Galactic Archaeology

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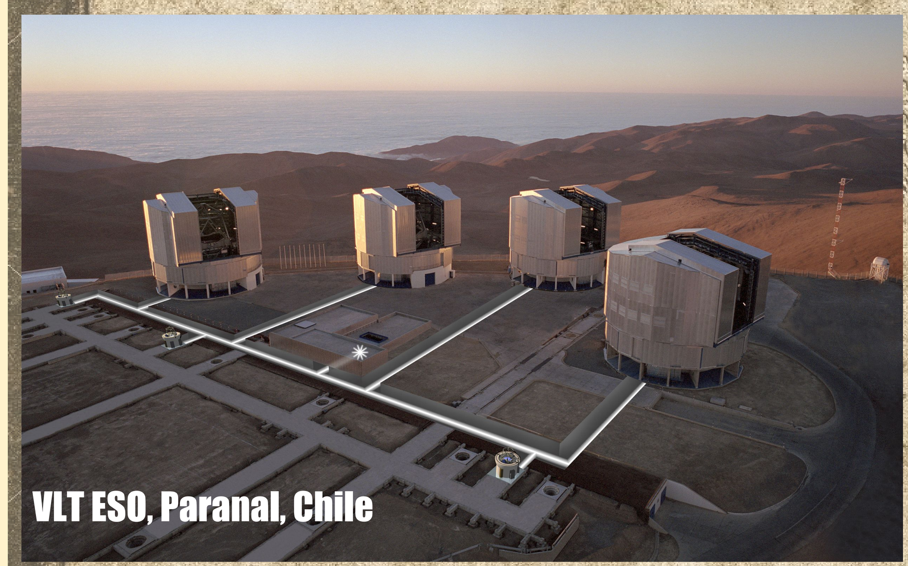
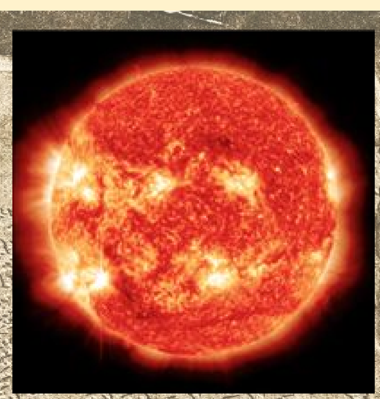
Galactic Archaeology aims at unveiling the Milky Way's history by studying the fossil record preserved in stellar light. Together with distances, ages and 3D velocities, chemical information will have a revolutionary impact on understanding galaxy formation. Stellar physics combines the observations with theoretical interpretations of the structure of stars. This knowledge is essential to decipher the observed chemical patterns within the Galaxy's stellar populations. Major new developments in stellar physics have a direct impact on understanding the observational data.

