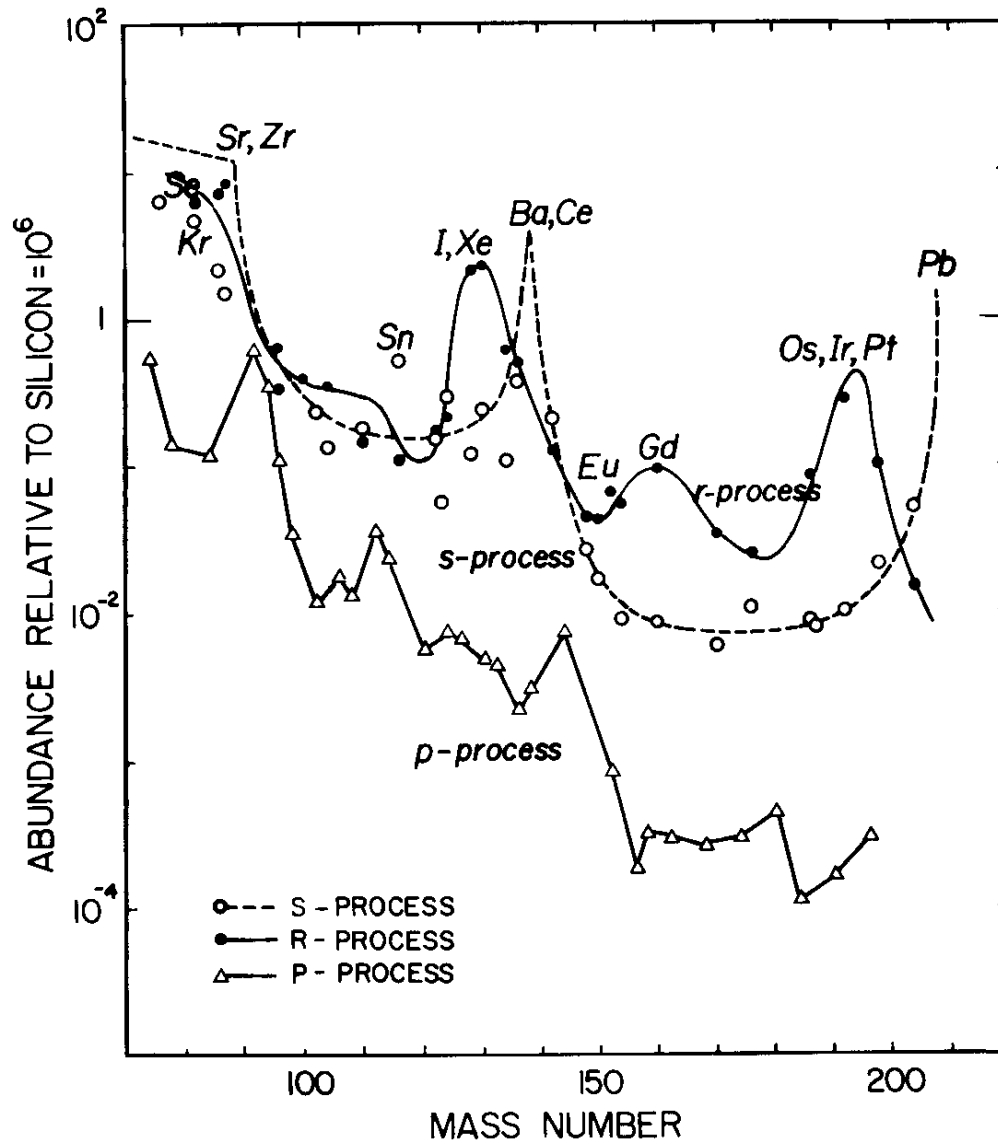
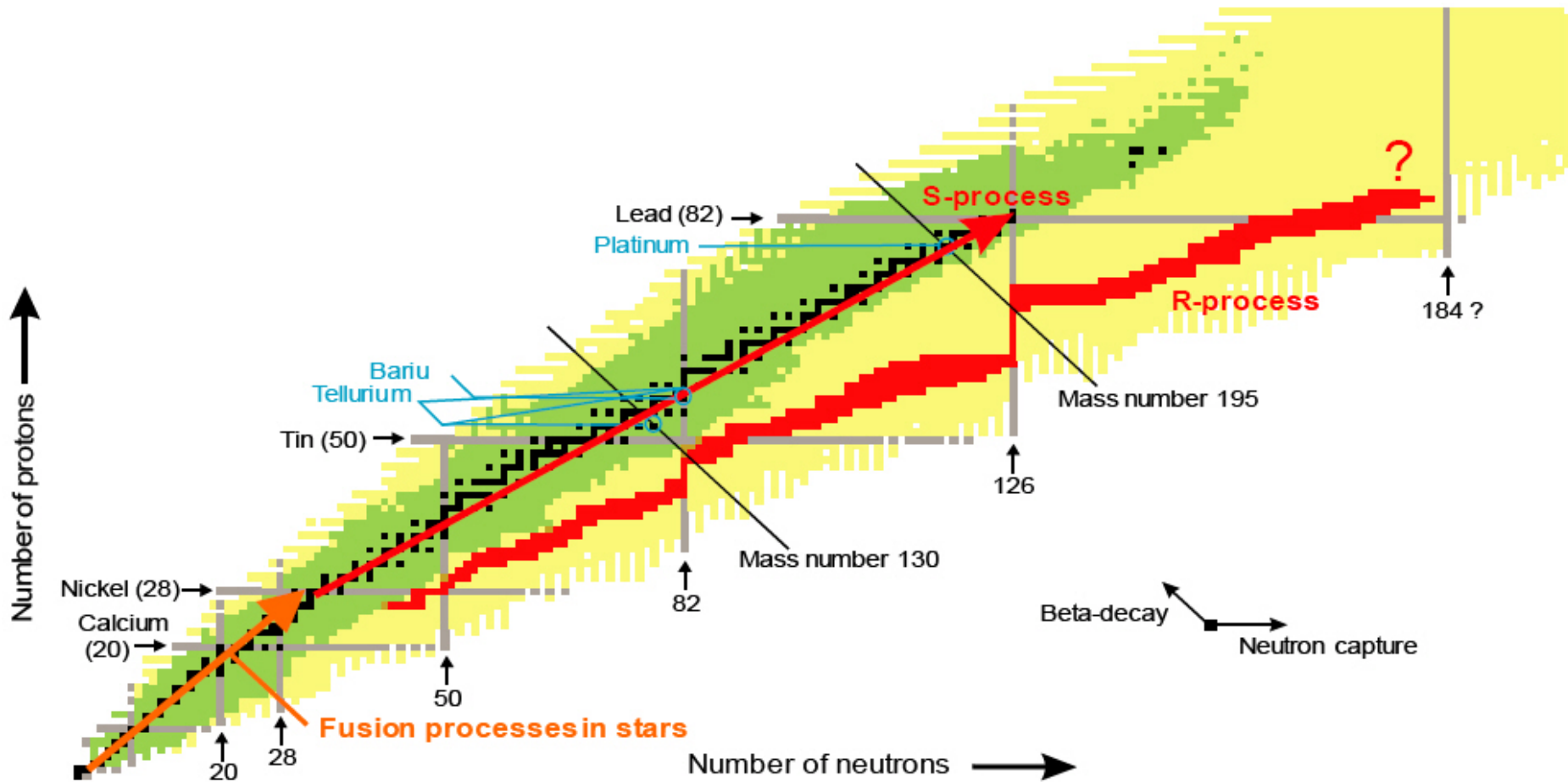


