AST 383 Nucleosynthesis

Here are some suggestions for reading this week.

1. Page l, Chapter 3. This covers topics we shall discuss in the next couple of classes.

2. Meteorites - most especially, CI1 carbonaceous chondrites provide extensive and generally precise data on elemental and particularly isotopic abundance ratios for many but NOT all elements.

There are many tables of standard abundances in the literature. The most recent is by Lodders, Palme and Gail in Landolt- Bornstein, New Series, Vol. VI/4B, Chap. 4.4 -- available on ADS. All tables are based heavily on meteoritic data and supplemented where necessary with solar or stellar data and -- earlier tables -- with interpolations or theoretical suggestions.

LPG are worth reading to see the history of such tables, the sources of most precise (usually, most recent) data for the solar photosphere and meteorites. Note too how LPG normalize meteoritic data measured with respect to Si to solar data measured NATURALLY to H. Also note how LPG fill in gaps where neither meteorites not solar photosphere provide a reliable elemental or isotopic abundance.

Stellar nucleosynthesis has been going on for the 4.5 Gyr since the solar system was formed. Yet, elemental abundances in young stars appear to be very similar to those in the Sun- see Lodders et al. (Table 11). How can this be consistent with (simple?) models of the Chemical Evolution of the Galaxy?

3. The following paper on astro-ph is an exciting confirmation of of a recent discovery on nucleosynthesis by nova explosions and suggests that such outbursts
may be an effective source of Li-7. See arXiv:1601.05168

The ^{7}Be II Resonance Lines in Two Classical Novae V5668 Sgr and V2944 Oph by
Akito Tajitsu, Kozo Sadakane, Hiroyuki Naito, Akira Arai, Hideyo Kawakita, Wako Aoki

We report spectroscopic observations of the resonance lines of
singly ionized ^{7}Be in the blue-shifted absorption line systems
found in the post-outburst spectra of two classical novae --
V5668 Sgr (Nova Sagittarii 2015 No.2) and V2944 Oph (Nova Ophiuchi 2015).
The unstable isotope, ^{7}Be, should has been created during the
thermonuclear runaway (TNR) of these novae and decays to form ^{7}Li
within a short period (a half-life of 53.22 days).
Confirmations of ^{7}Be are the second and the third ones following
the first case found in V339 Del by Tajitsu et al. (2015).
The blue-shifted absorption line systems in both novae are clearly
divided into two velocity components, both of which contain ^{7}Be.
This means that the absorbing gases in both velocity components consist of
products of TNR. We estimate amounts of ^{7}Be produced during
outbursts of both novae and conclude that significant ^{7}Li
should have been created. These findings strongly suggest that the
explosive production of ^{7}Li via the reaction
^{3}He(α,γ)^{7}Be and subsequent decay to ^{7}Li
occurs frequently among classical novae and contributes to the process of
the Galactic Li enrichment.

The reaction sequence ^{7}Be to ^{7}Li is called the Cameron-Fowler
mechanism. It has been invoked - correctly - to explain Li
enrichment in red giants. For novae, the mechanism relies on the same
nuclear reaction sequence with the difference that the fragile ^{7}Be
(and ^{7}Li) are dispatched to a `safe' (low temperature) region by
different mechanisms.

Cameron, A.G.W. & Fowler, W.A. 1971, ApJ, 164, 111
See Iliadis p. 369 for a one paragraph summary..