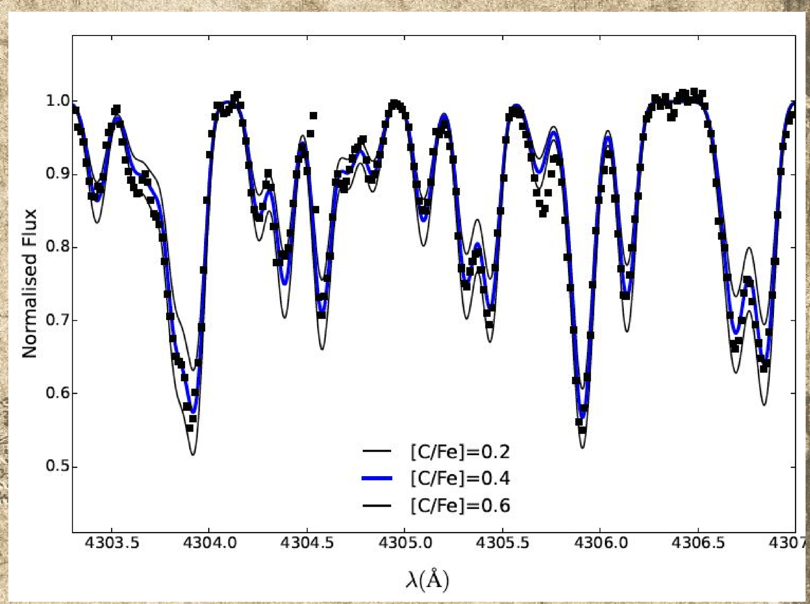




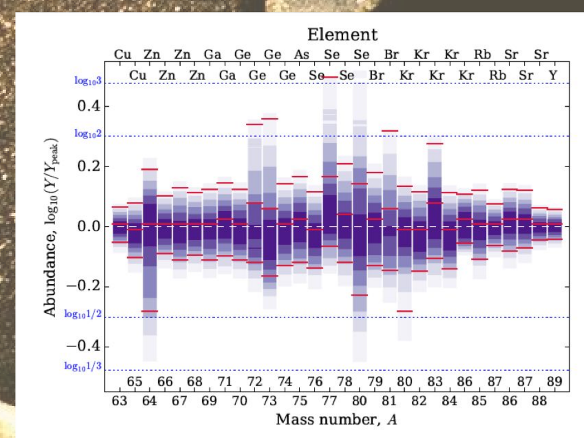
VLT ESO, Paranal, Chile

High resolution spectra of stars taken from the best telescopes

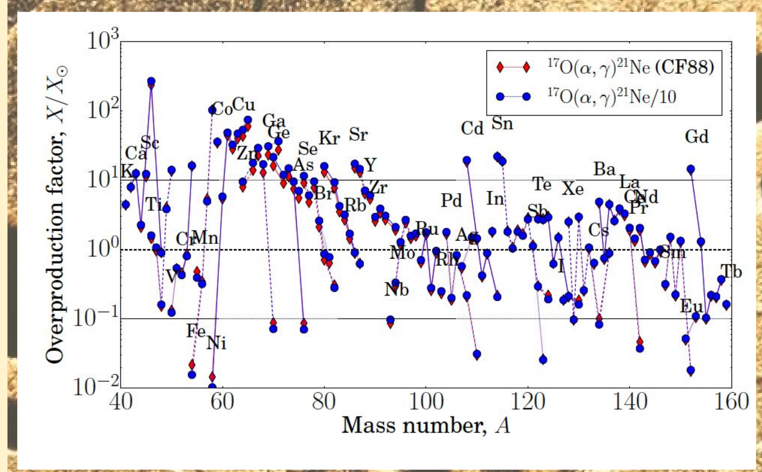
Chemical abundances of most of the elements can be measured.