# The origin of heavy elements in the solar system



(Pagel, Fig 6.8)

each process contribution is a mix of many events !



~35 p-nuclei cannot be made in s- or r-process:  $^{74}\text{Se}$ ,  $^{78}\text{Kr}$ ,  $^{84}\text{Sr}$ ,  $^{92}\text{Mo}$ ,  $^{94}\text{Mo}$ ,  $^{96}\text{Ru}$ ,  $^{98}\text{Ru}$ ,  $^{102}\text{Pd}$ ,  $^{106}\text{Cd}$ ,  $^{108}\text{Cd}$ ,  $^{112}\text{Sn}$ ,  $^{113}\text{In}$ ,  $^{114}\text{Sn}$ ,  $^{115}\text{Sn}$ ,  $^{120}\text{Te}$ ,  $^{124}\text{Xe}$ ,  $^{126}\text{Xe}$ ,  $^{130}\text{Ba}$ ,  $^{132}\text{Ba}$ ,  $^{136}\text{Ce}$ ,  $^{138}\text{La}$ ,  $^{138}\text{Ce}$ ,  $^{144}\text{Sm}$ ,  $^{152}\text{Gd}$ ,  $^{156}\text{Dy}$ ,  $^{158}\text{Dy}$ ,  $^{162}\text{Er}$ ,  $^{164}\text{Er}$ ,  $^{168}\text{Yb}$ ,  $^{174}\text{Hf}$ ,  $^{180}\text{Ta}$ ,  $^{180}\text{W}$ ,  $^{184}\text{Os}$ ,  $^{190}\text{Pt}$ , and  $^{196}\text{Hg}$

