Measurement of $^{17}O(p,\gamma)^{18}F$

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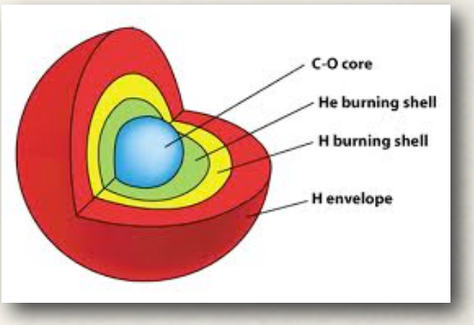
University of Notre Dame

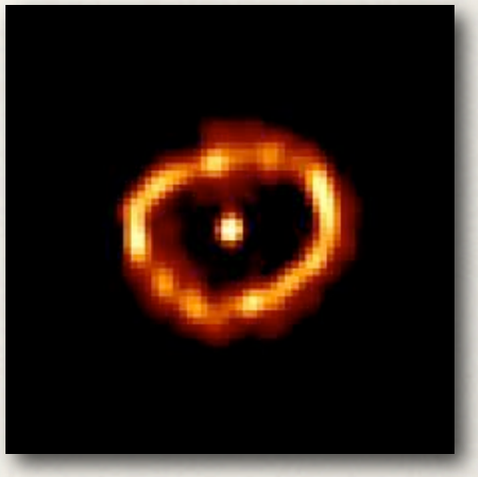
November 23th, 2011

Motivation

- Nucleosynthesis in Red Giants, AGB stars (0.03-0.1 T_9)



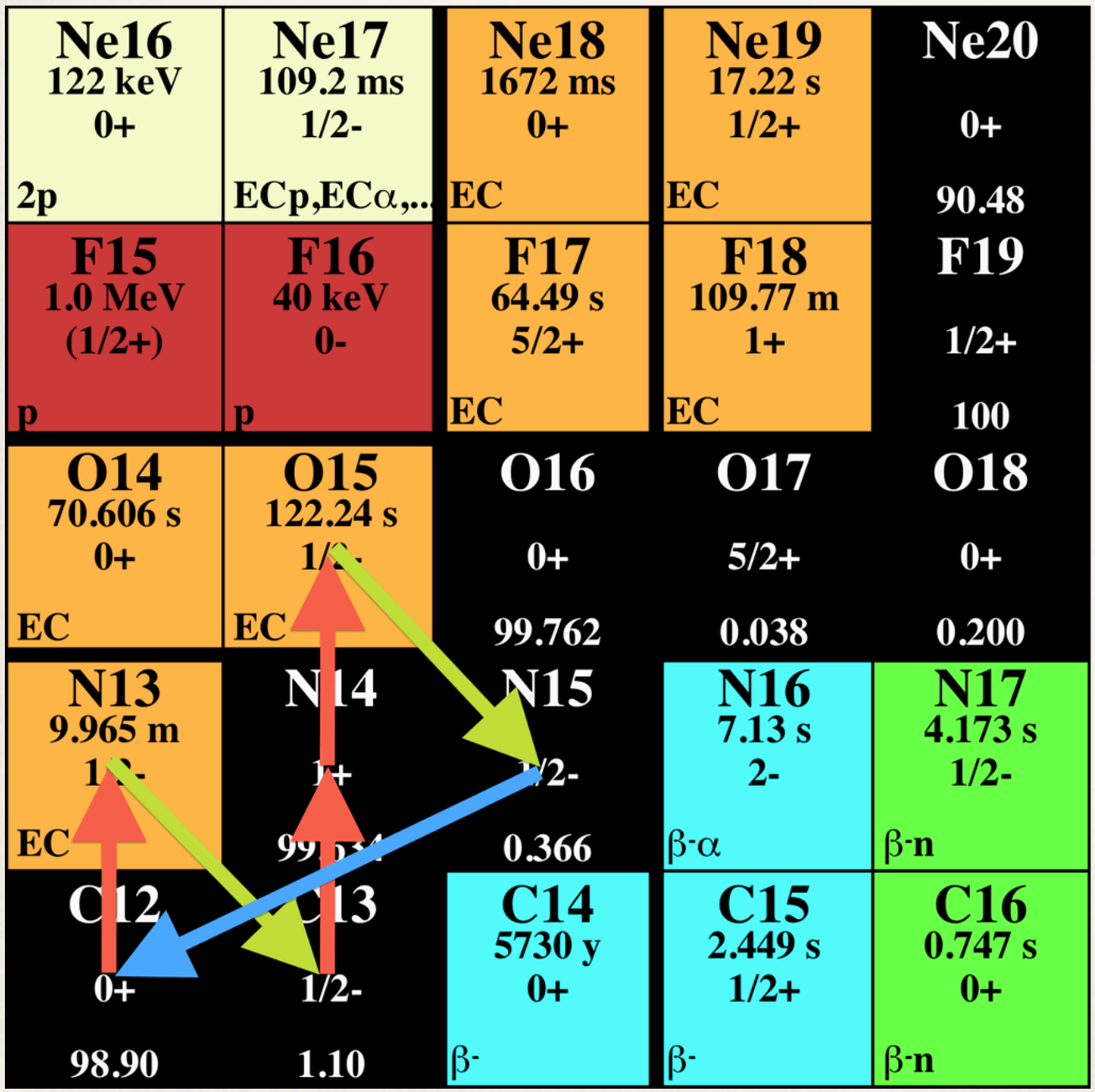
- Help constrain stellar and galactic evolution models through $^{17}O/^{16}O$, $^{18}O/^{16}O$.



