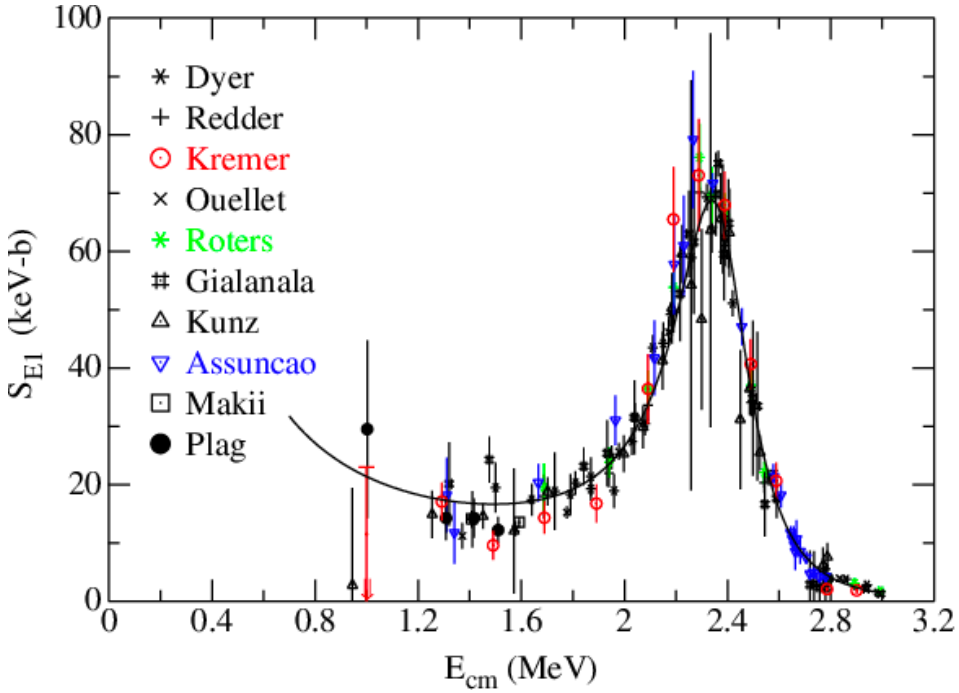
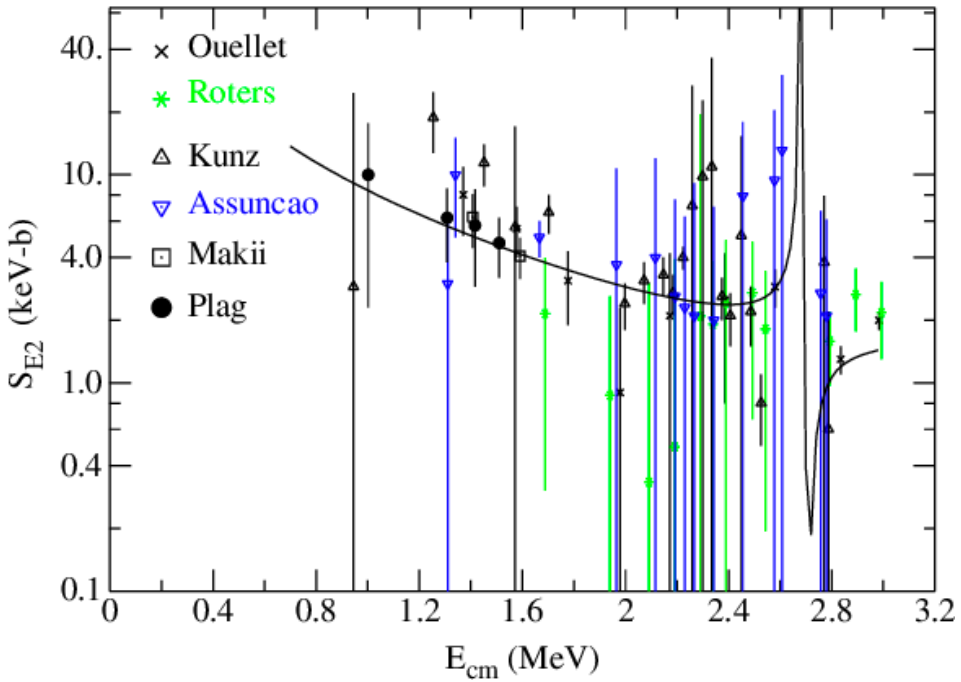
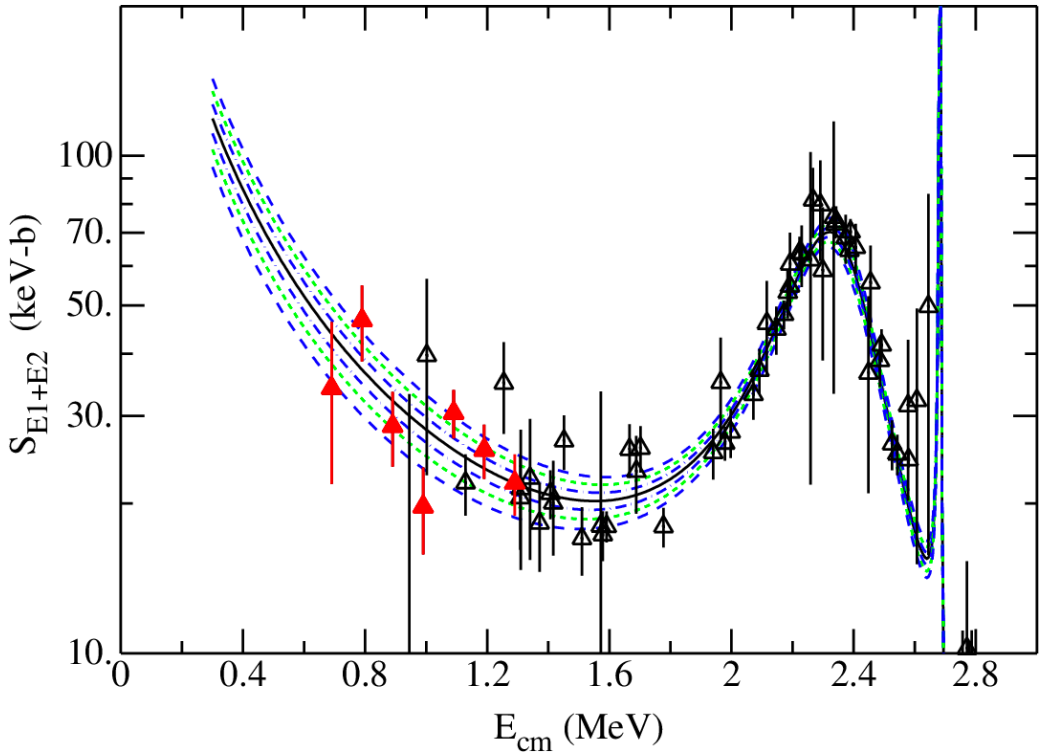
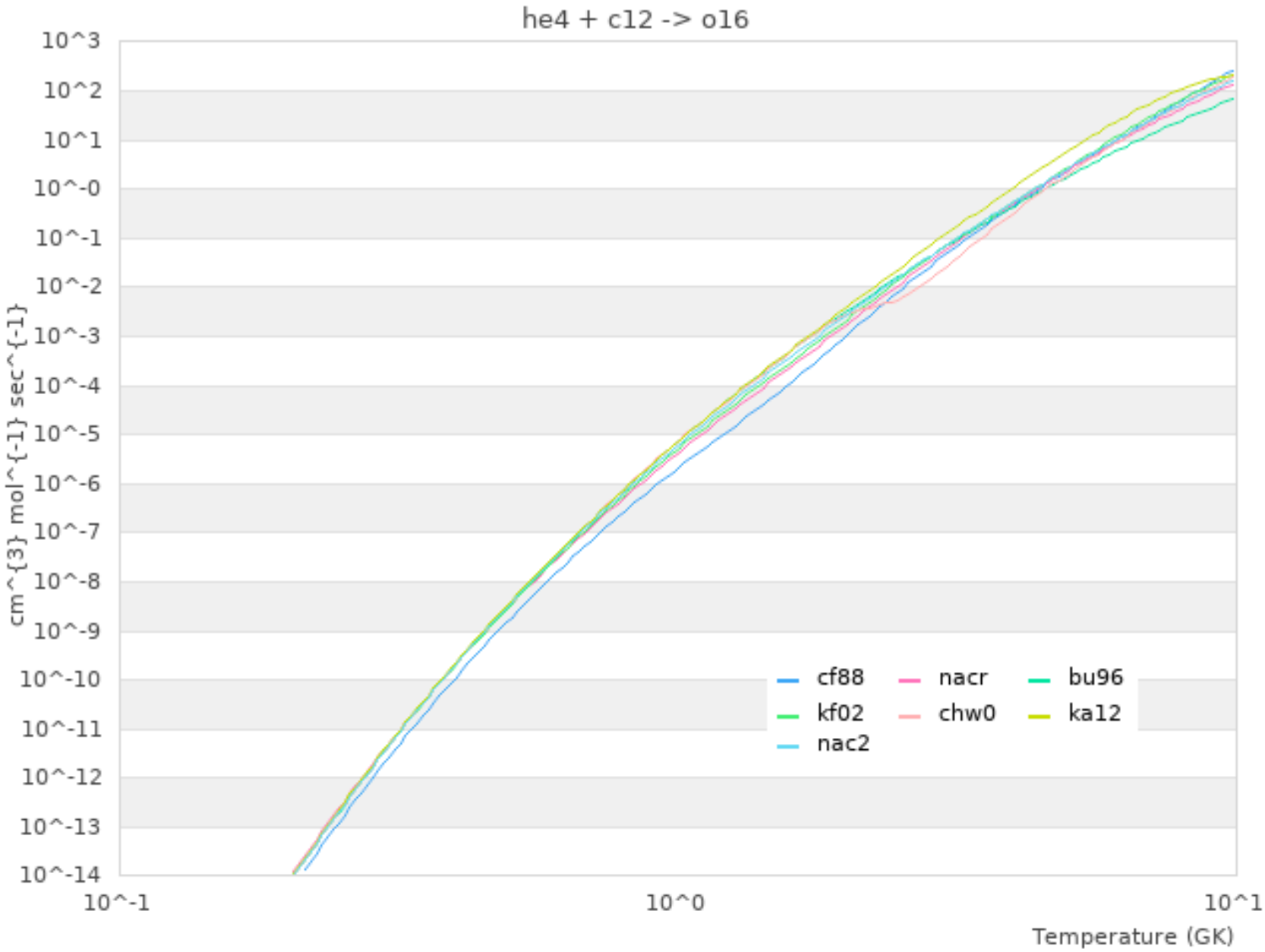