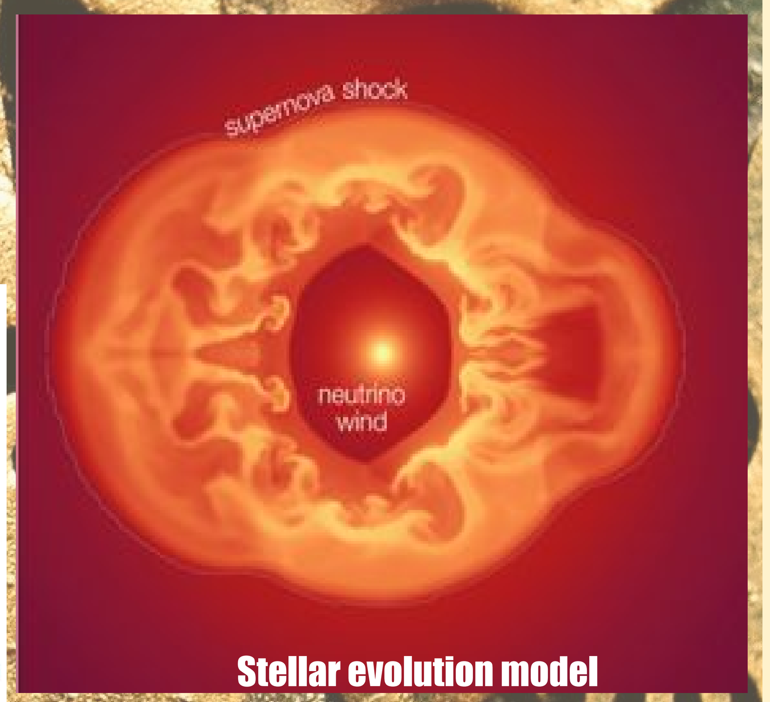


Uncertainties in nucleosynthesis due to nuclear reaction data



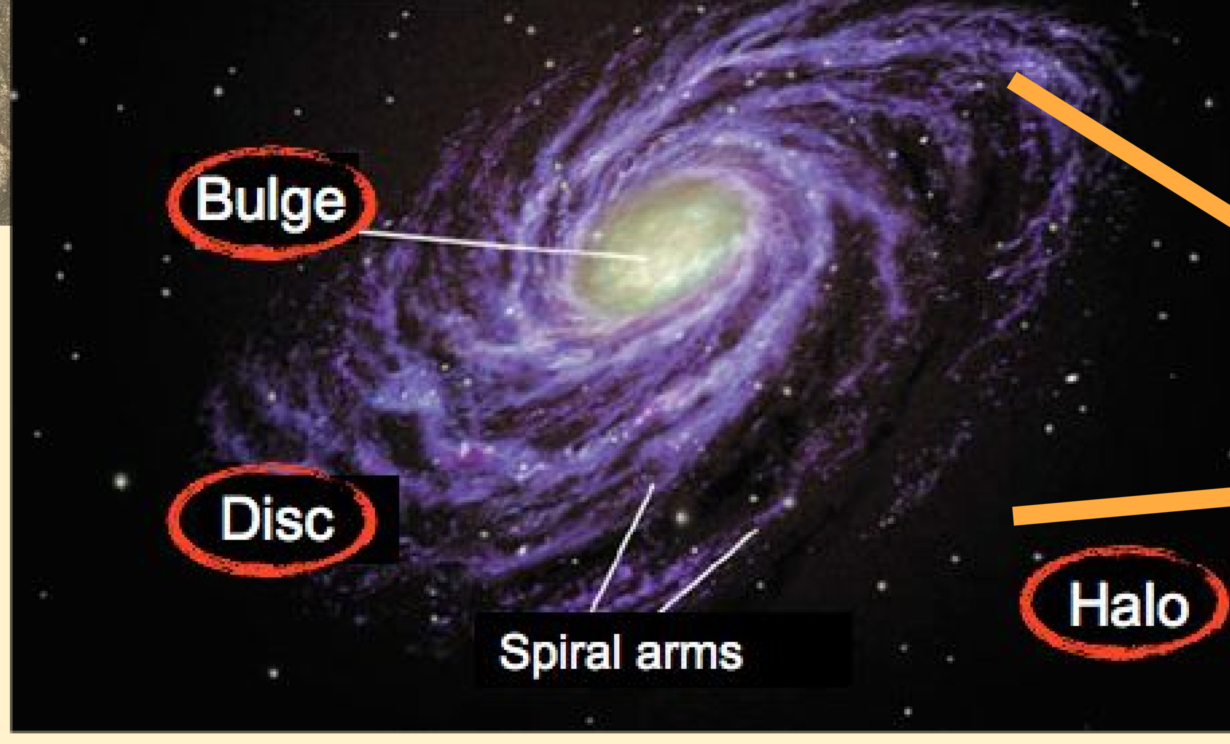
Stellar evolution model with nucleosynthesis