- ^{18}F production in Classical Novae. (0.1-0.4 T_9)

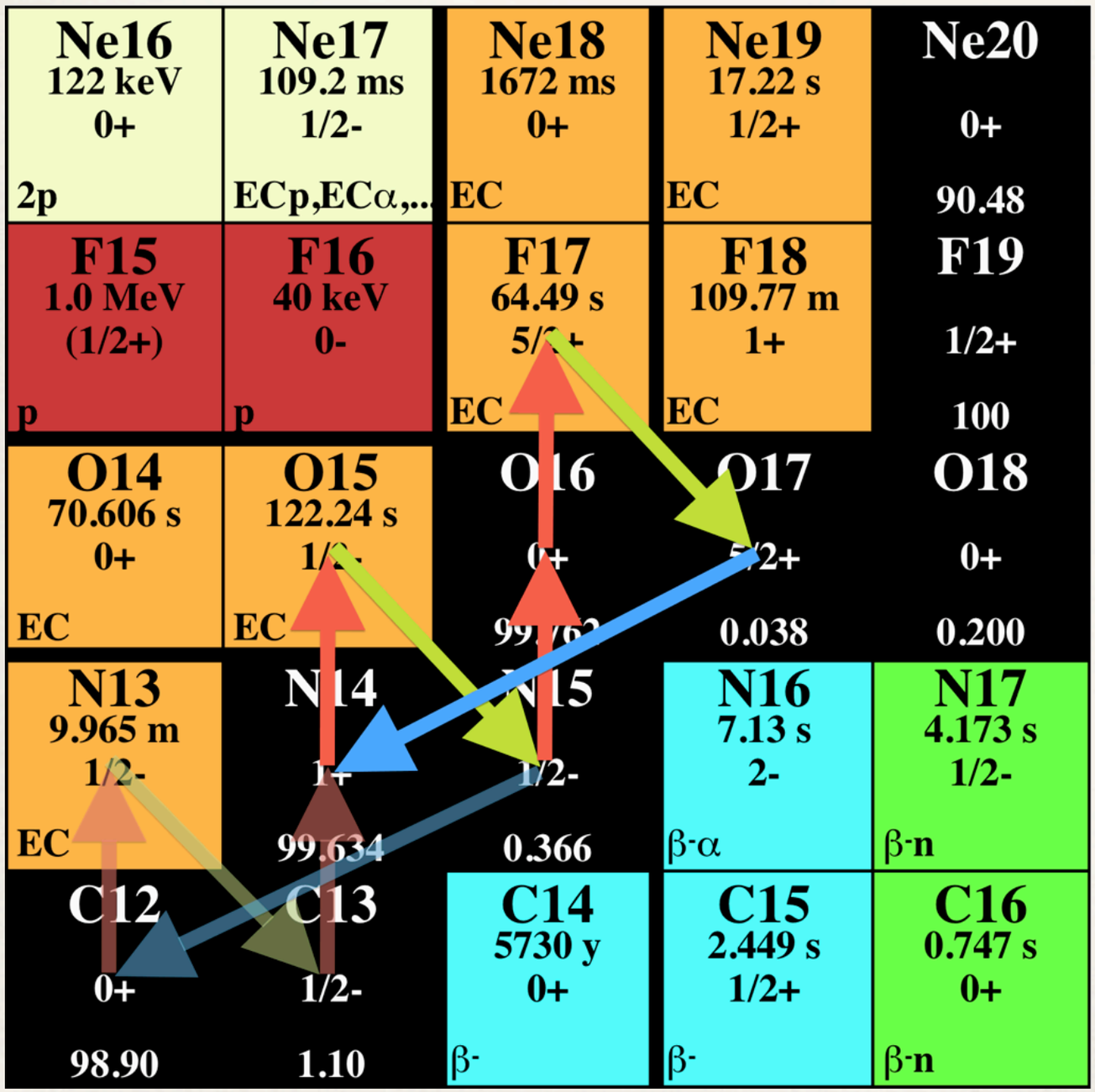
- A good R-Matrix case.