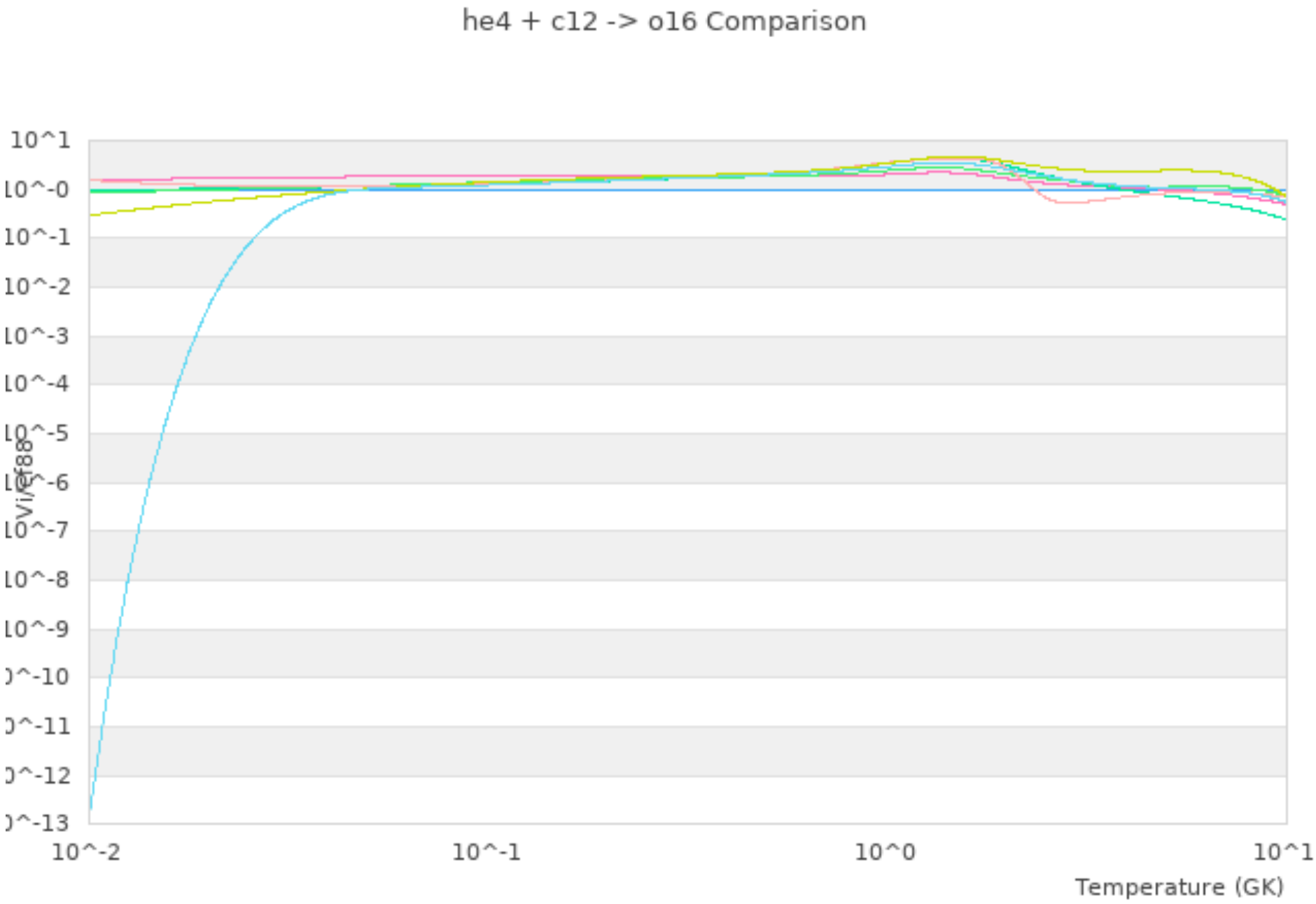


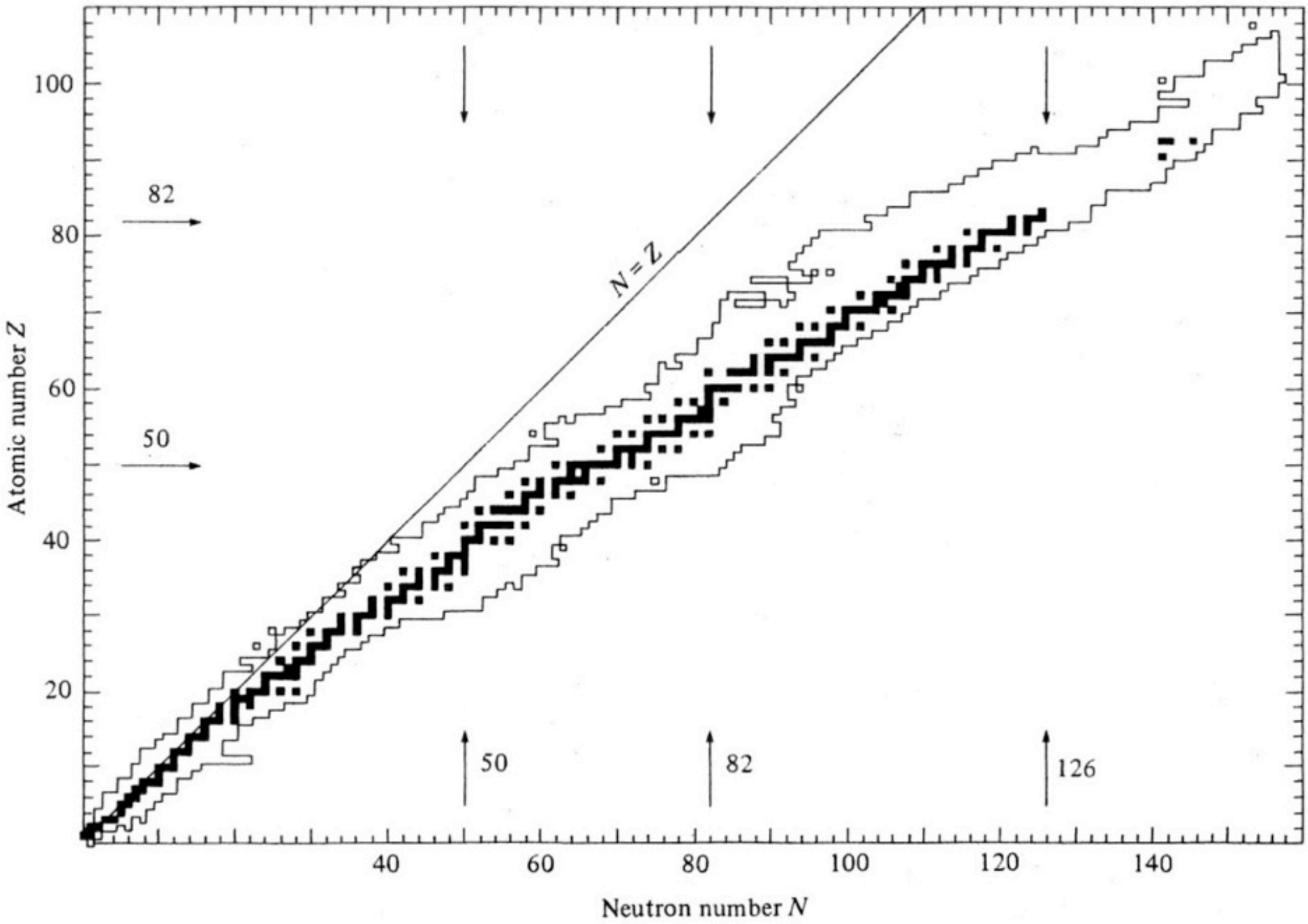


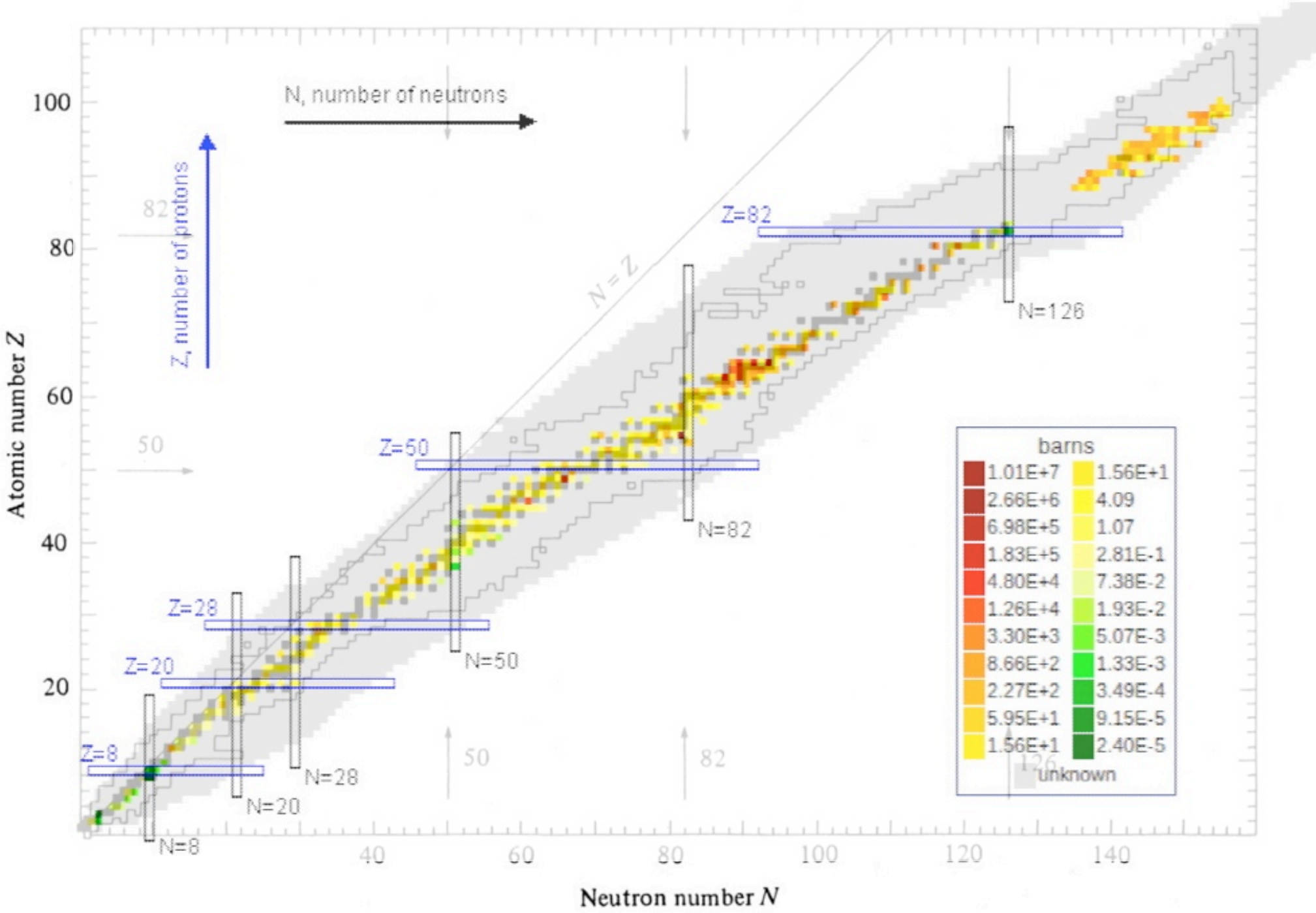
Sensitivity study for the $^{12}C(\alpha, \gamma)\ ^{16}O$ astrophysical reaction rate