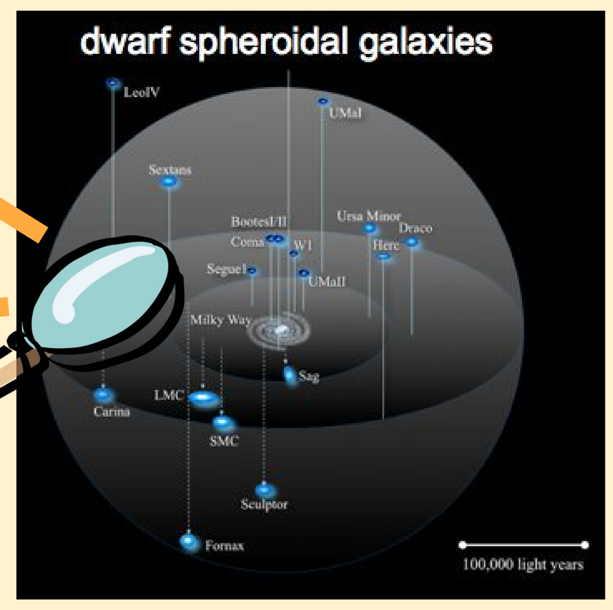




Stellar evolution model

Galactic chemical evolution



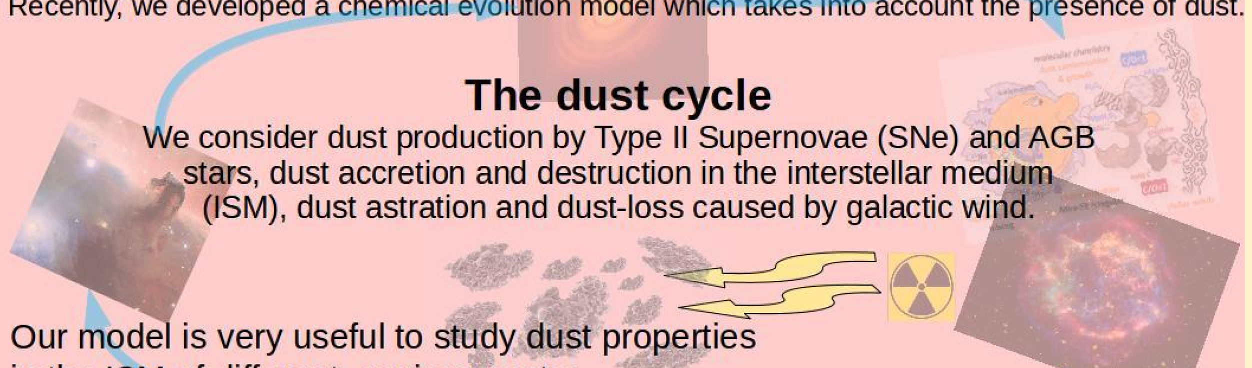


CHEMICAL EVOLUTION MODEL WITH DUST

Recently, we developed a chemical evolution model which takes into account the presence of dust.

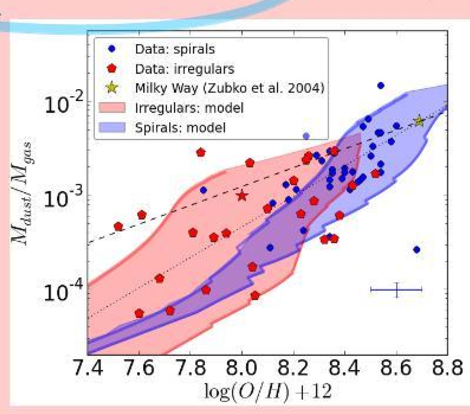
The dust cycle

We consider dust production by Type II Supernovae (SNe) and AGB stars, dust accretion and destruction in the interstellar medium (ISM), dust astration and dust-loss caused by galactic wind.



Our model is very useful to study dust properties in the ISM of different environments:

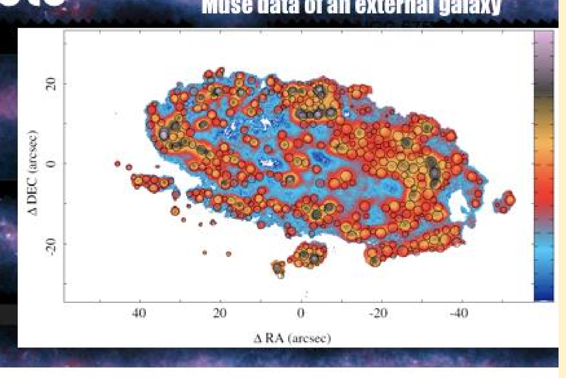
- **Elemental depletion** in Damped Lyman Alpha (DLA) systems.
- **Dust-to-gas** (D/G) **ratios** in the ISM of irregular and spiral galaxies (Figure).
- Investigate the **dust origin** in high redshift objects
- Study the **dust cosmic rate** across the Universe