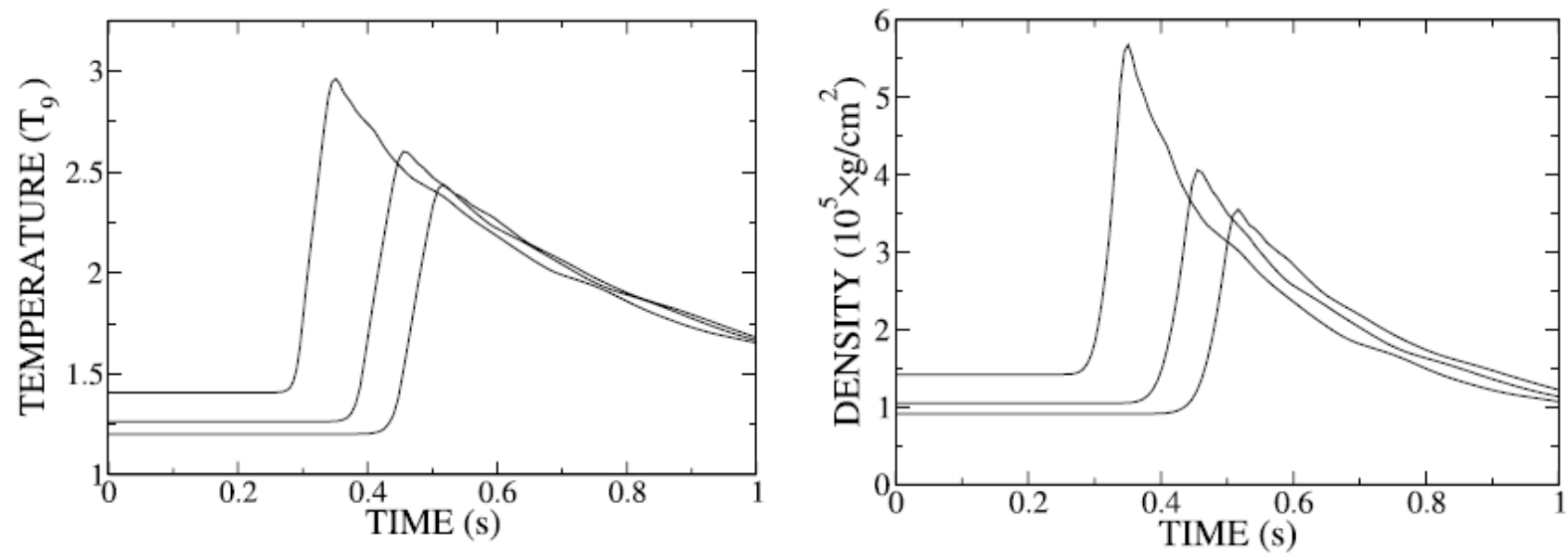
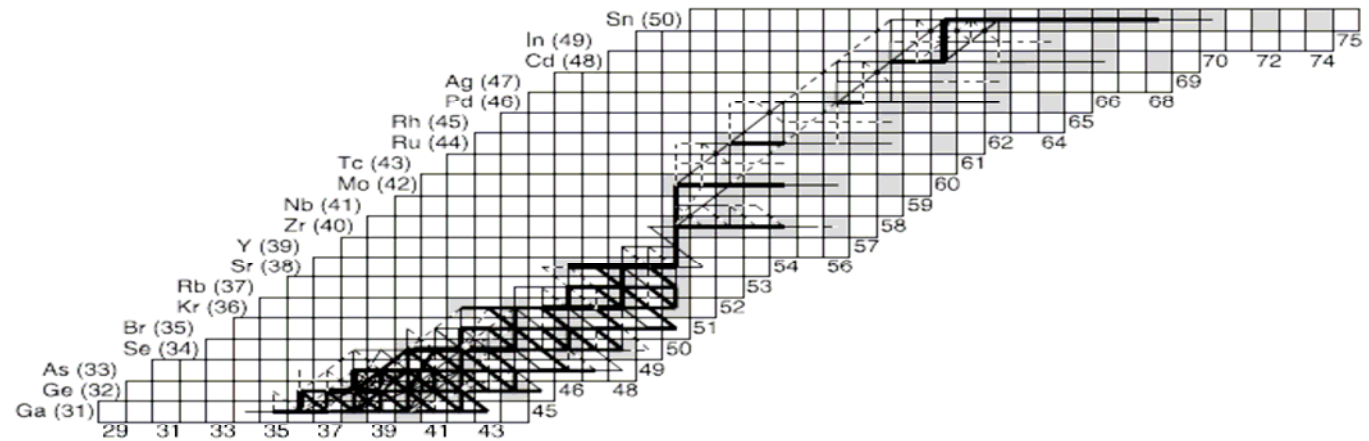
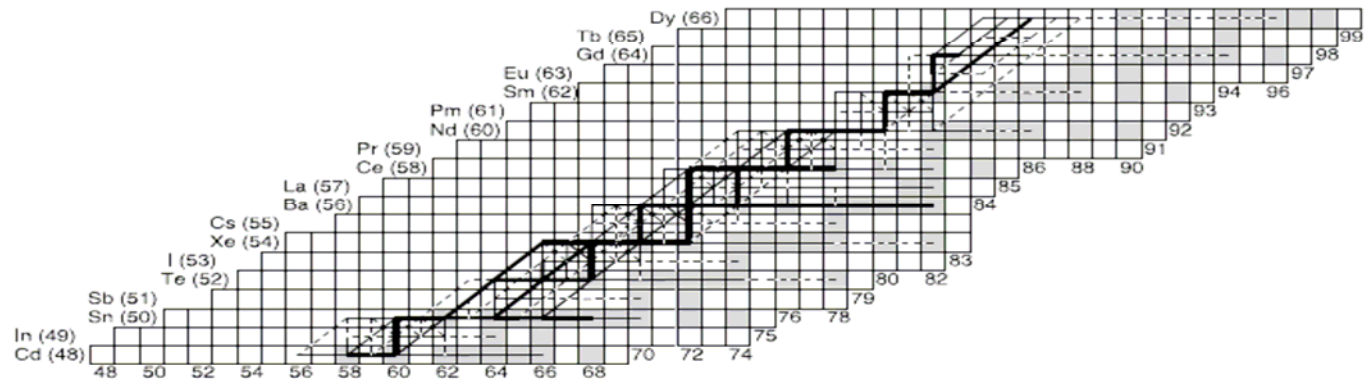
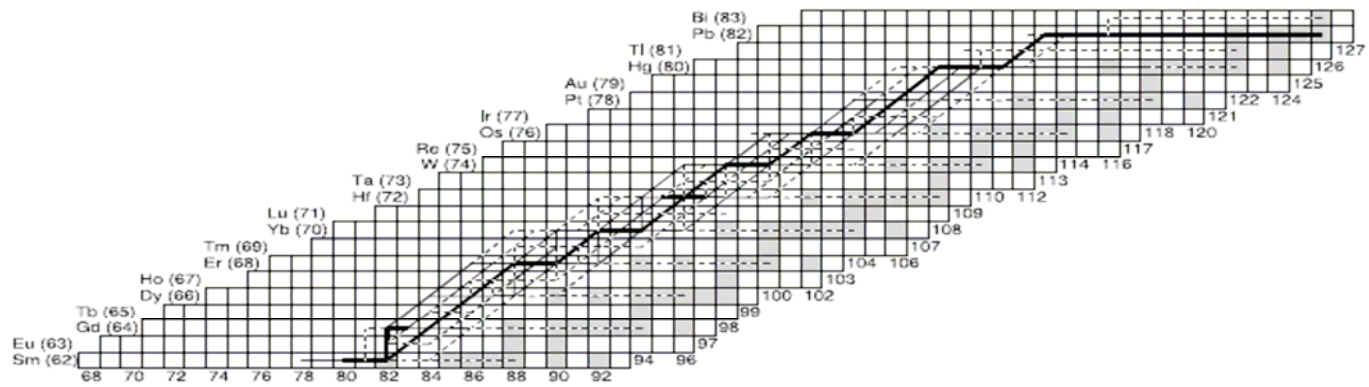


FIG. 2.—Temperature and density profiles of the SN shock front traversing the Ne/O layer of the pre-SN star.



