Final Remarks

Francesca Matteucci

GRBs at high redshift

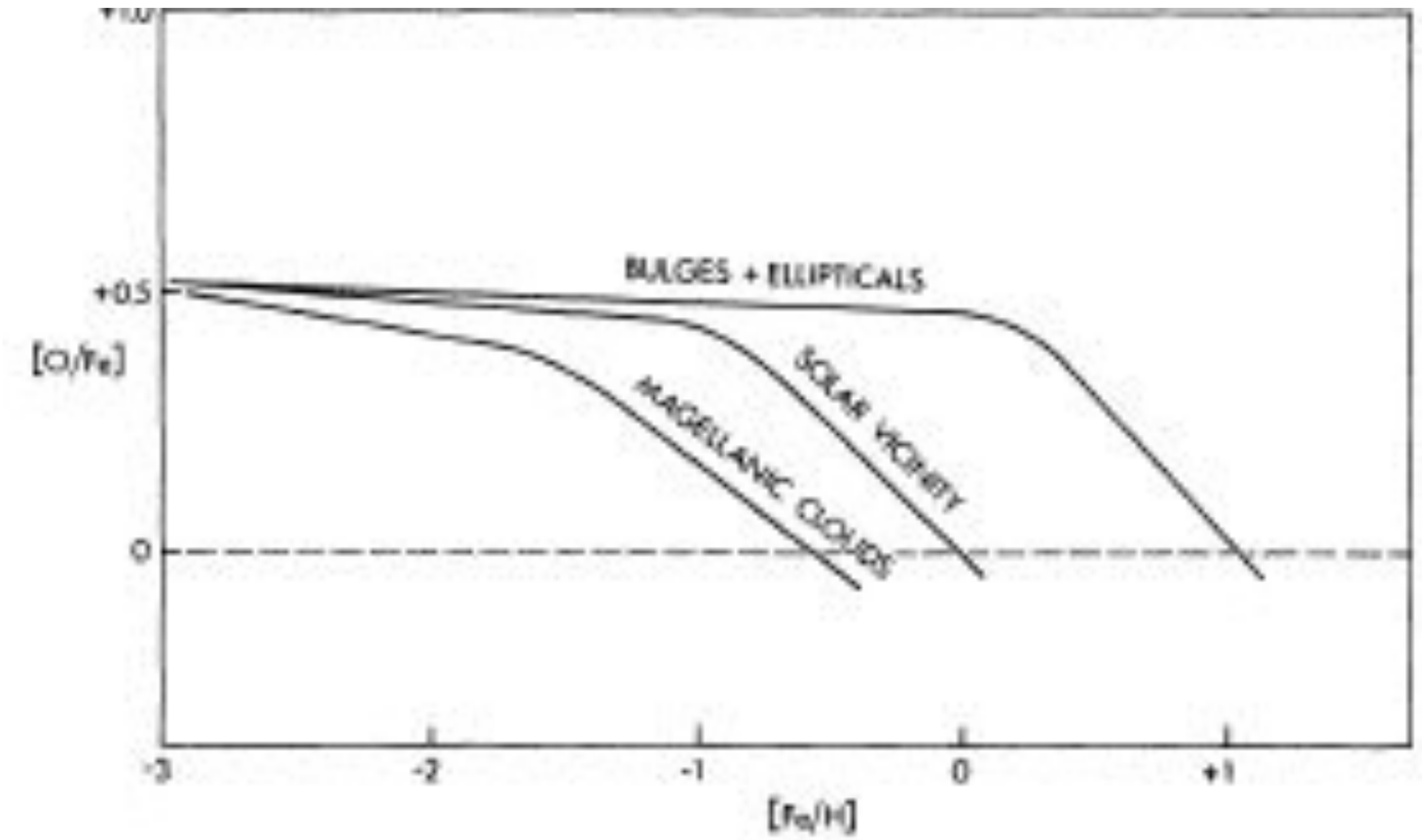
- GRBs are very powerful tools for studying the high-z universe

- They can trace the SFR, gas content and chemical abundances of the first galaxies