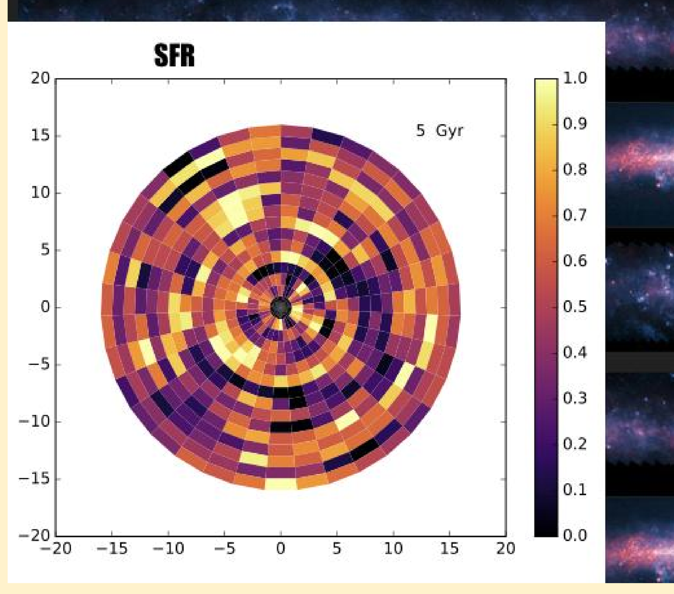


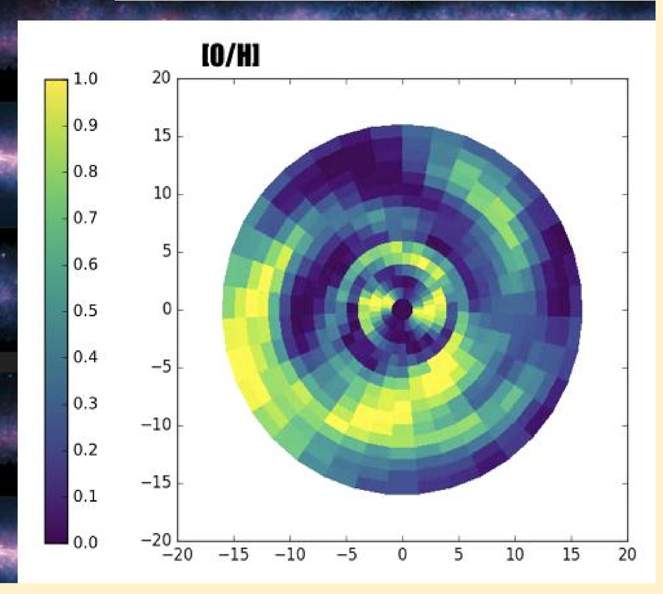
Models for the chemical evolution of galaxies need to account for collapse of gas and metals into stars, the synthesis of new elements within these stars, and the subsequent release of metal-enriched gas as stars lose mass and die.

Chemo-dynamical models

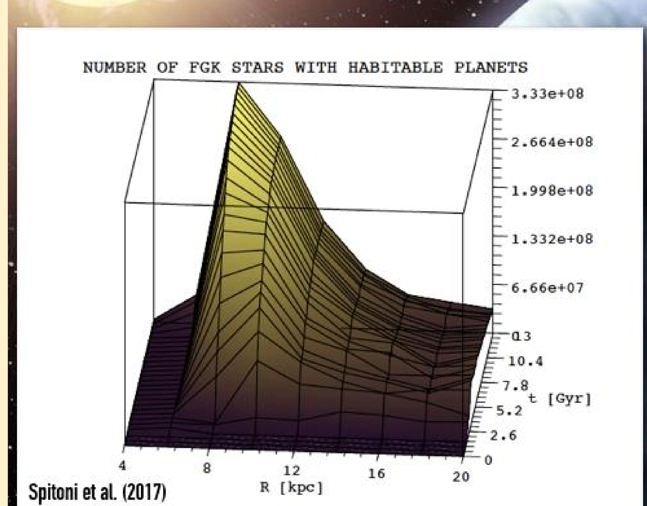
Using the most advanced results of hydrodynamical simulations, we create more realistic chemical evolution models. We can now compare our results with the most recent observations of external galaxies.







THE GALACTIC HABITABLE ZONE

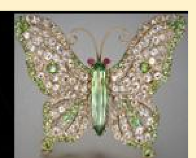


★ THE GALACTIC HABITABLE ZONE is defined as the region with sufficiently high metallicity to form planetary systems in which Earth-like planets could be born and might be capable of sustaining life, after surviving to close supernova explosion events (Gonzalez et al. 2001).

