

Characterizing the relationship between stars, gas, and metals in galaxies is a critical component of understanding the cosmic baryon cycle. This talk will present contemporary censuses of the chemical make-up of Universe on cosmological scales. The metal mass density in cold gas ($T < 10^4$ K) contains virtually all the metals produced by stars for $z > 2.5$. At lower redshifts, the contributors to the total amount of metals are more diverse; at $z < 1$, most of the observed metals are bound in stars. Overall there is little evidence for a "missing metals problem" in modern censuses. We will contrast these results with a number of recent efforts to simulate the metals on global scales.