Hydrogen Equilibrium Burning



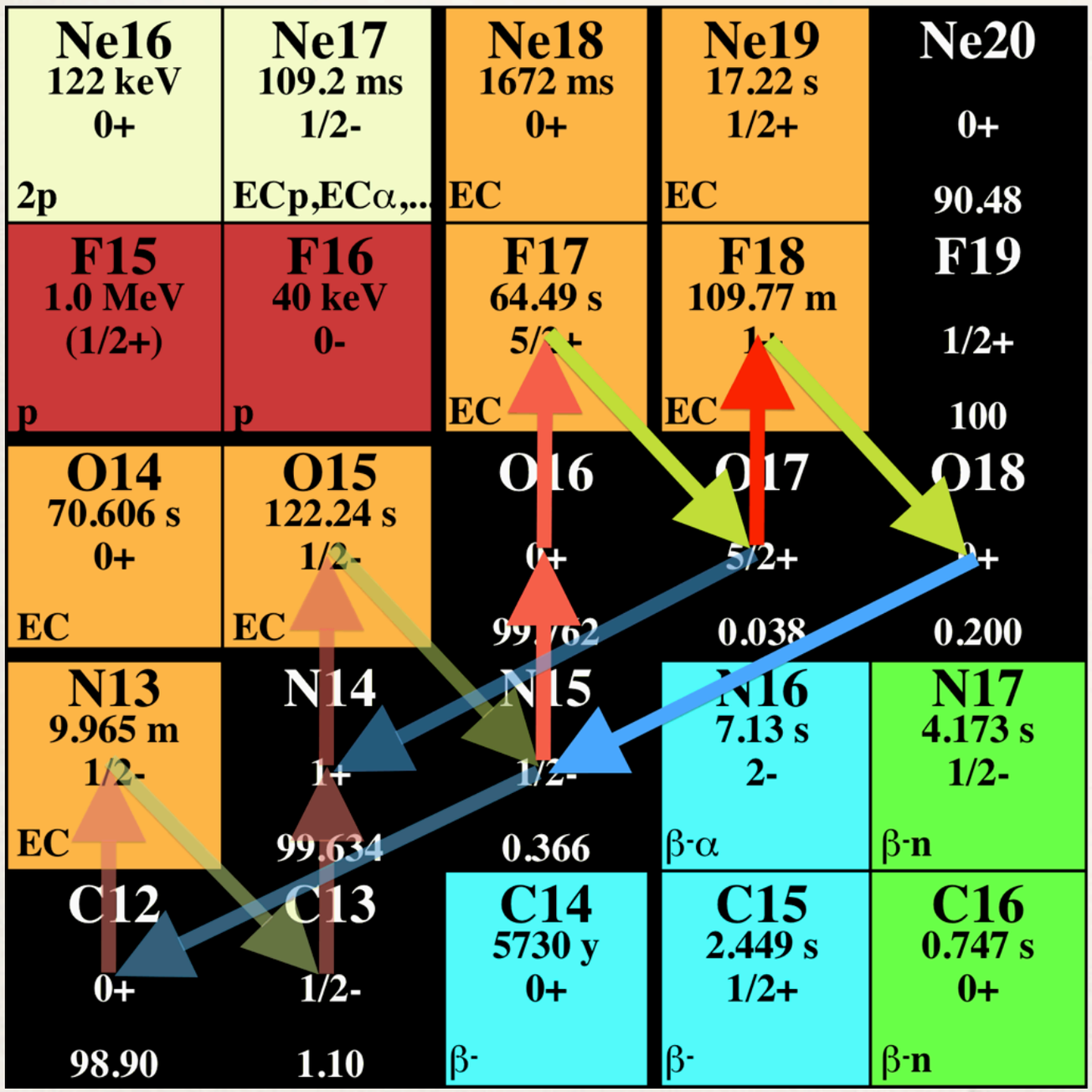
CNO I

Hydrogen Equilibrium Burning



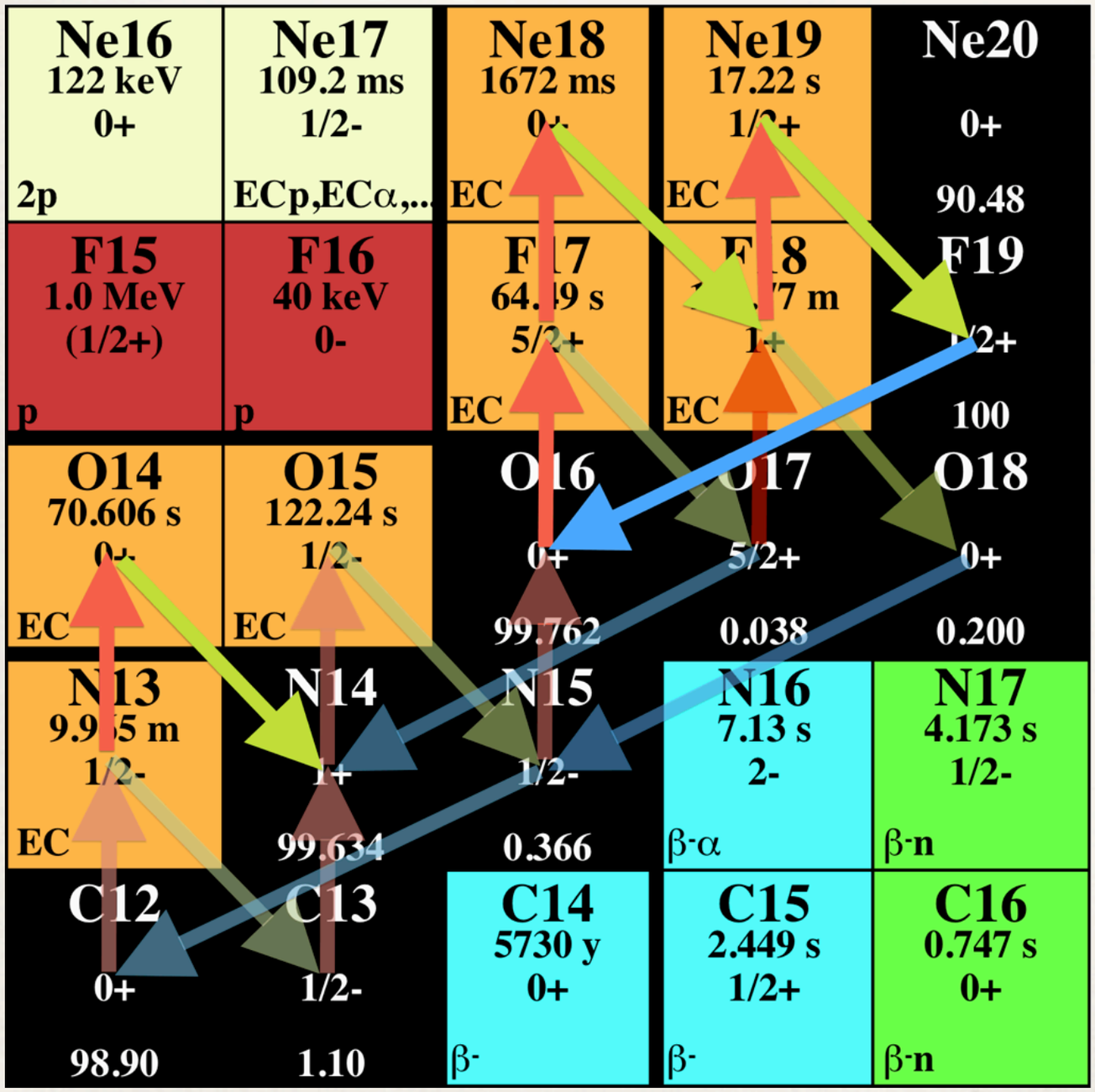
CNO II