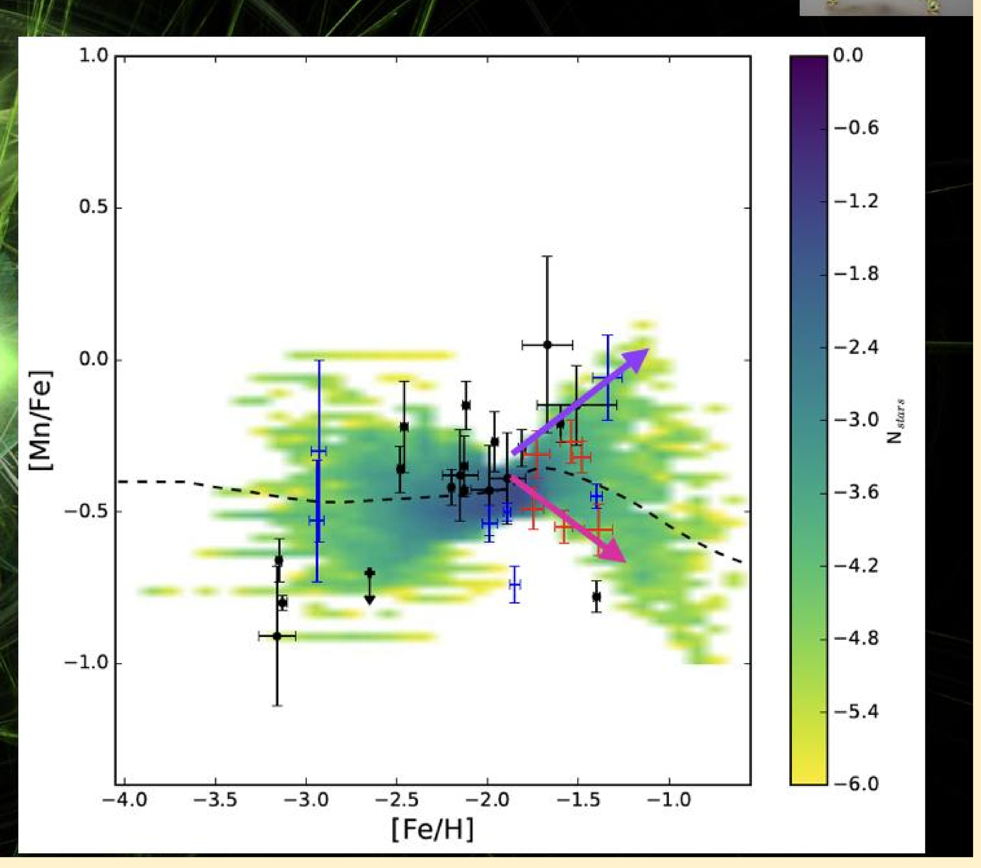
★ The maximum number of stars hosting habitable planets is at 8 kpc from the Galactic centre

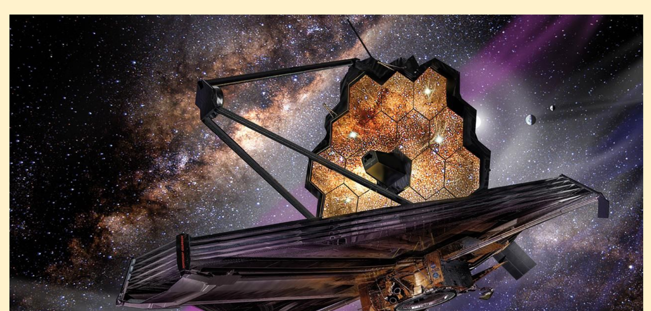
★ We apply detailed chemical evolution model for the Milky Way to study the Galactic habitable zone.

Stochastic chemical evolution models



We can study the origin of the spread in chemical abundance space. In this case it is originated by two possible SNe Ia progenitors: Chandrasekhar-mass & sub-Chandrasekhar mass





James Webb space telescope

THE FUTURE ...

ELT ESO, Armazones, Chile