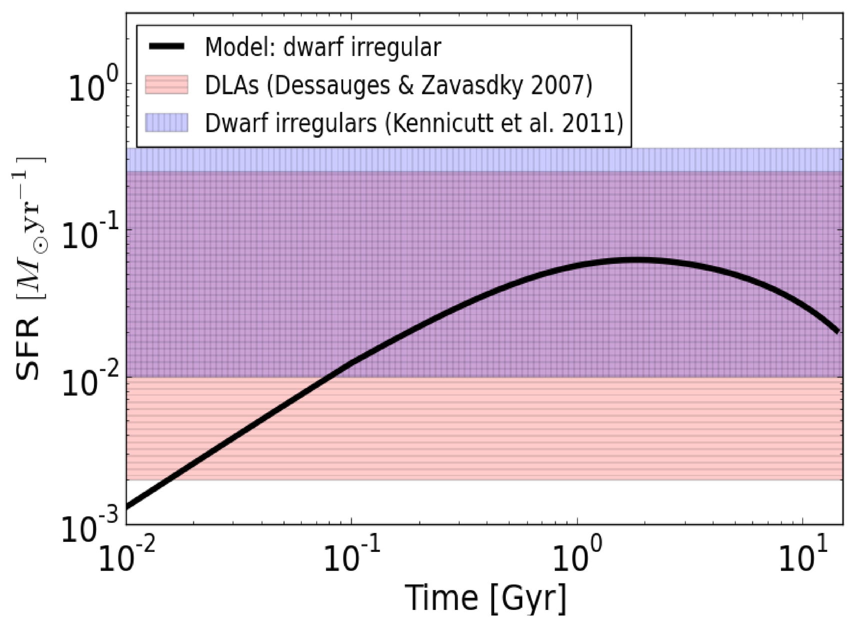
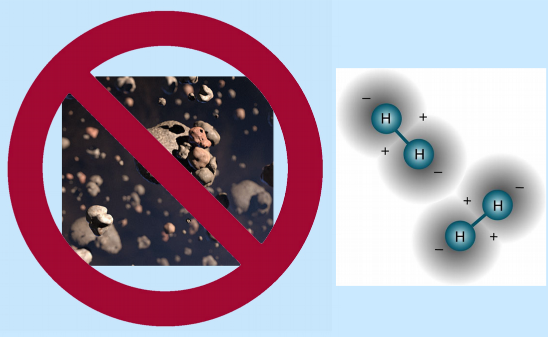
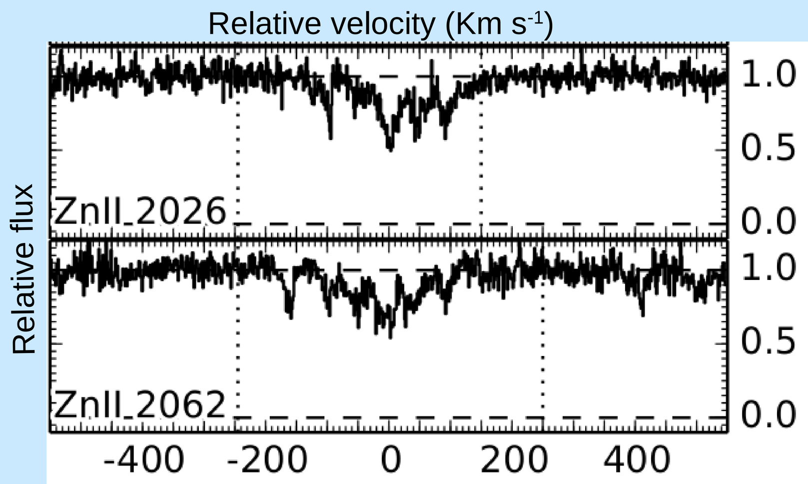


Fig. 1. Star formation histories of a typical dwarf irregular galaxy compared to measurements in DLAs.

Volatile elements
(Zn, S, P)

NO DUST





Volatile elements are characterized by low condensation temperatures and tend to stay in the gas phase of the ISM. Thus we expect **agreement between observed gas-phase abundances and model without dust correction**:

Models = DLA data

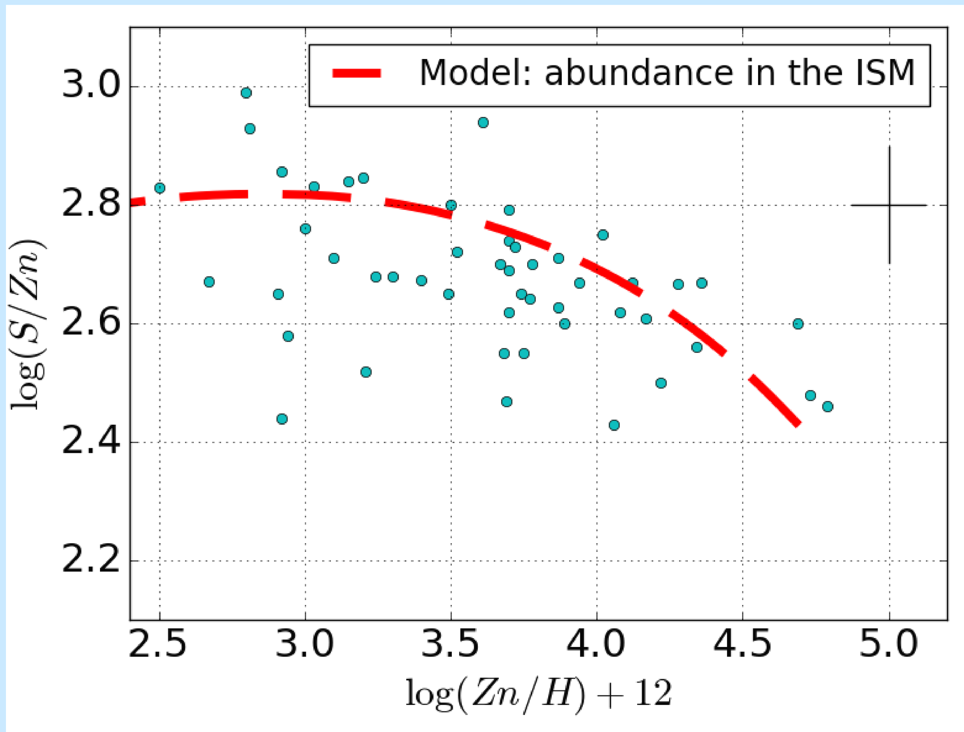
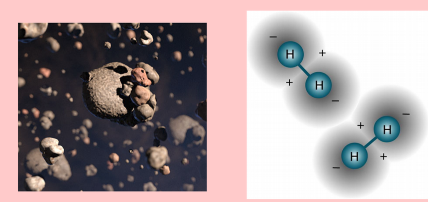
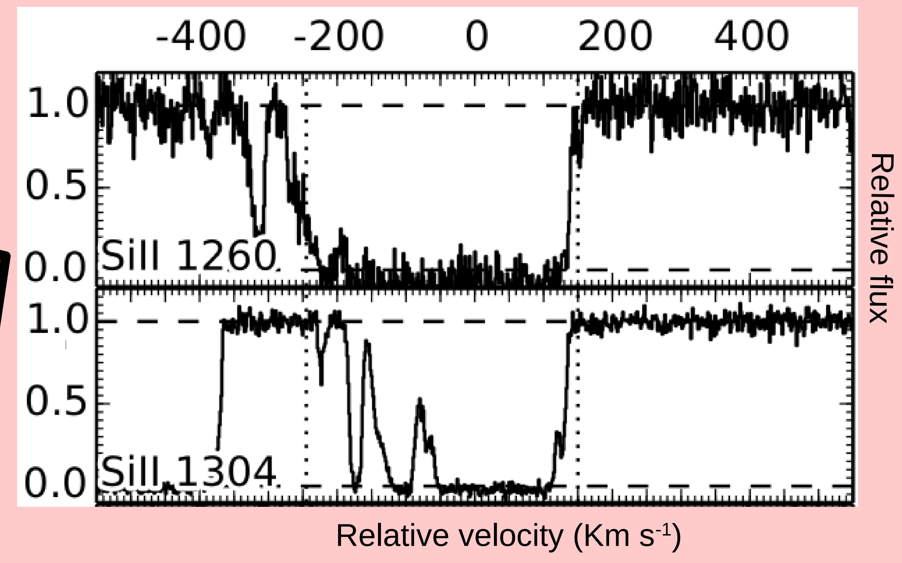


Fig. 2. Volatile S/Zn abundance ratios versus Zn/H in DLA systems for data and chemical evolution model (red dashed line). Data: collection of Vladilo et al. (2011) and Gioannini et al. (2017).