Hydrogen Equilibrium Burning



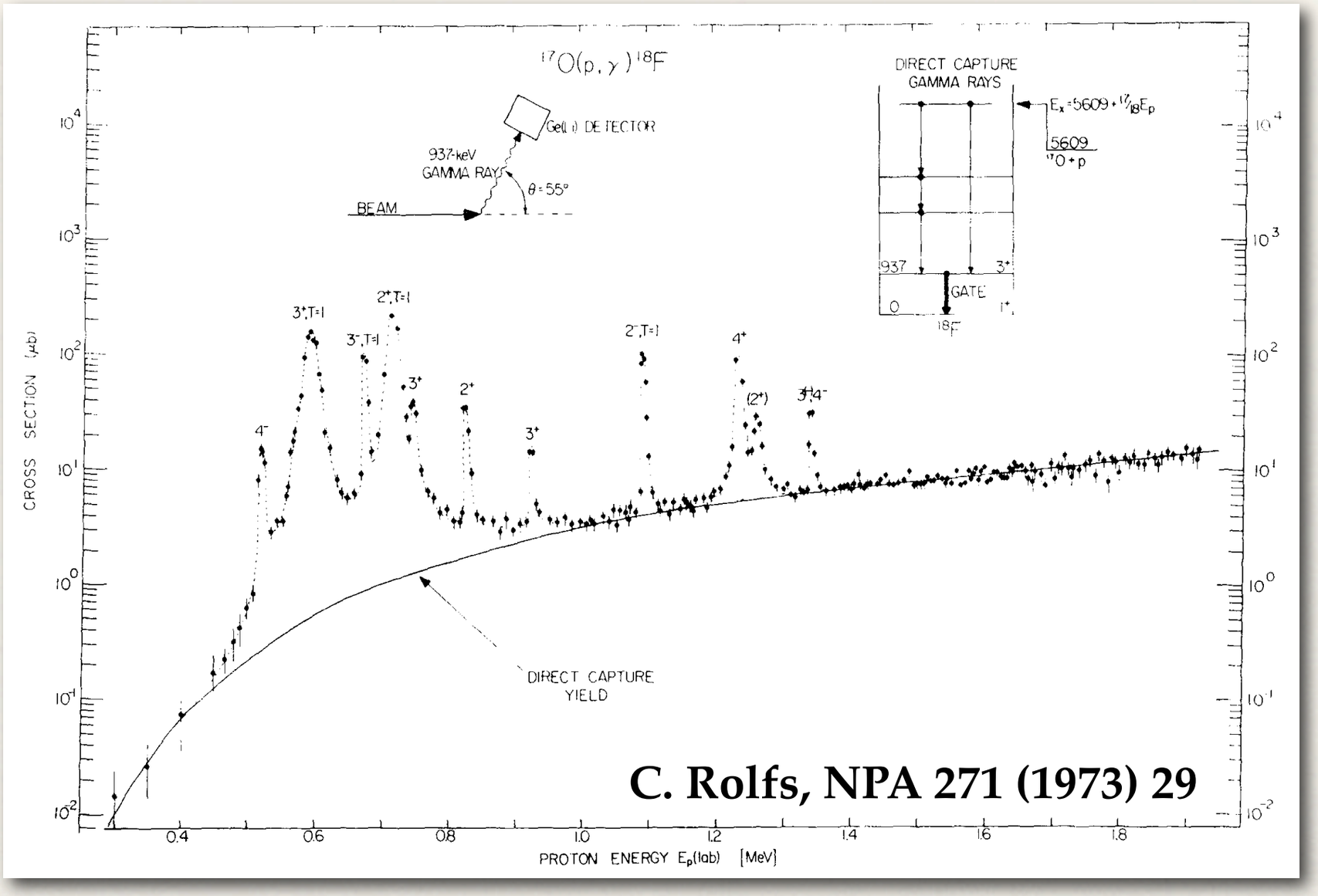
CNO III

Hydrogen Explosive Burning



Hot CNO

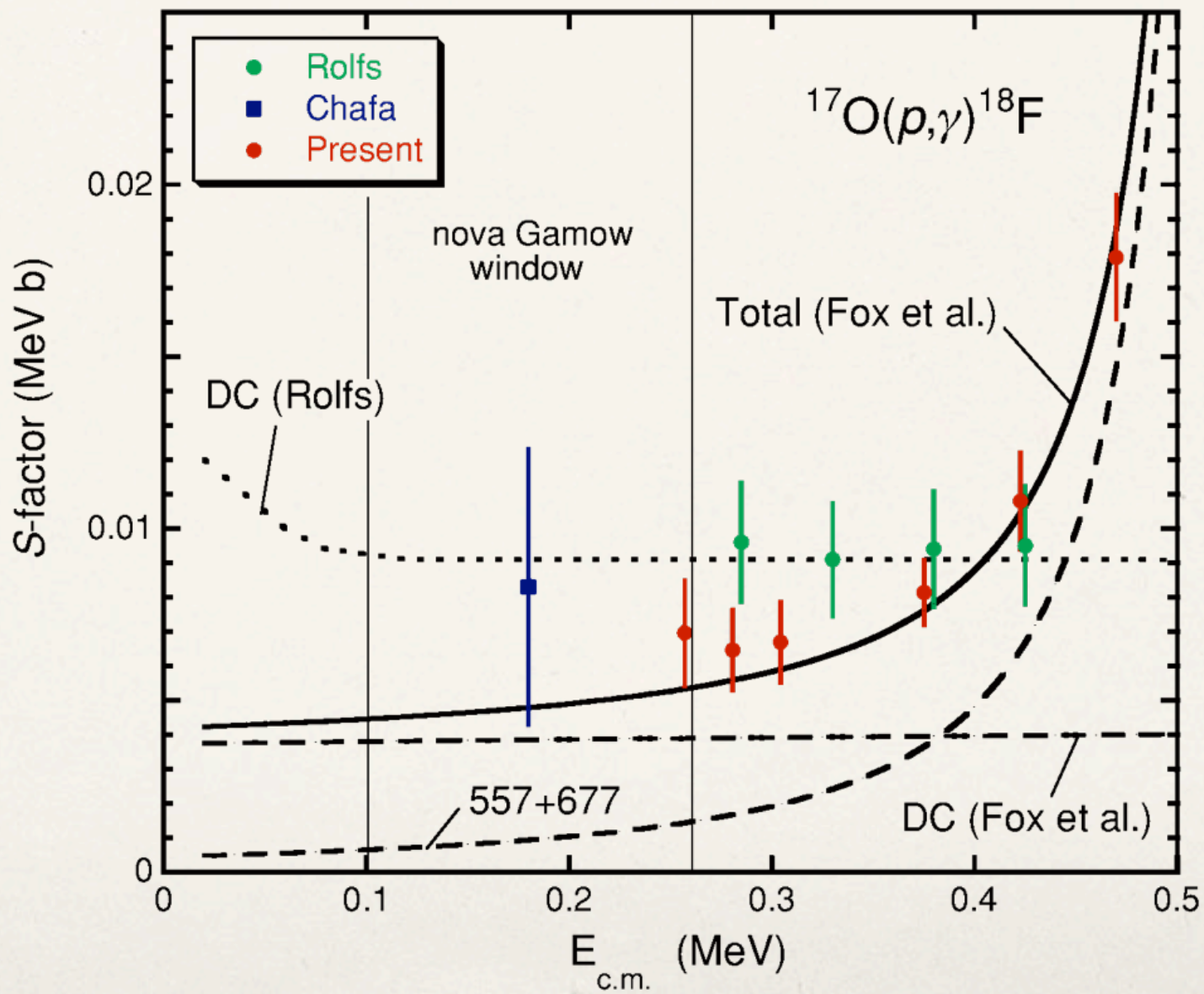
