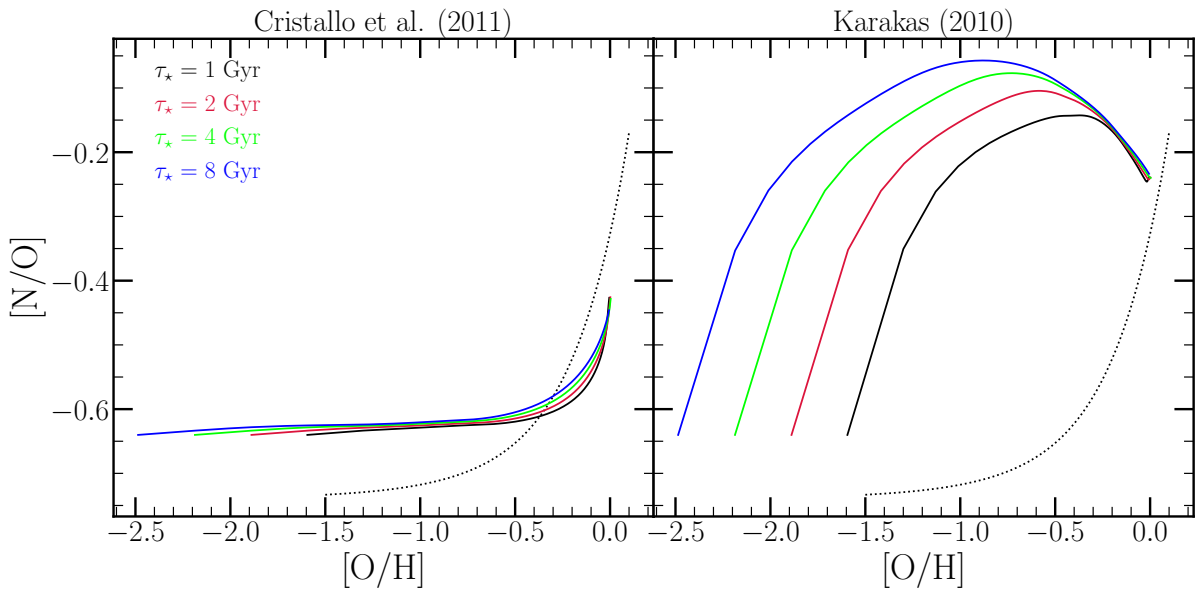

Figure 1: [N/O]-[O/H] tracks as predicted by Cristallo et al. (2011) (left) and Karakas (2010) (right). Colored lines denote different SFE timescales denoted in the legend in the upper left. The black dotted line denotes the fit to the observed [N/O]-[O/H] relation published in Henry, Edmunds & Köppen (2000).

One-Zone Models

The Impact of the AGB Star Yields

How do the abundances predicted by one-zone models differ between the Cristallo et al. (2011) and Karakas (2010) yield sets?

Taking $\dot{M}_\star$ = constant, $\eta = 2.0$, and $y_{\rm N}^{\rm CC} = 4.15 \times 10^{-4}$ as suggested by supernova yields and the observed [N/O] plateau at low [O/H], the [N/O]-[O/H] tracks for $\tau_\star = 1$, 2, 4, and 8 Gyr for both studies is shown in Fig. 1. The black dotted line denotes the population-averaged trend published in Henry, Edmunds & Köppen (2000). The model recovers the qualitative observational trend with the Cristallo et al. (2011) yields, though the increase in [N/O] at high [O/H] isn't as large as in the observations. The Karakas (2010) yields predict a trend in tension with the observations, but this makes sense when considering how these yields depend on mass and metallicity (see Fig. **??**). Their highest yields are for higher mass stars at low metallicity; although the Cristallo et al. (2011) yields also predict the yields to increase with stellar mass, the metallicity trend appears to be what's most important here. At early times when [O/H] is low, the high mass AGB stars dump a lot of N, getting the ISM off the plateau more or less immediately. The peak and subsequent decrease in [N/O] at high [O/H] can be understood from the decrease in the N yields near solar Z as reported by Karakas (2010).

Since the Cristallo et al. (2011) yields recover the correct trend, but the Karakas (2010) yields appear to have a more realistic magnitude, better agreement with the observations can be achieved by simply amplifying the Cristallo et al. (2011) yields by some factor; this is demonstrated in Fig. 2. The model with amplified yields agrees with the observational

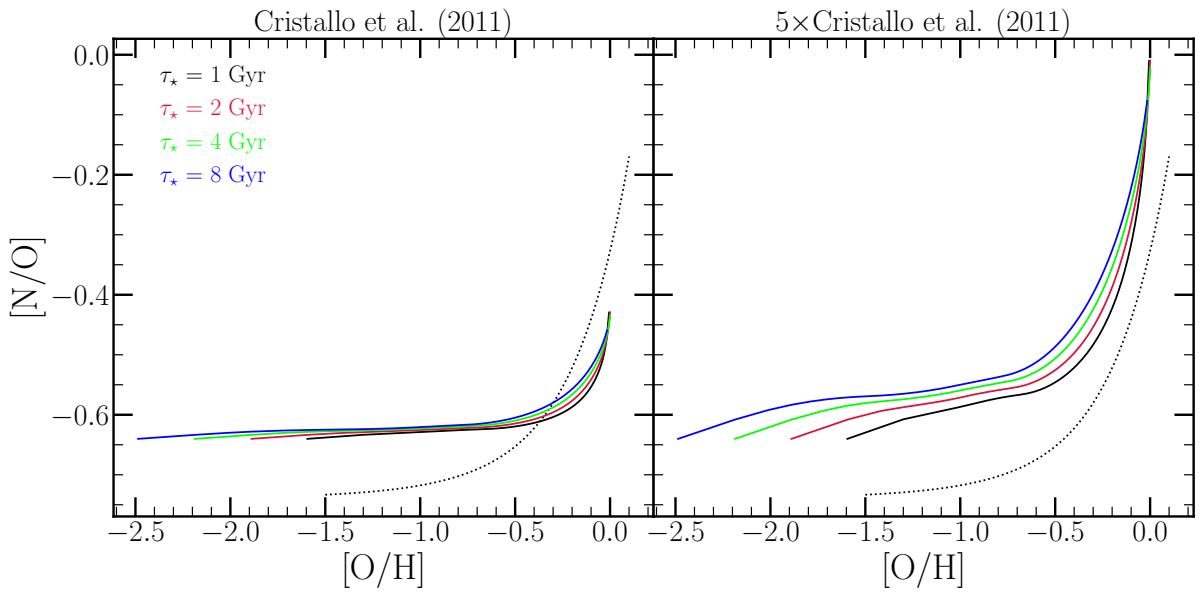

Figure 2: [N/O]-[O/H] tracks as predicted with the Cristallo et al. (2011) yields (left), and with the same yield set but amplified by a factor of 5 (right).

result better, even though it overestimates [N/O] and all [O/H]. A better match could be achieved by lowering $y_{\rm N}^{\rm CC}$, which predicts a plateau at a marginally higher [N/O] than Henry, Edmunds & Köppen (2000). Nonetheless, this is a good demonstration that even taking the more realistic of the two yield sets, the yields must be artificially amplified by a substantial prefactor in order to predict ∼solar [N/O] at ∼solar [O/H]. **This re-raises the question of the timescales of N enrichment from a single stellar population: if AGB stars make up a more substantial fraction of the nitrogen enrichment in the universe, will that increase the characteristic delay times of nitrogen production seen with the base set of yields from Cristallo et al. (2011)? This should impact the amplitude of variability in its production.**

Bibliography

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