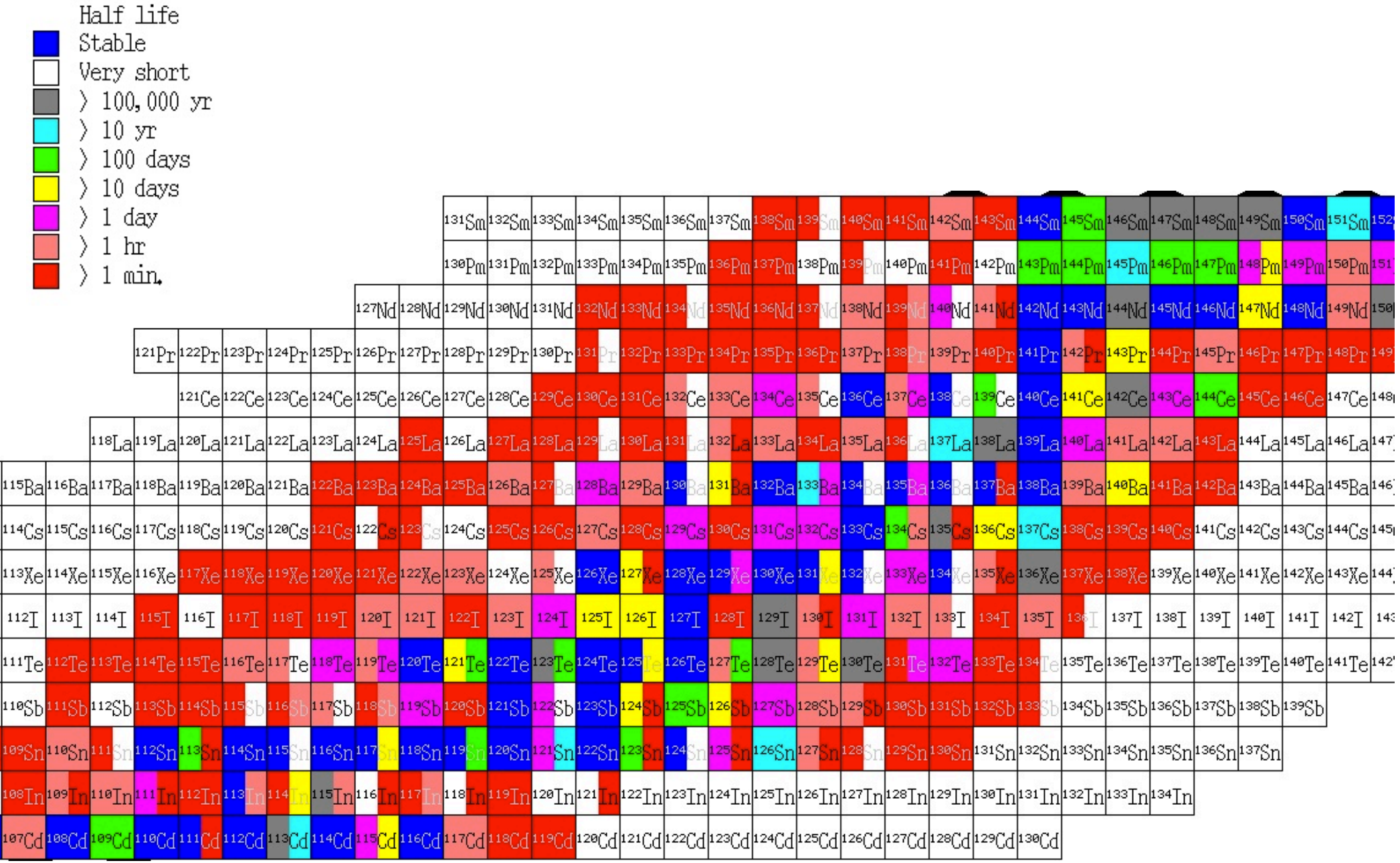
R. J. Holt , B.W. Filippone, and Steven C. Pieper

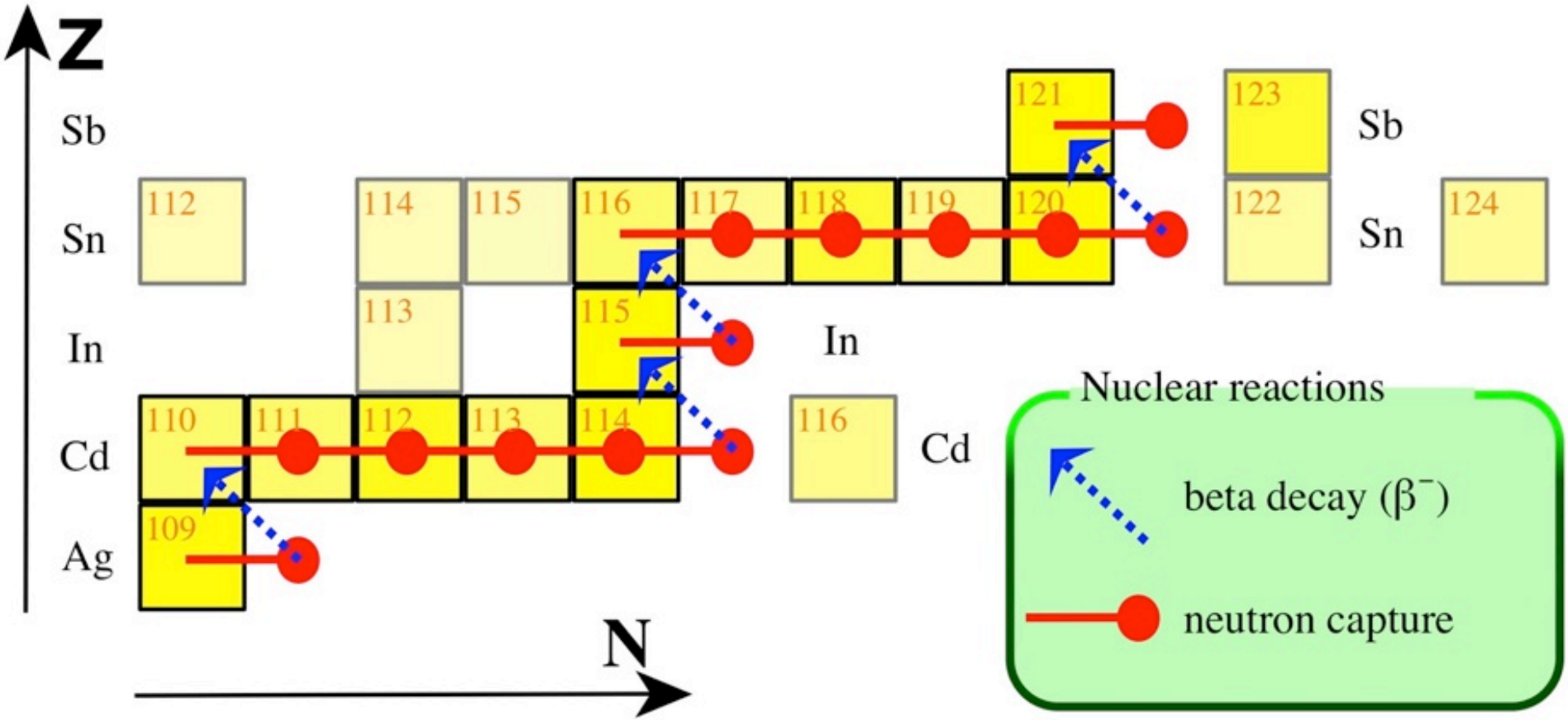

he4 + c12 -> o16
10^3
10^2
10^1
10^-0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
10^-9
10^-10
10^-11
10^-12
10^-13
10^-14
cm^{3} mol^{-1} sec^{-1}
10^-1
10^0
10^1
Temperature (GK)
cf88
kf02
nac2
nacr
chw0
bu96
ka12


he4 + c12 -> o16 Comparison
10^1
10^-0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
10^-9
10^-10
10^-11
10^-12
10^-13
10^-2
10^-1
10^0
10^1
Temperature (GK)