Previous Measurements



C. Rolfs, NPA 271 (1973) 29

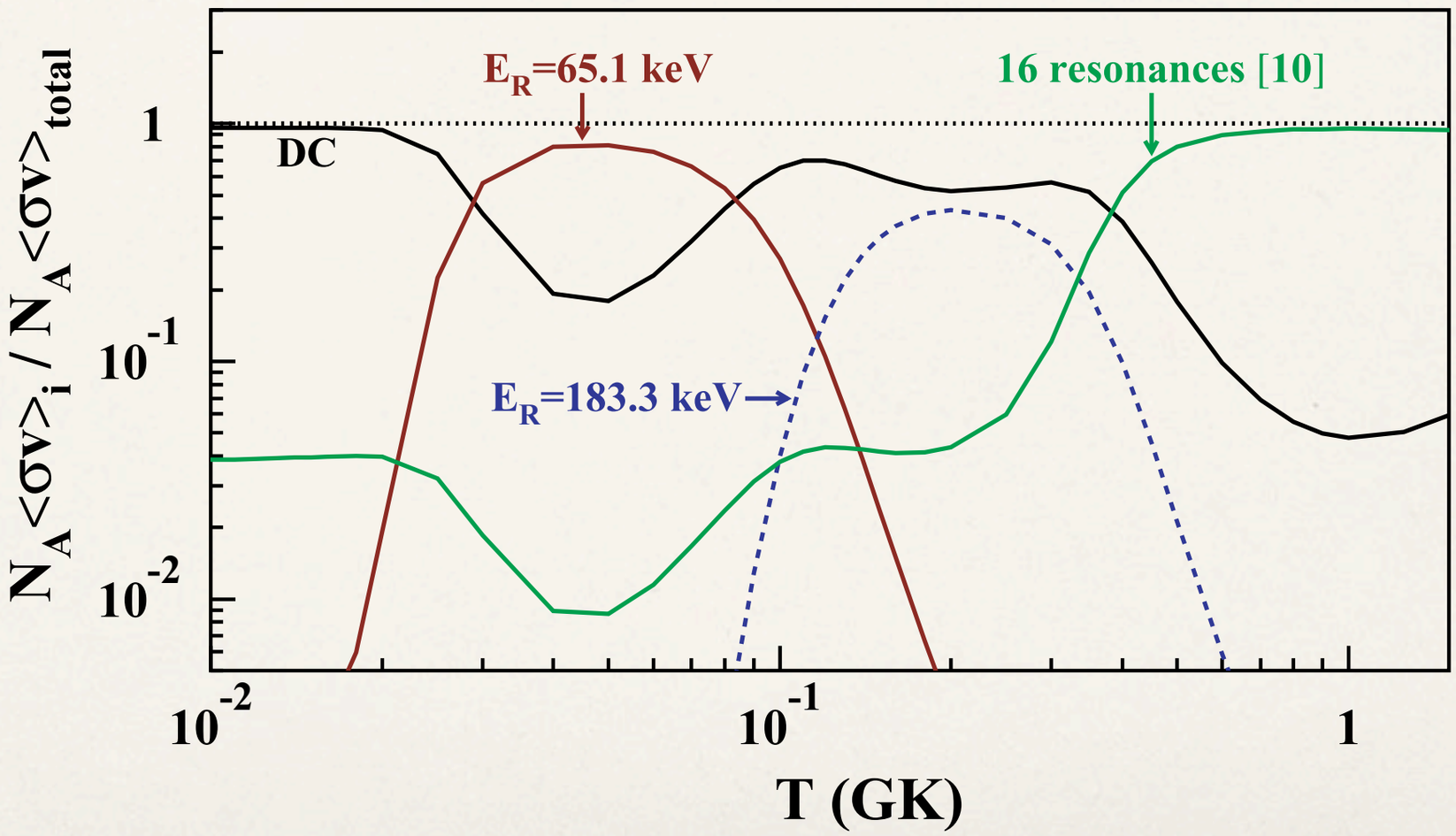
Previous Measurements

Newton et al. PHYSICAL REVIEW C **81**, 045801 (2010)