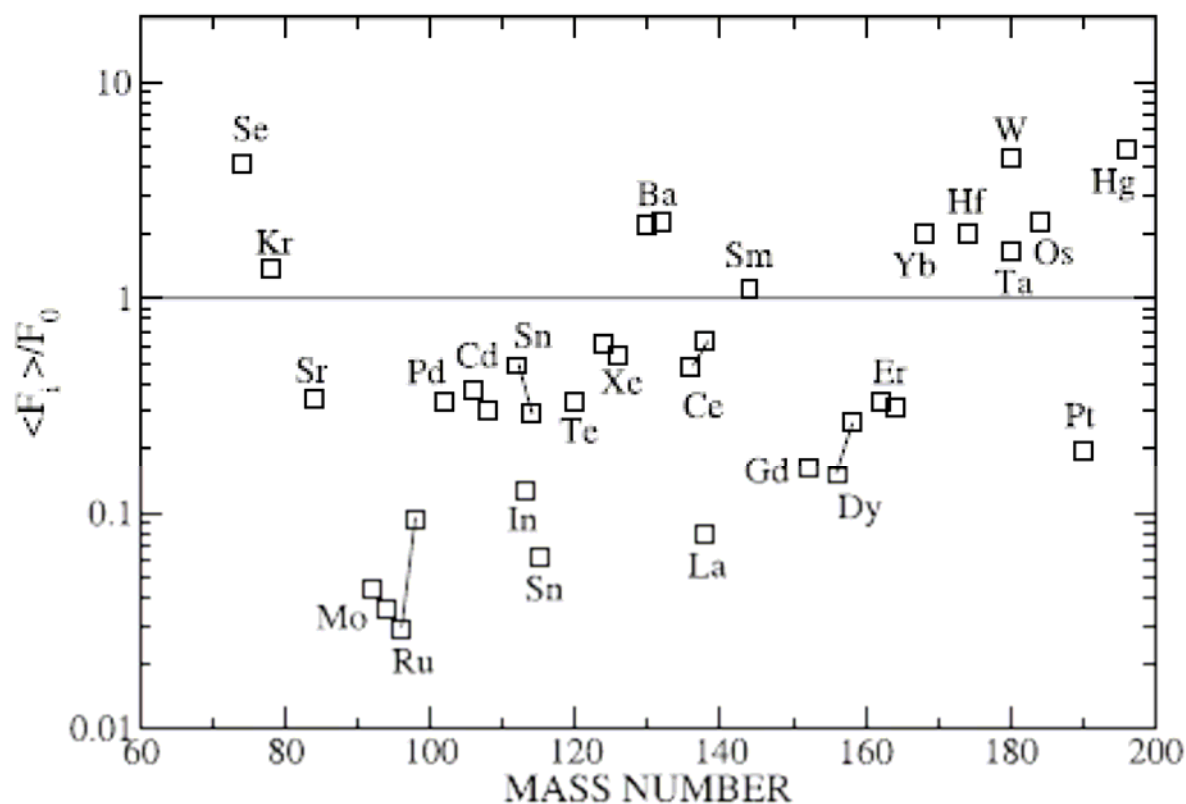
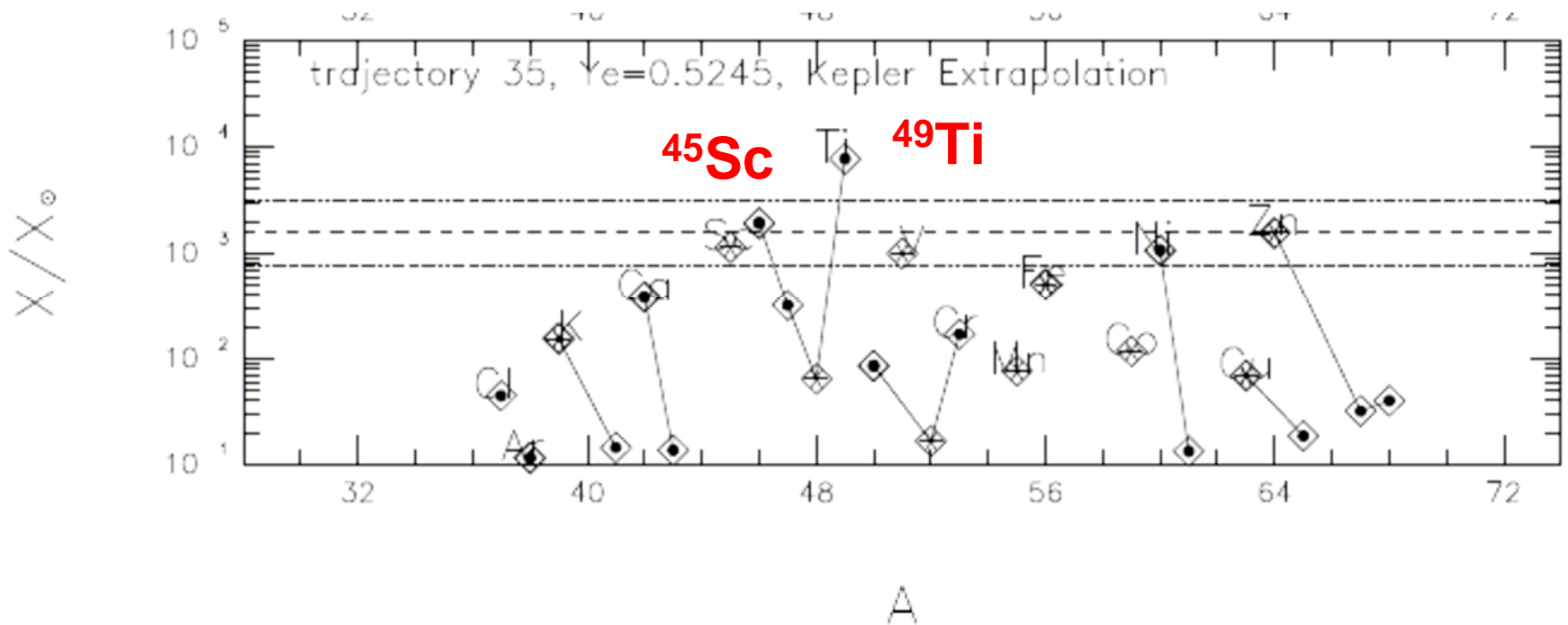


FIG. 4.—Averaged normalized overproduction factor for the proton-rich  $p$ -nuclei from network calculation with standard reaction rates (see text).