100
80
60
40
20
Atomic number Z
82
50
N = Z
50
82
126
40
60
80
100
120
140
Neutron number N


N, number of neutrons
Z, number of protons
82
50
N=Z
Z=82
N=126
Z=50
N=82
Z=28
N=50
Z=20
N=28
Z=8
N=20
N=8
barns
1.01E+7
2.66E+6
6.98E+5
1.83E+5
4.80E+4
1.26E+4
3.30E+3
8.66E+2
2.27E+2
5.95E+1
1.56E+1
1.56E+1
4.09
1.07
2.81E-1
7.38E-2
1.93E-2
5.07E-3
1.33E-3
3.49E-4
9.15E-5
2.40E-5
unknown
Atomic number Z
Neutron number N
20
40
60
80
100
120
140


Half life
Stable
Very short
〉 100,000 yr
〉 10 yr
〉 100 days
〉 10 days
〉 1 day
〉 1 hr
〉 1 min.


Z
Sb
Sn
In
Cd
Ag
N
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
Sb
Sn
In
Cd
Nuclear reactions
beta decay (β⁻)
neutron capture

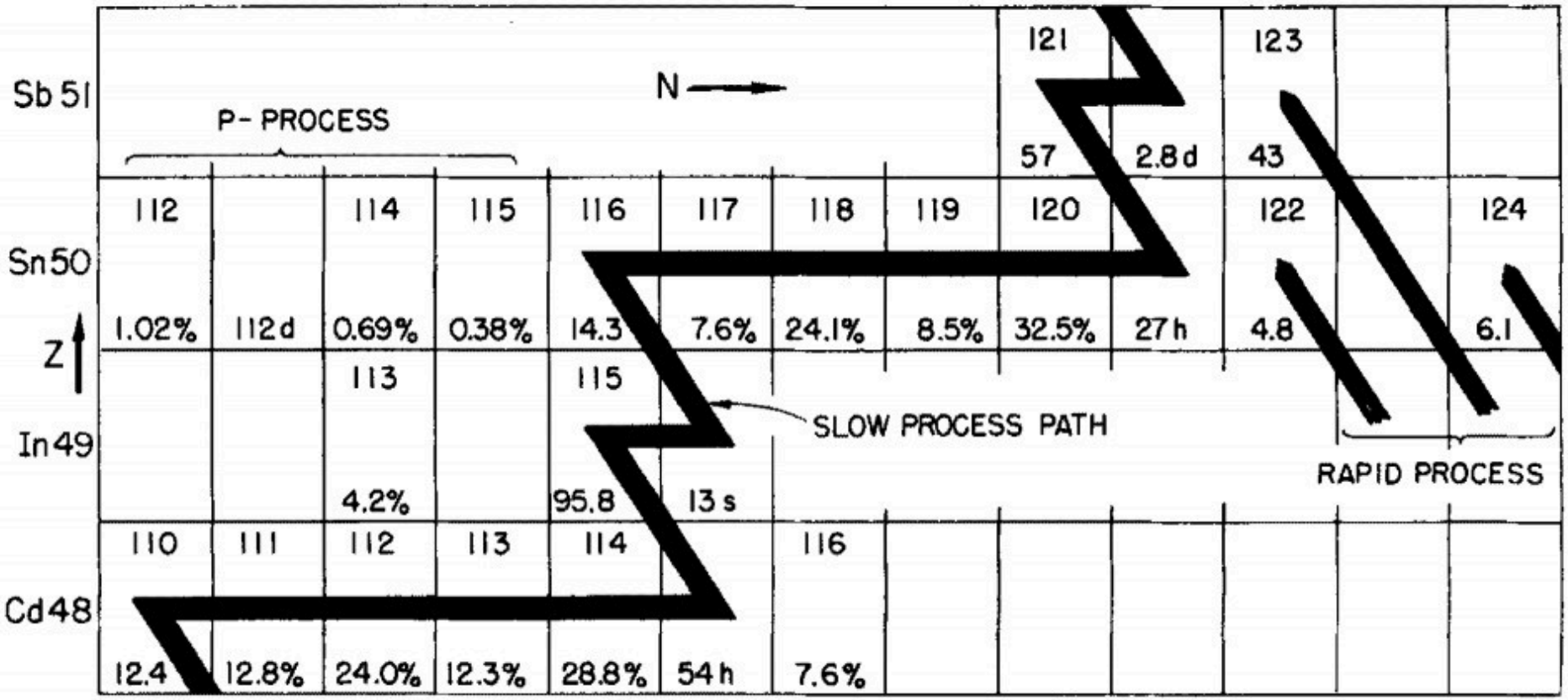
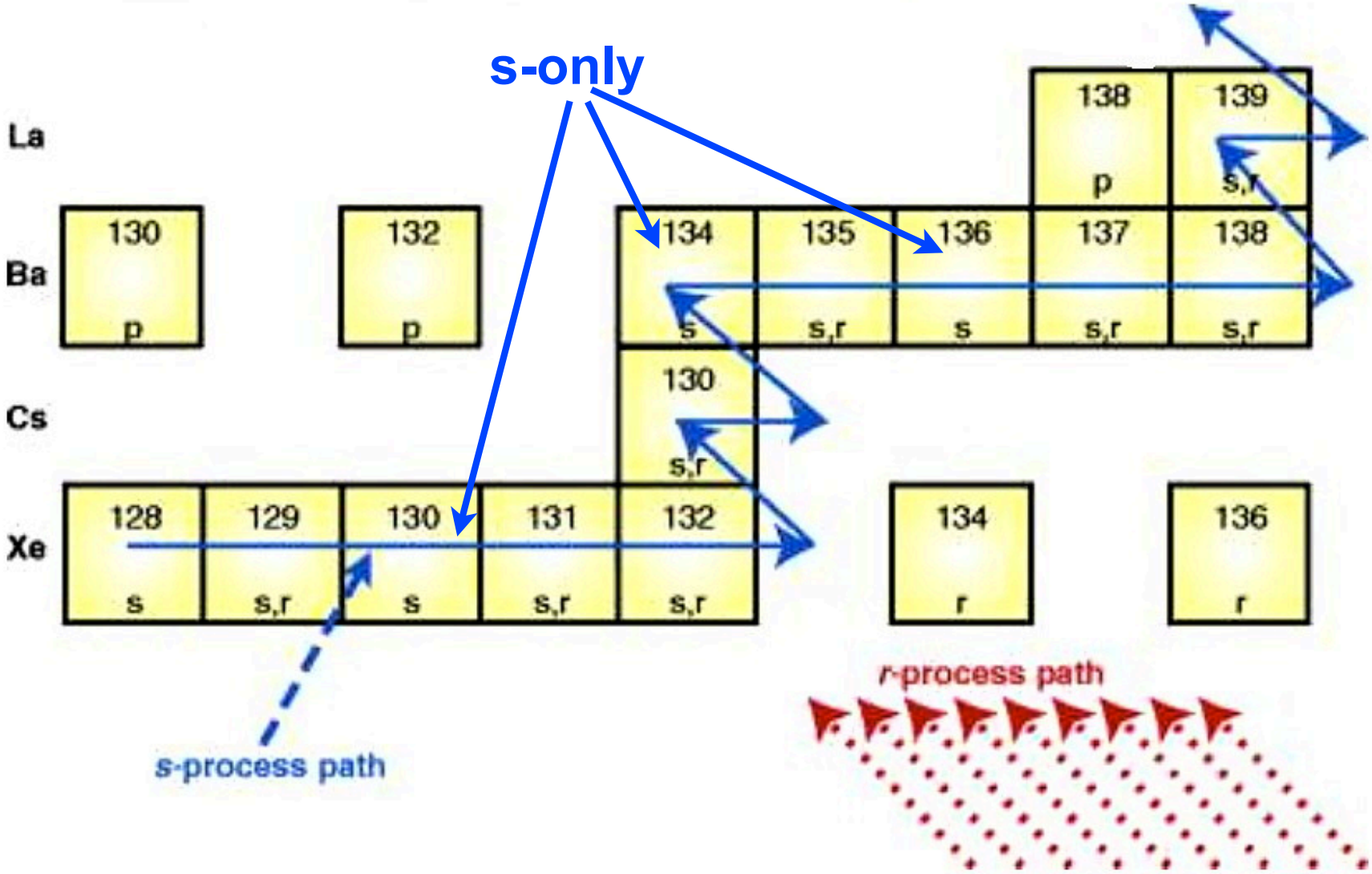
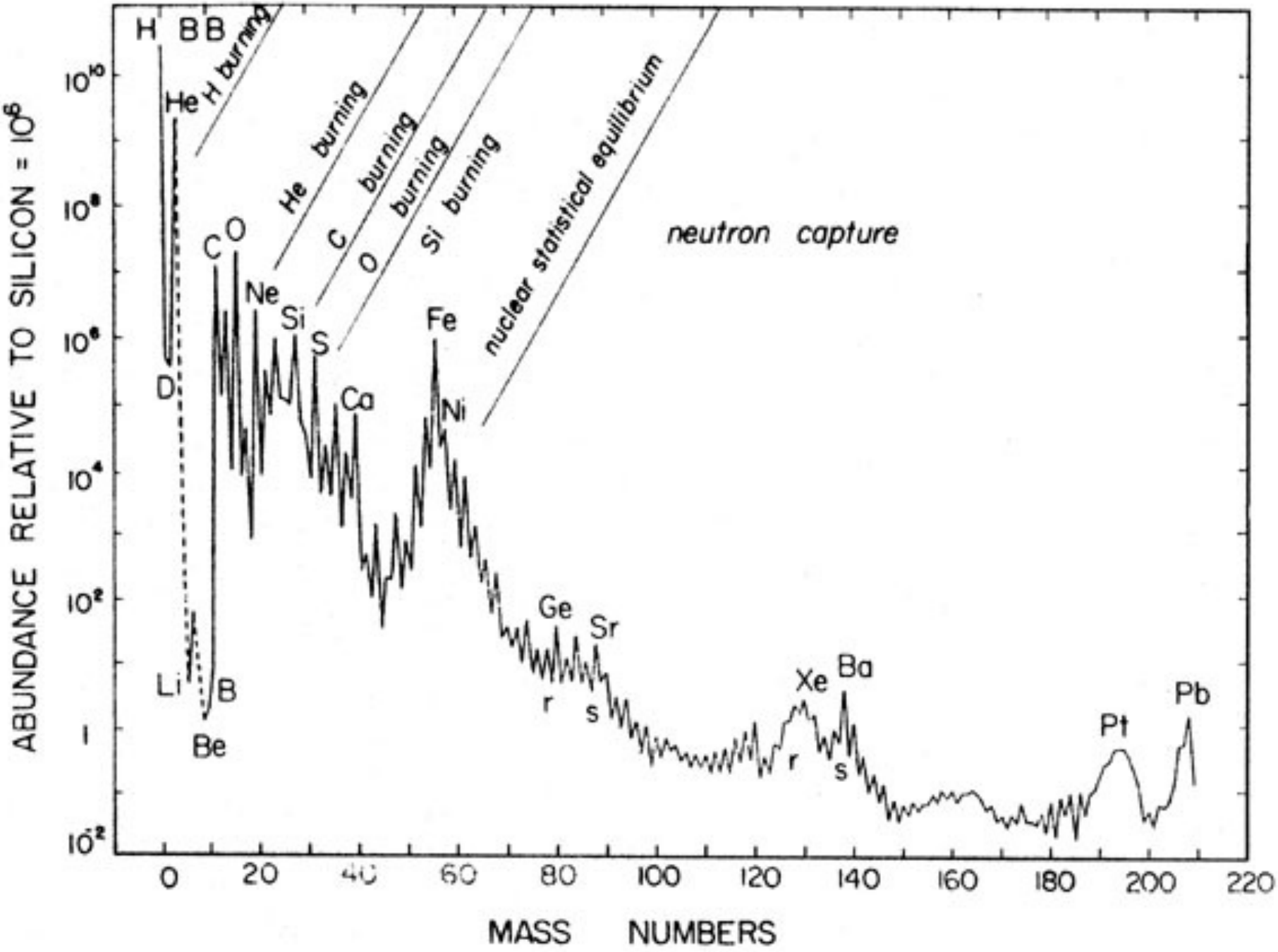