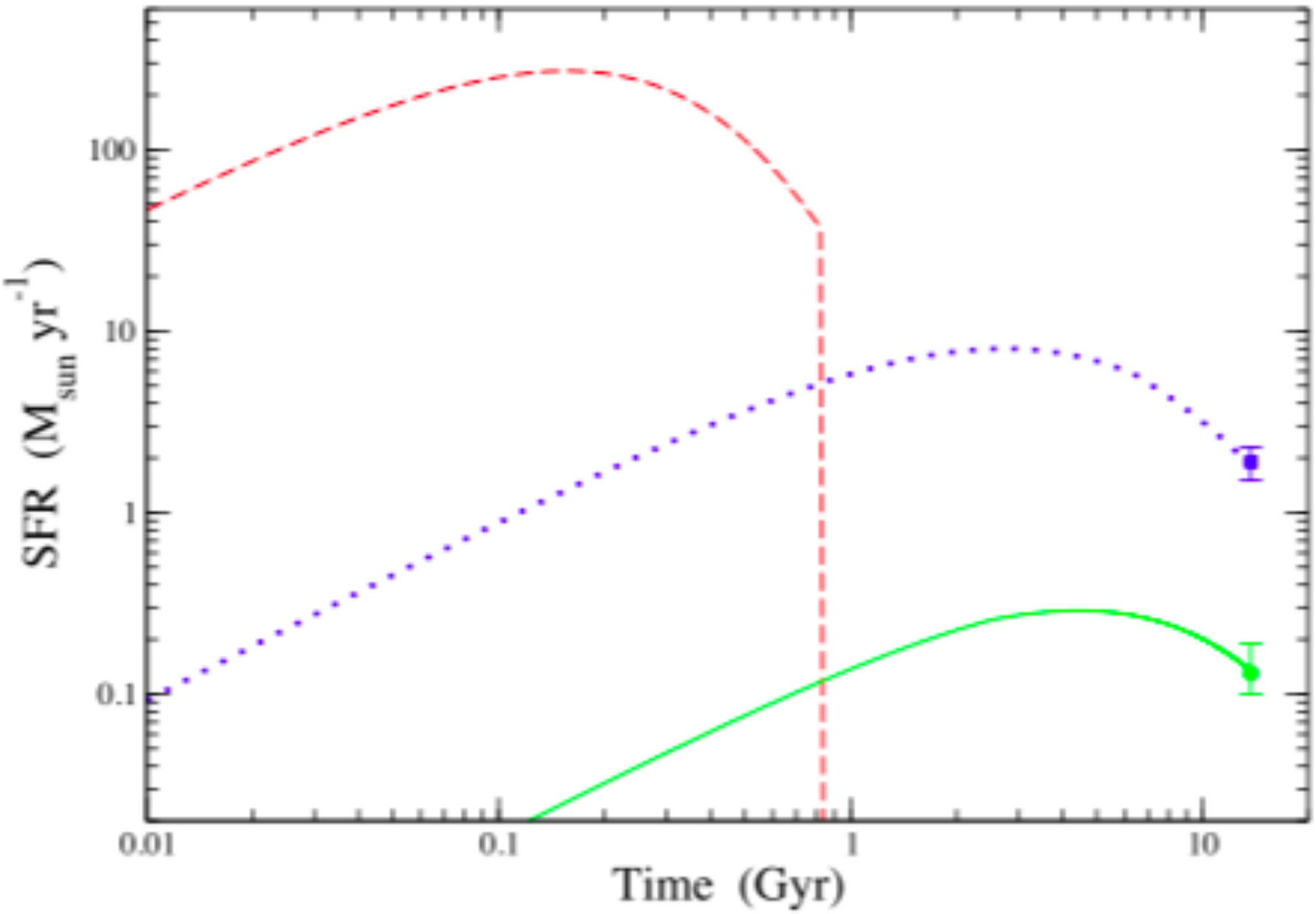
- Abundances and abundance ratios in host galaxies of long GRBs can tell us the morphological type of the hosts (see Grieco et al. 2014, MNRAS, 444,1065; Palla et al. 2020, 889, 4)