Refractory elements
(Si, Fe, O, Mg)

GAS & DUST





Refractory elements have high condensation temperatures and they tend to be incorporated into solid grains and no detectable from spectroscopy. Thus, we expect **NO agreement between measured gas-phase abundances and model. To match observations we need a model which takes into account the presence of dust.**

Models ≠ DLA data

Dust-corrected Model = DLA data

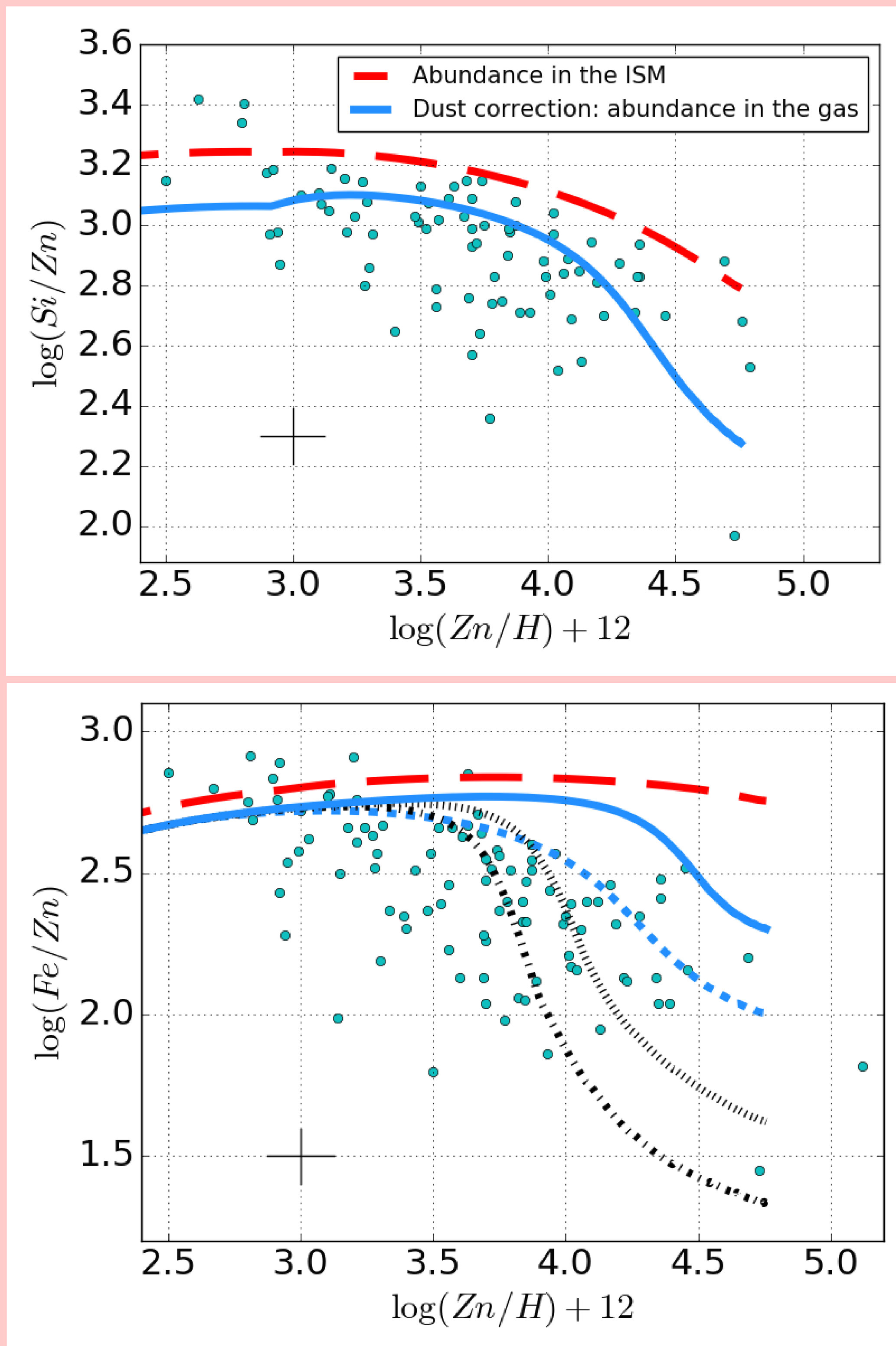


Fig. 3. Abundance ratios of refractory (Si,Fe) over volatile (Zn) versus log(Zn/H)+12. Data and ISM model same as in Fig. 2. Blue solid and dashed lines represent the dust-corrected model with and without dust contribution from Type Ia SNe, respectively. Black lines: models with more efficient iron-growth.

Conclusions

- The agreement between our models and data, confirms the tight connection between DLAs and dwarf galaxies
- The depletion pattern of refractories, compared with the dust-corrected model, suggests that **Si and Fe undergo a different history of dust formation and evolution.**
- Iron seems to be incorporated in a dust species different from silicates, such as in metallic particles.
- The depletion pattern of silicon can be easily explained by the dust production of Type II SNe and accretion in the ISM
- Iron in dust: models and data are in agreement only when assuming a more efficient dust accretion, which is consistent with the **presence of iron nano-particles in the ISM**.

References:

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