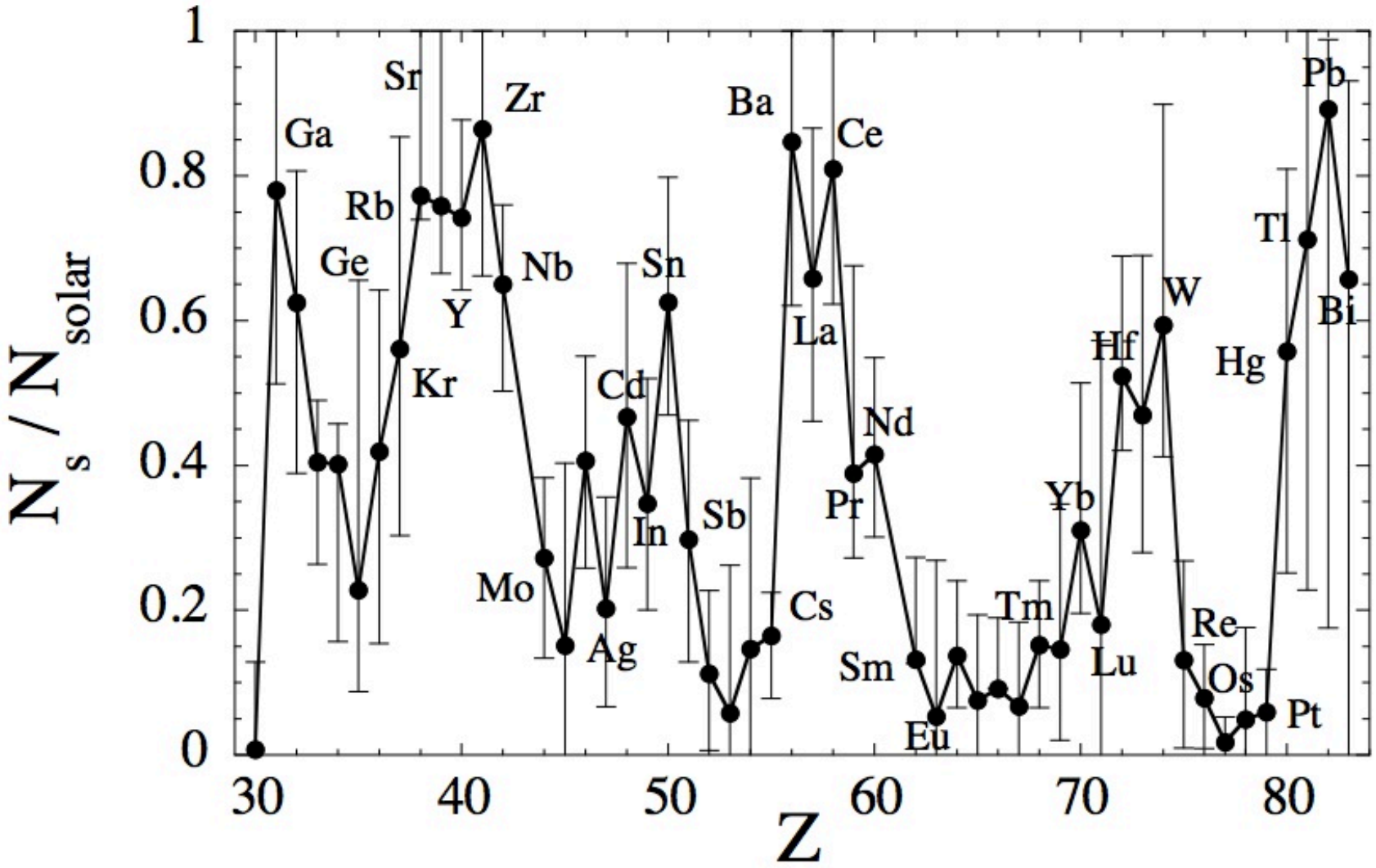
FIG. 4. The *s*-process path through the isotopes of tin. The neutron number increases by units of one on a slow time scale until negative beta activity occurs and the path moves to the isobar of higher Z. This path can be determined from empirical evidence on the beta stability of nuclei. Note that the path bypasses the *p*-process and the *r*-process nuclei. The *r*-process nuclei are the end products of an isobaric beta-decay chain as shown at the far right from neutron-rich progenitors produced in an intense neutron flux. The *p*-process nuclei are produced by subjecting a small fraction of *s* and *r*-process nuclei to an intense proton or photon flux.


s-only
La
Ba
Cs
Xe
138
p
139
s,r
130
p
132
p
134
s
135
s,r
136
s
137
s,r
138
s,r
130
s,r
128
s
129
s,r
130
s
131
s,r
132
s,r
134
r
136
r
s-process path
r-process path

overall solar system abundances

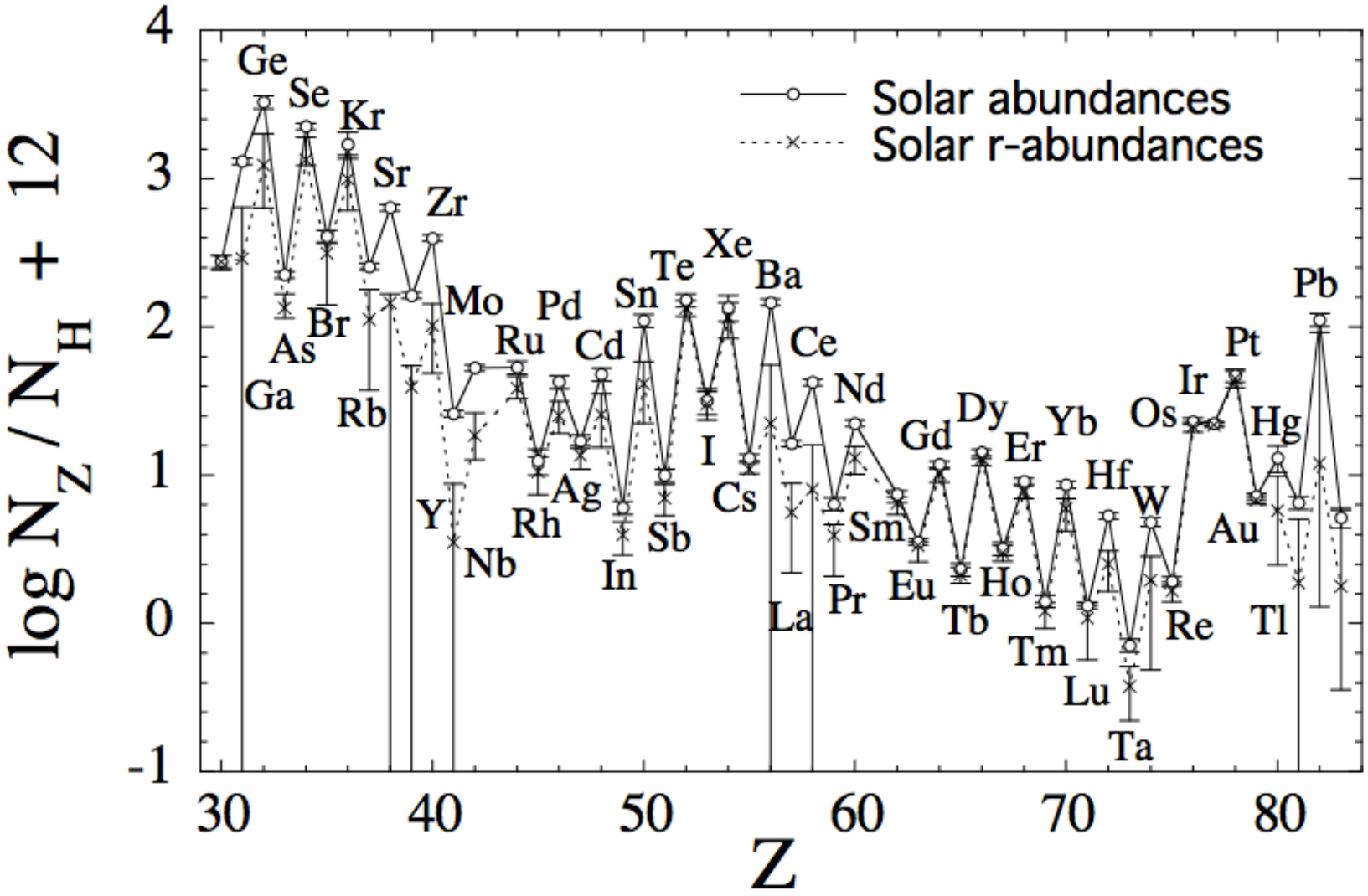


solar system - s process (model)