- Dust effects should be taken into account

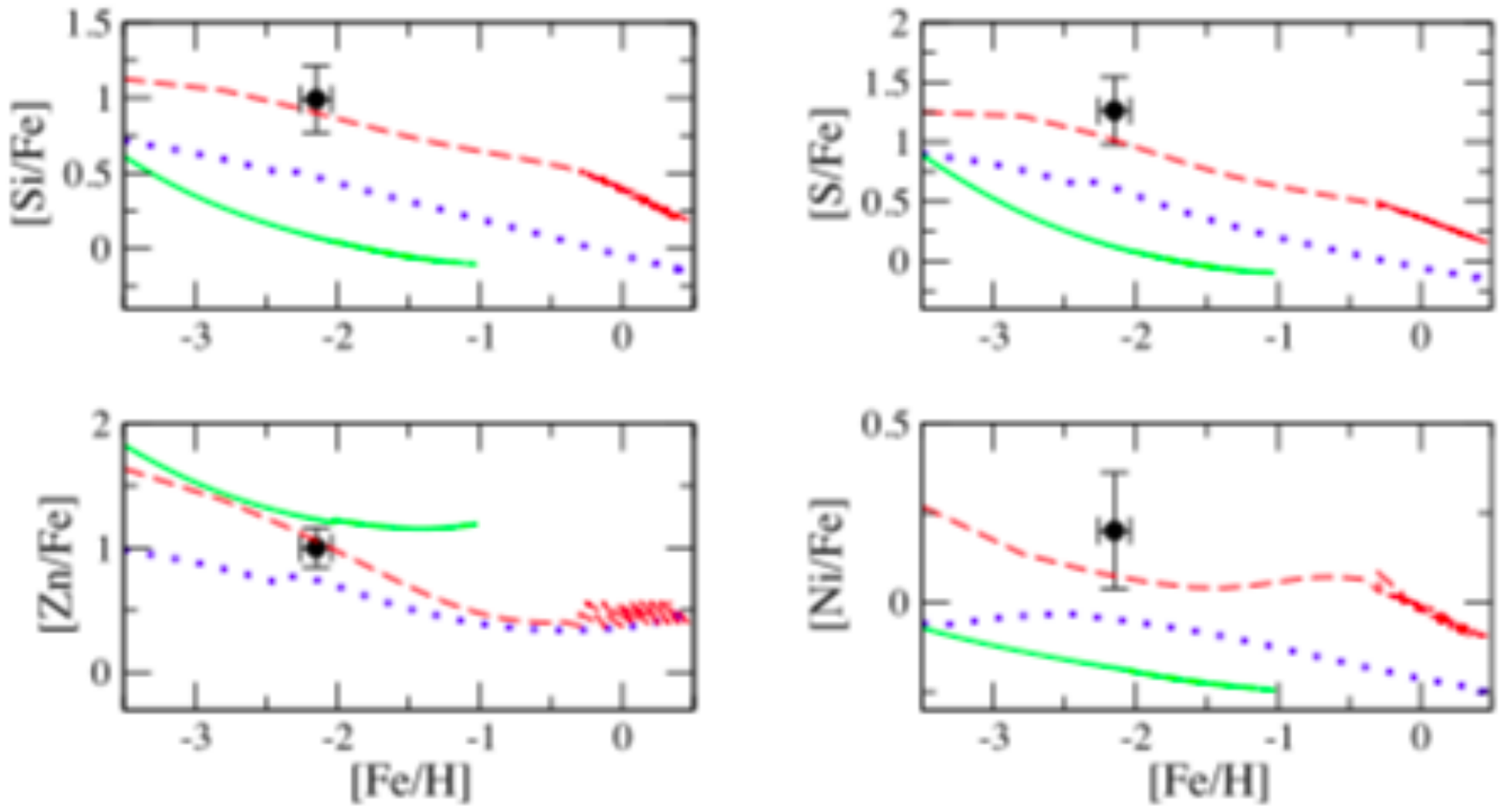
Time-delay model
Matteucci& Brocato 1990



SFRs in different galaxies:Grieco+2014



Example:GRB120 85 (z=2.3) host is a spheroid in formation



Galactic Archaeology at High Redshift: Inferring the Nature of GRB Host Galaxies from Abundances

Marco Palla[1,2], Francesca Matteucci[1,3,4], Francesco Calura[5], and Francesco Longo[2,4,6]
[1] Dipartimento di Fisica, Sezione di Astronomia, Universitá degli Studi di Trieste, via G.B. Tiepolo 11, I-34131, Trieste, Italy; marco.ball94@gmail.com
[2] IFPU—Institute for Fundamental Physics of the Universe, Via Beirut 2, I-34014, Trieste, Italy
[3] INAF, Osservatorio Astronomico di Trieste, via G.B. Tiepolo 11, I-34131, Trieste, Italy
[4] INFN, Sezione di Trieste, via A. Valerio 2, I-34100, Trieste, Italy
[5] INAF, Osservatorio Astronomico di Bologna, via P. Gobetti 93/3, I-40129, Bologna, Italy
[6] Dipartimento di Fisica, Universitá degli Studi di Trieste, via A. Valerio 2, I-34100, Trieste, Italy
Received 2019 October 1; revised 2019 December 6; accepted 2019 December 8; published 2020 January 20

Abstract

We identify the nature of high-redshift long gamma-ray burst (LGRB) host galaxies by comparing the observed abundance ratios in the interstellar medium with detailed chemical evolution models accounting for the presence of dust. We compare abundance data from LGRB afterglow spectra to abundance patterns as predicted by our models for different galaxy types. We analyze [X/Fe] abundance ratios (where X is C, N, O, Mg, Si, S, Ni, Zn) as functions of [Fe/H]. Different galaxies (irregulars, spirals, spheroids) are, in fact, characterized by different star formation histories, which produce different [X/Fe] versus [Fe/H] relations ("time-delay model"). This allows us to identify the star formation history of the host galaxies and to infer their age (i.e., the time elapsed from the beginning of star formation) at the time of the GRB events. Unlike previous works, we use newer models in which we adopt updated stellar yields and prescriptions for dust production, accretion, and destruction. We consider a sample of seven LGRB host galaxies. Our results suggest that two of them (GRB 050820, GRB 120815A) are star-forming spheroids, two (GRB 081008, GRB 161023A) are spirals, and three (GRB 090926A, GRB 050730, GRB 120327A) are irregulars. The inferred ages of the considered host galaxies span from 10 Myr to slightly more than 1 Gyr.

Identification of the GRB hosts

- At high redshift some hosts can be spheroids in formation, when the SFR is still active

- In local universe we preferentially see long GRBs in star forming galaxies which are either spiral or irregulars

- More abundance data of specific chemical elements are necessary to shed light on primordial galaxies by means of LGRBs

THANKS to all the participants, hope you enjoyed the conference!!