# The vp process

J.Pruet et al. 2004: early neutrino driven winds in core collapse SNe are p-rich ( $Y_e \sim 0.5$ )

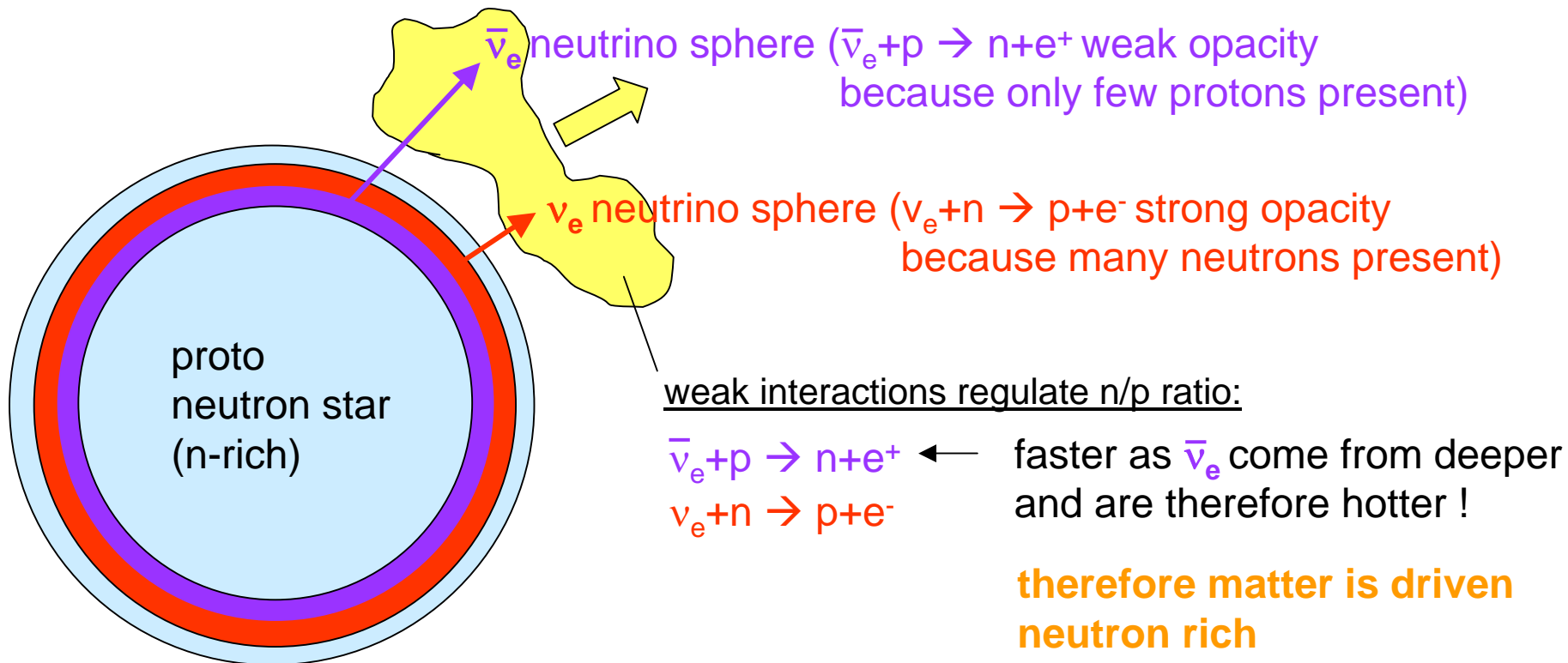


→ Origin of some isotopes not fully accounted for in SN?

# Recall: r-process in Supernovae ?

Most favored scenario for high entropy:

Neutrino heated wind evaporating from proto neutron star in core collapse



# The $\nu p$ process – the role of neutrinos?

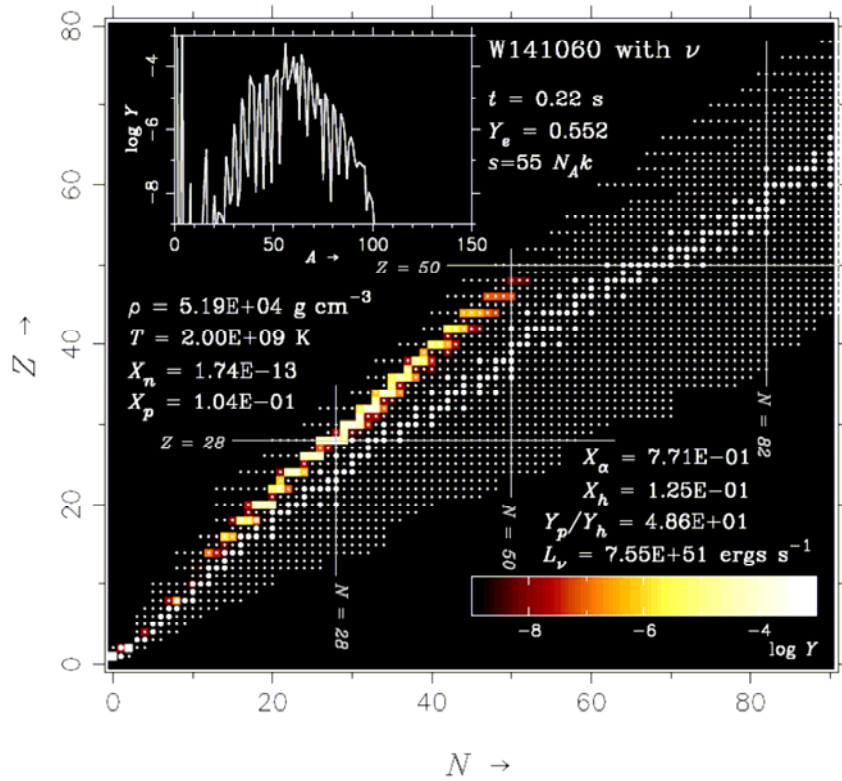
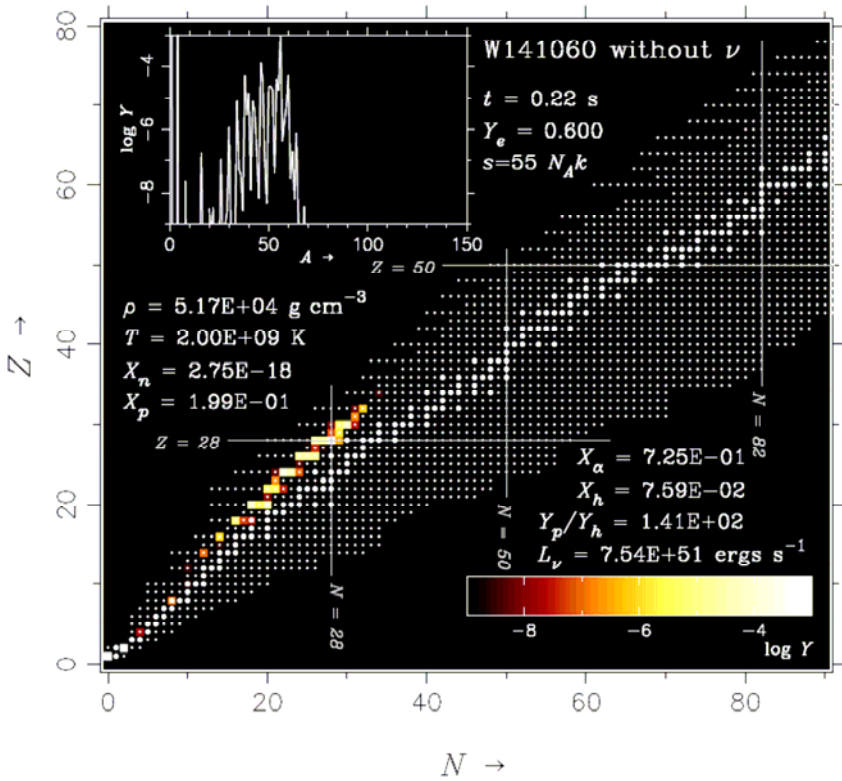
Froehlich et al. 2006