Direct Capture Contribution

A. CHAFA *et al.* PHYSICAL REVIEW C **75**, 035810 (2007)



Goals of the New Experiment

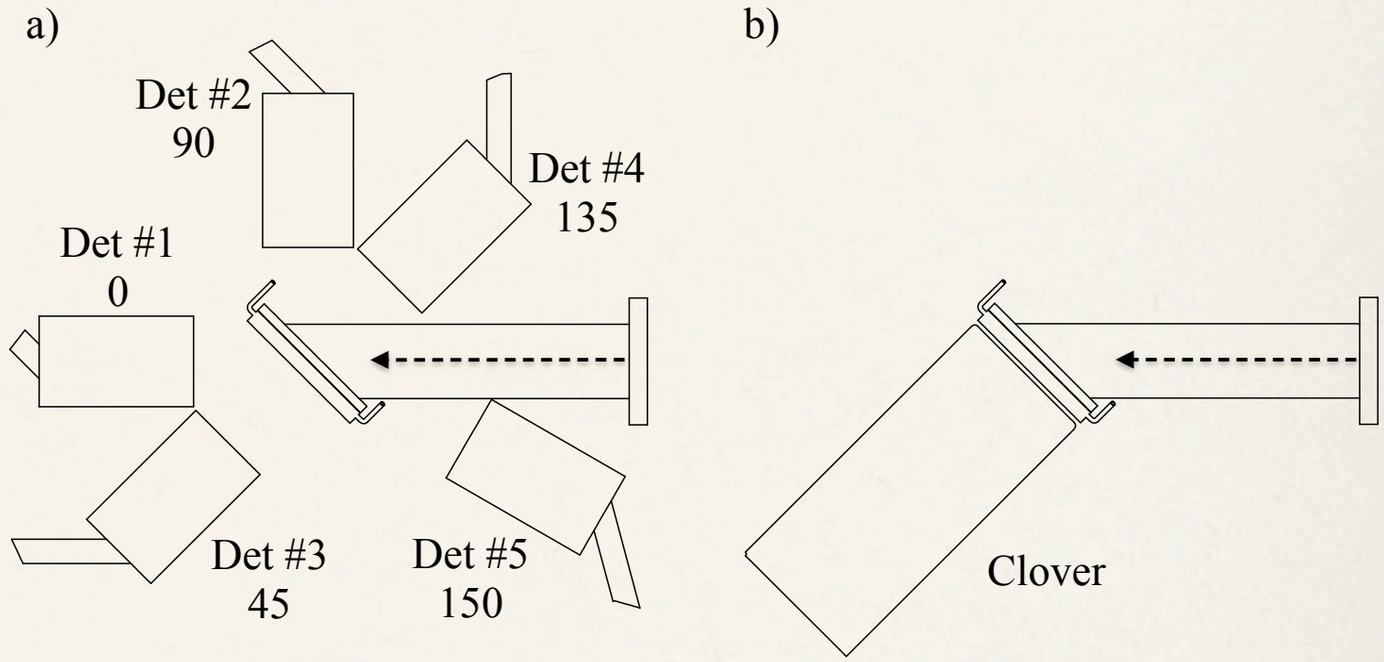
- Measure at high energies
- Angular Distributions

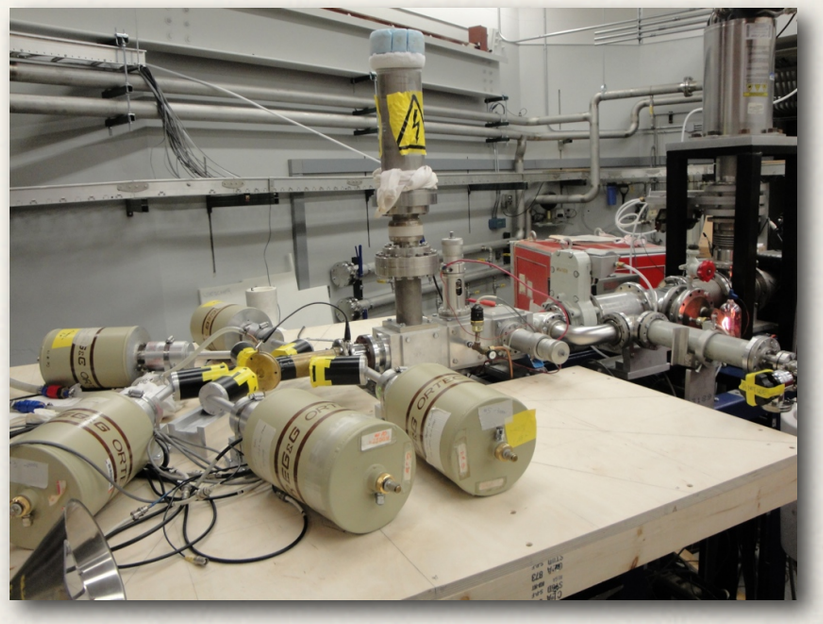
} → Extrapolate Direct Capture

- "Eliminate" summing corrections.
- Compare measurements.

Experimental procedure

- 2 Ge detector set-ups
- Implanted Targets
- Anodized Ta_2O_5 targets (90% ^{17}O)
- Proton Energies 400-1800 keV



