The First Star Formation Epoch and High Redshift Quasars

M. Dietrich (University of Florida, Dept. of Astronomy)
211 Bryant Space Science Center, Gainesville, FL 32611-2055, USA

Quasars are among the most luminous objects in the universe. Hence, they can be observed in detail up to the highest redshifts. Assuming that the gas associated with quasars is closely related to their host galaxy, they can be used to trace star formation history and to probe the conditions of the early universe.
The chemical composition of the interstellar medium depends on the stellar processes and the corresponding evolutionary time scales of the dominant sources for the release of individual elements. α-elements, e.g. O, Ne, Mg, Si, produced predominantly in high mass stars on short time scales ($\sim 10^7$ yrs). Although SN II ejecta may contribute modestly to the iron abundance it is generally believed that the main source of iron is given by SN Ia explosions. The significantly longer time scale of the evolution of SN Ia progenitors results in an iron enrichment delay of $\sim$ 1 Gyr with respect to α-elements. Because this delay does not depend on any of the evolution time scales (e.g., the star formation rate), it can serve as an absolute *clock* for dating the age of stellar populations.
We observed high redshift quasars ($3.5 \lesssim z \lesssim 5$) in the near infrared to measure the strength of rest-frame ultraviolet iron emission features. The line ratio FeII /MgII2798 is a valuable indicator of the Fe/α-element ratio in quasars. The relative strength of the iron emission will be compared with results obtained for local quasar populations. A measurement of high Fe/α-element abundances would suggest that the first substantial star formation epoch occured $\lesssim$ 1 Gyr prior to $z \simeq 4$, i.e., at least at $z_f \simeq 10$. A result for low Fe/α-element, on the other hand, would suggest that the stellar populations are young, although we could not rule out the possibility that the IMF is peculiar in the early universe.