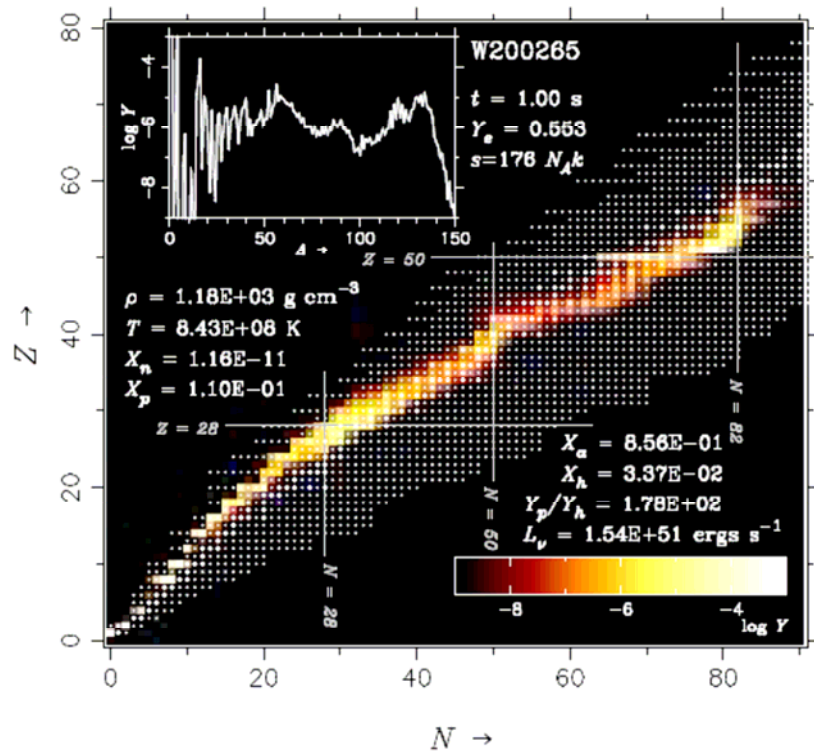
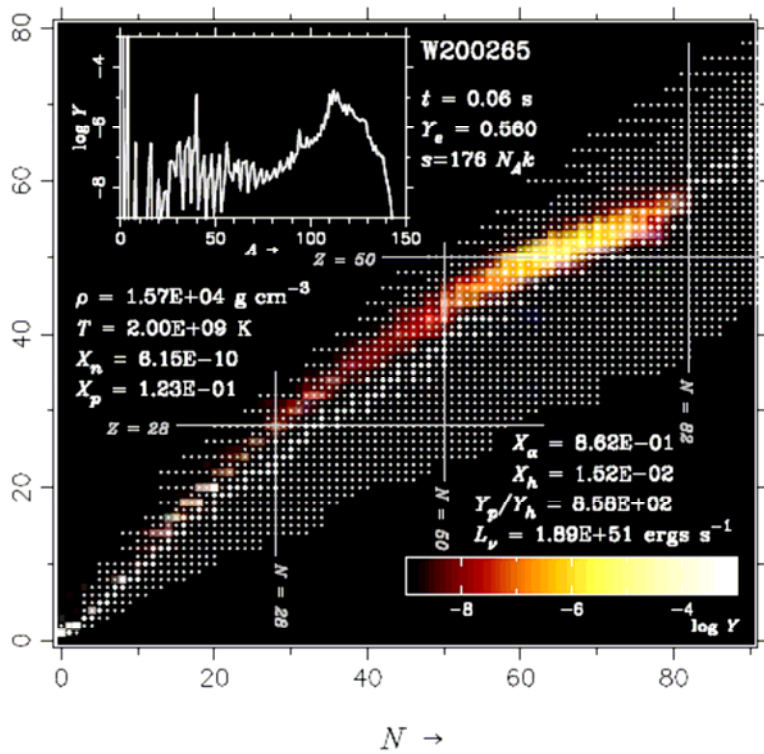
Pruet et al. 2006