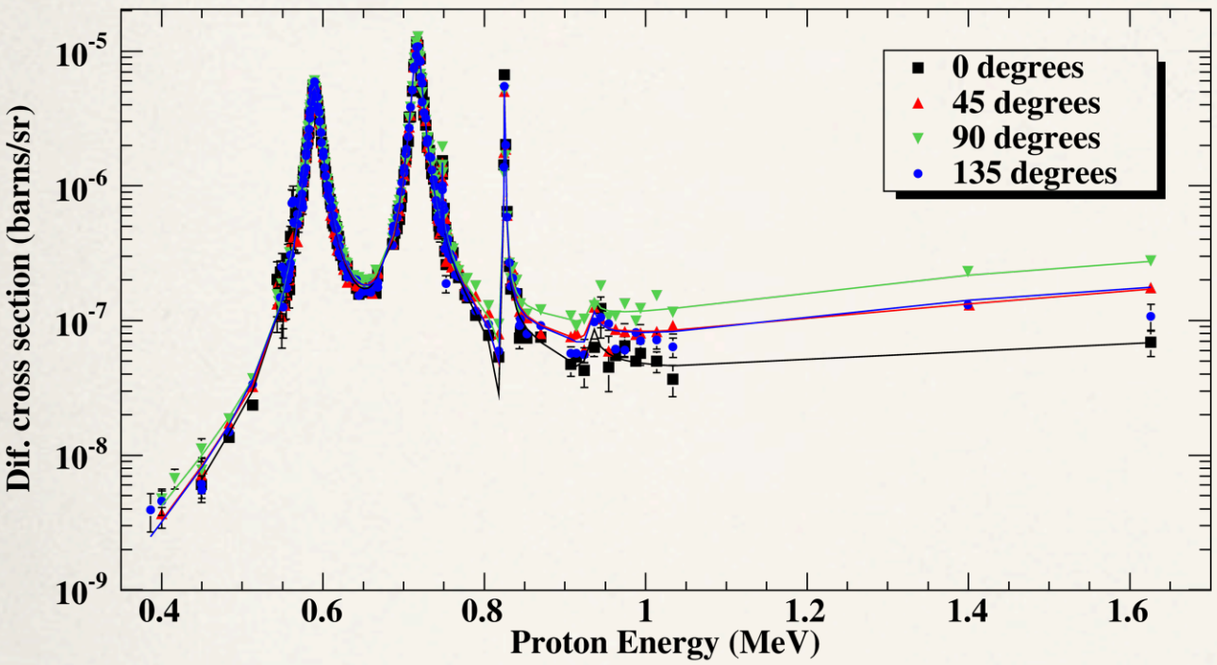


Results-Strengths

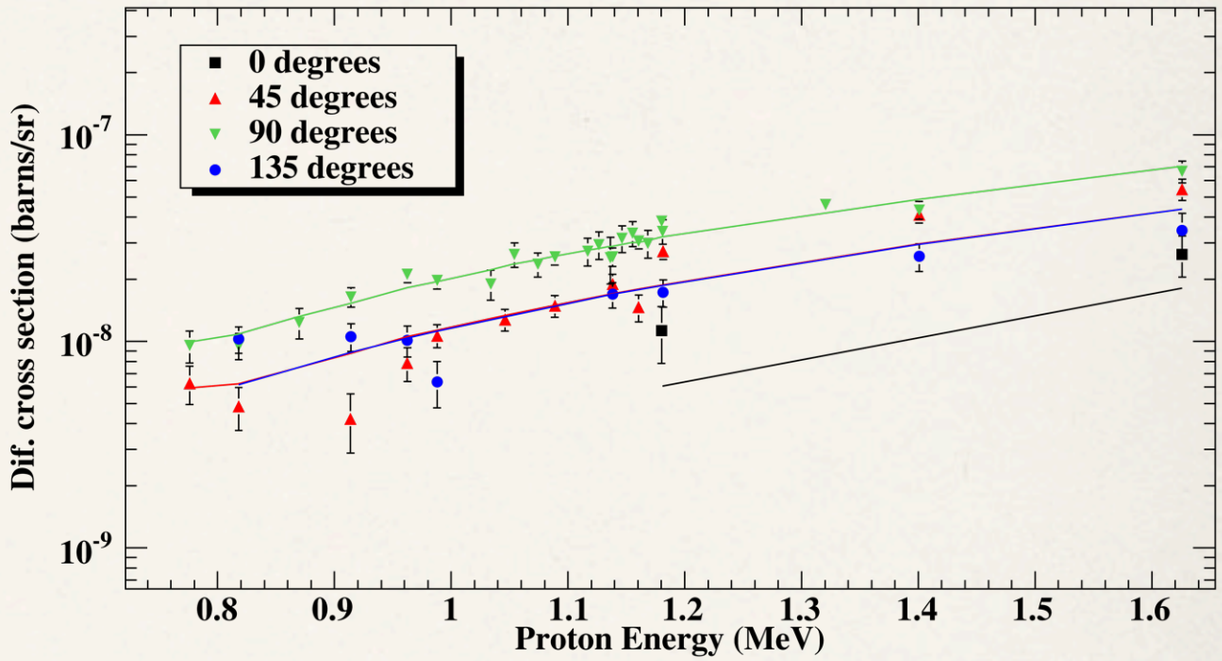
Resonance	Present ωγ (eV)	Rolfs* ωγ (eV)	Newton ωγ (eV)
517	(1.23±0.14)e-02	(1.30±0.25)e-02	(1.37±0.22)e-02
590	(3.50±0.40)e-01	(3.47±0.09)e-01	-
714	(5.54±0.70)e-01	(4.7±1.2)e-01	-
826	(3.05±0.24)e-02	(3.1±0.9)e-02	-
926	(1.83±0.17)e-02	(1.86±0.74)e-02	-
1098	(2.81±0.31)e-01	(2.2±0.6)e-01	-