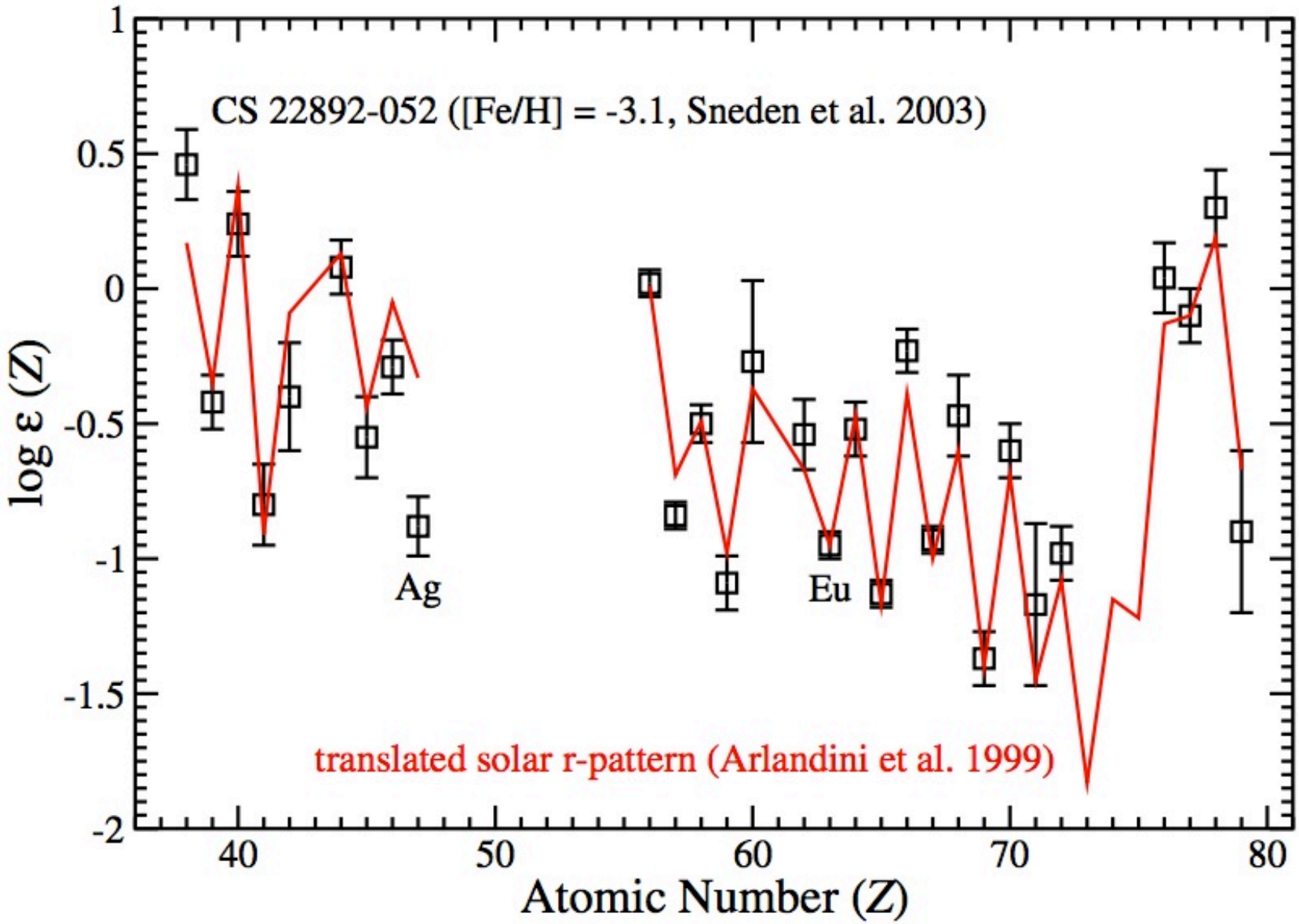


from Arnould et al. 2007, Physics Reports, 450, p. 97

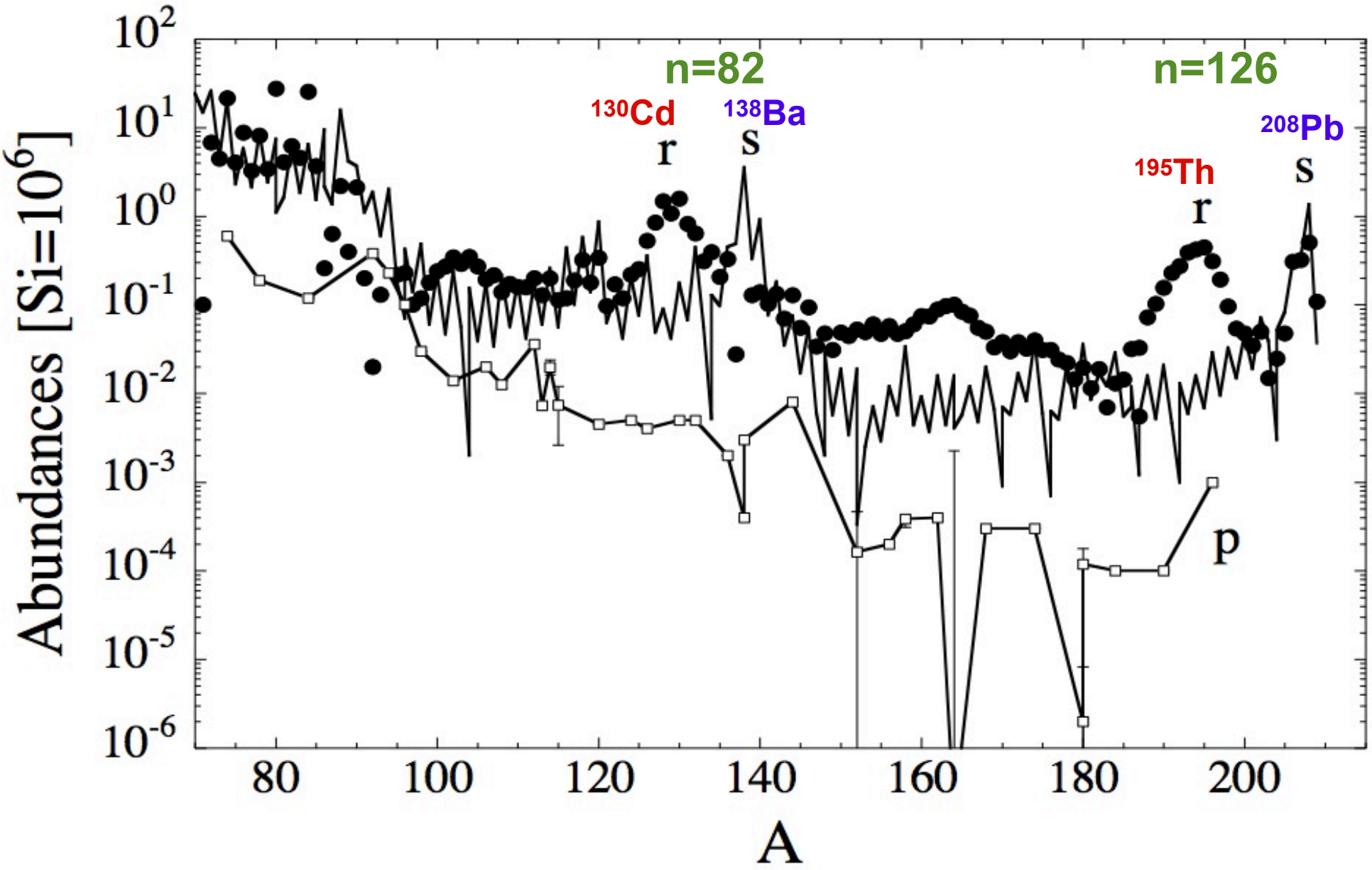
solar system - r process



from Arnould et al. 2007, Physics Reports, 450, p. 97



from Qian & Wasserburg 2007, Physics Reports, 442, p. 237



from Arnould et al. 2007, Physics Reports, 450, p. 97