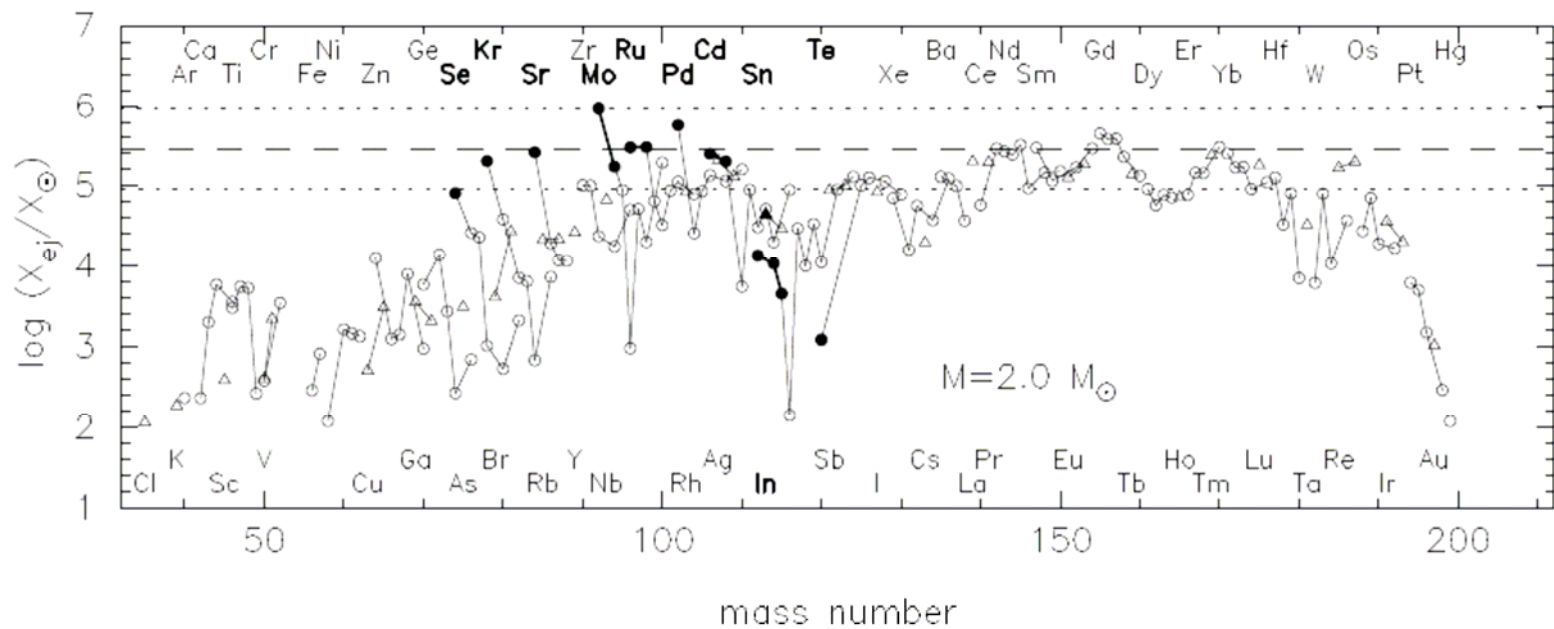
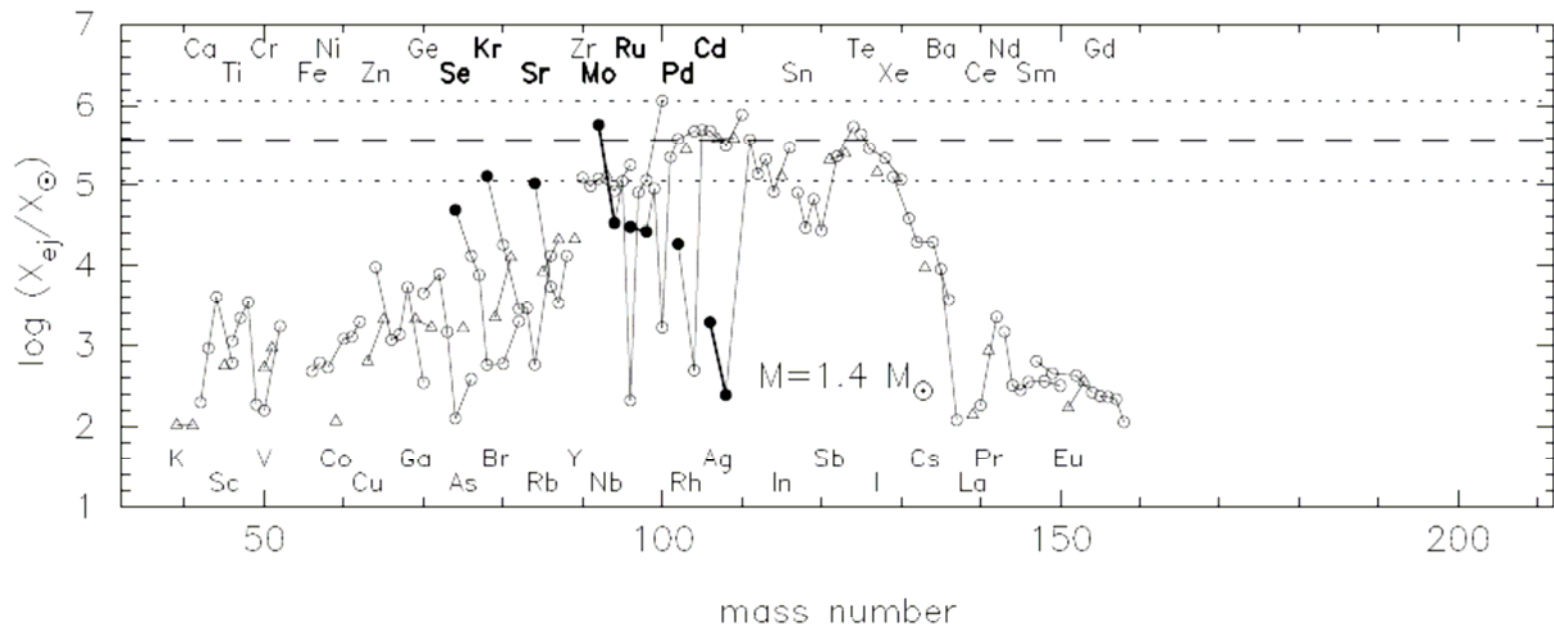
Wanajo et al. 2006

Recall  $\alpha$ -effect in r-process ...

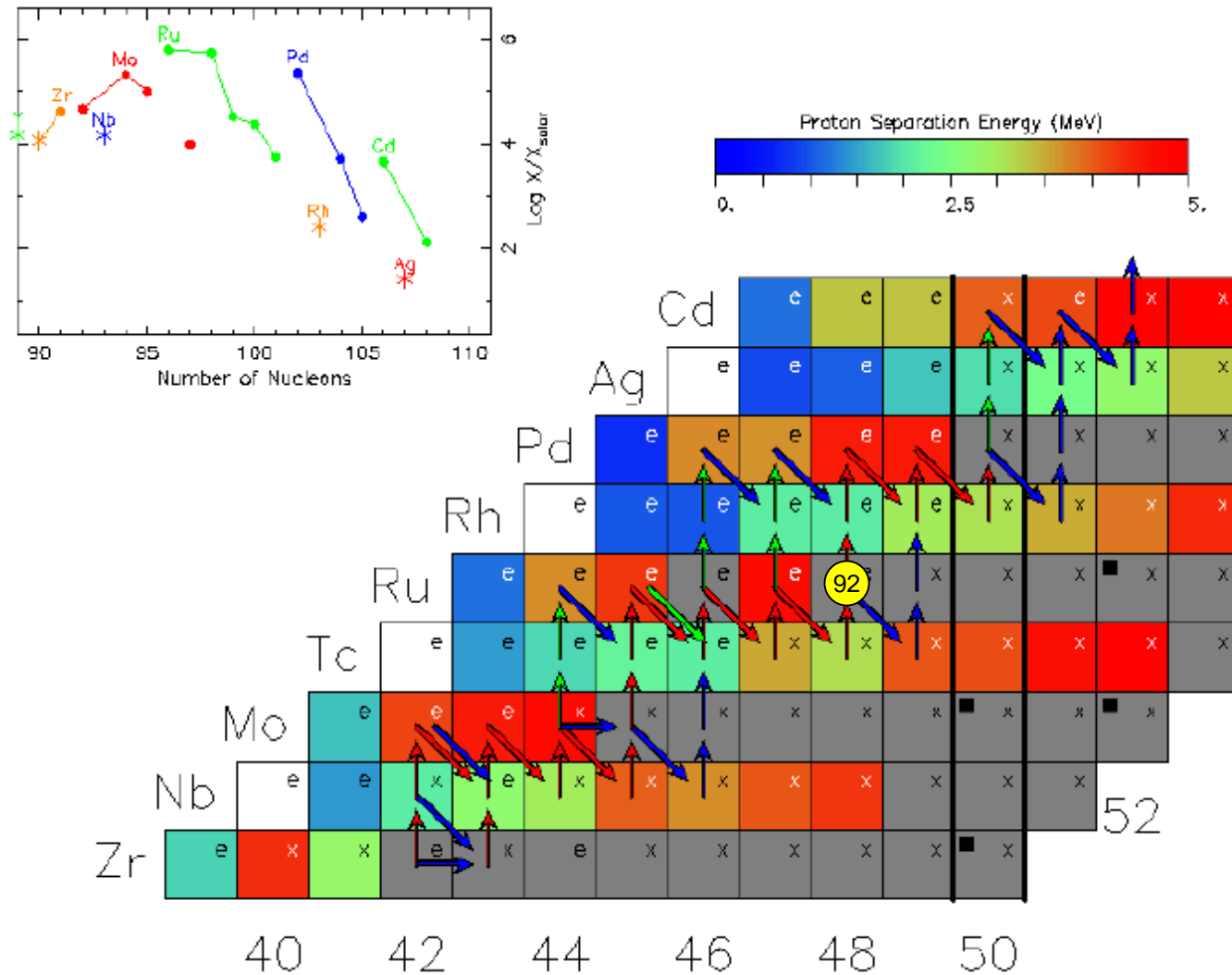




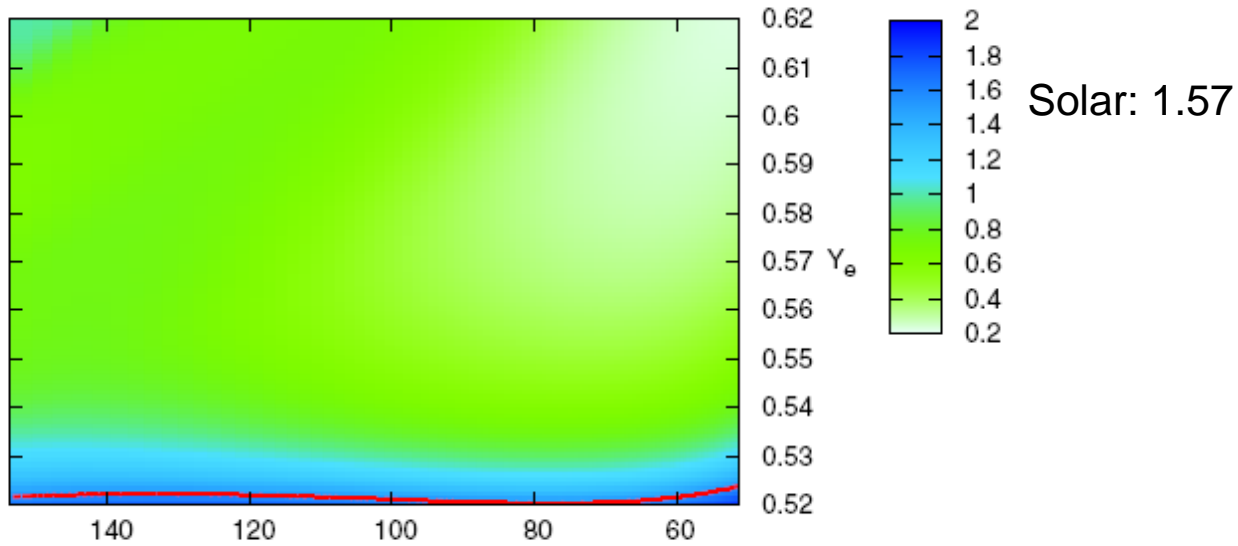




# Fisker et al. 2009 – can one make $^{92}\text{Mo}/^{94}\text{Mo}$ in solar proportions?



# 92Mo/94Mo ratio



# 92Mo overproduction

Entropy/baryon