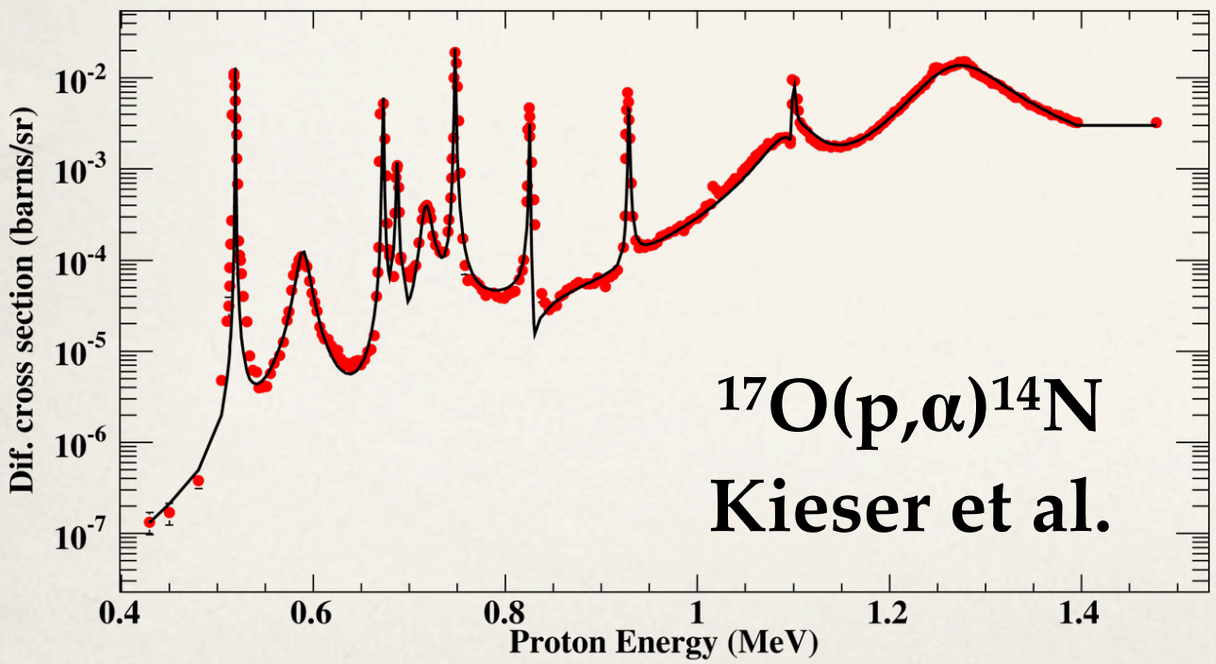
Results- R Matrix Fits

Pr→937



Pr→4964

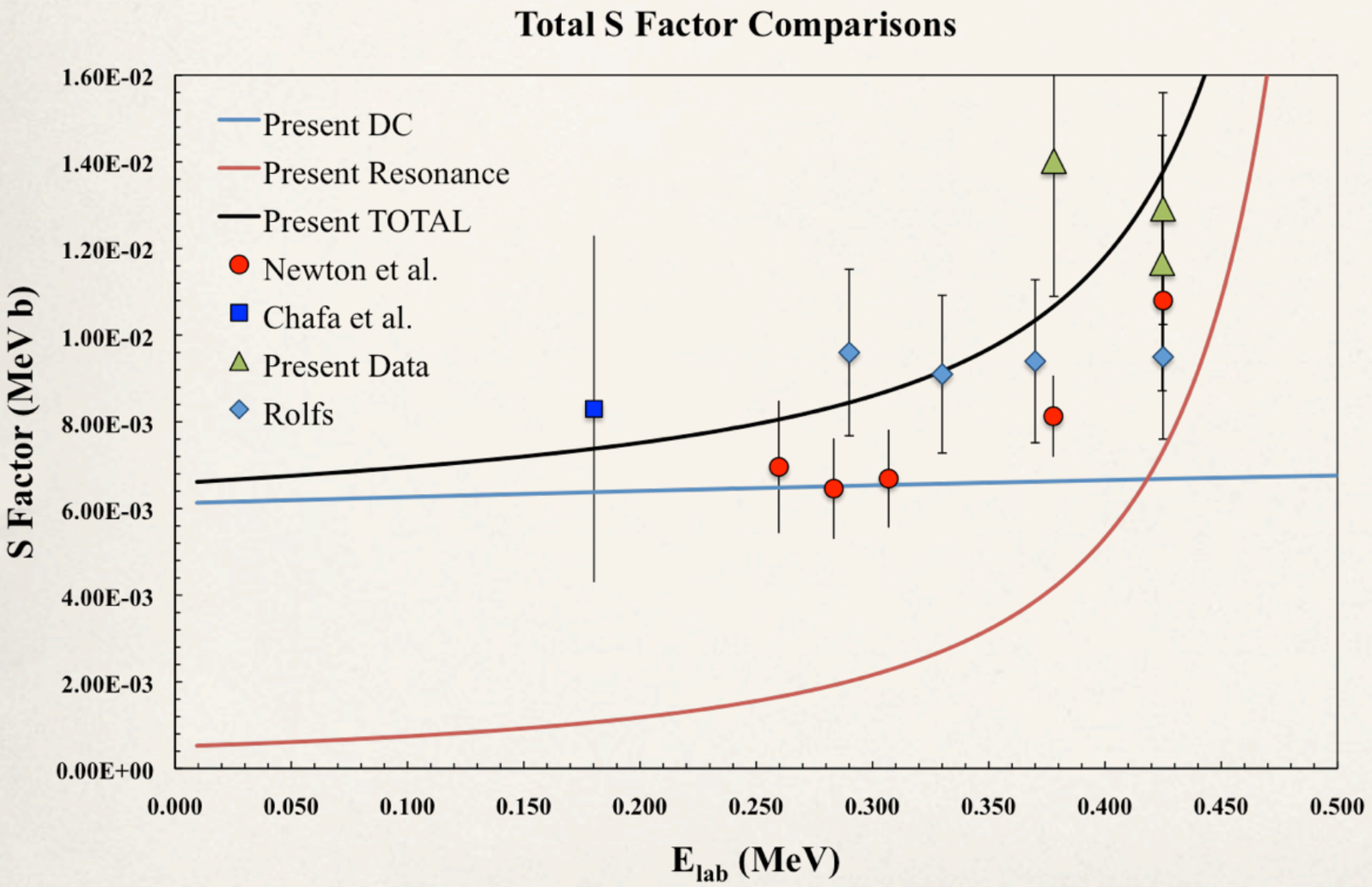




(p,γ) → 12 Primary Transitions + (p,α)
Simultaneous Fit
R Matrix code AZURE

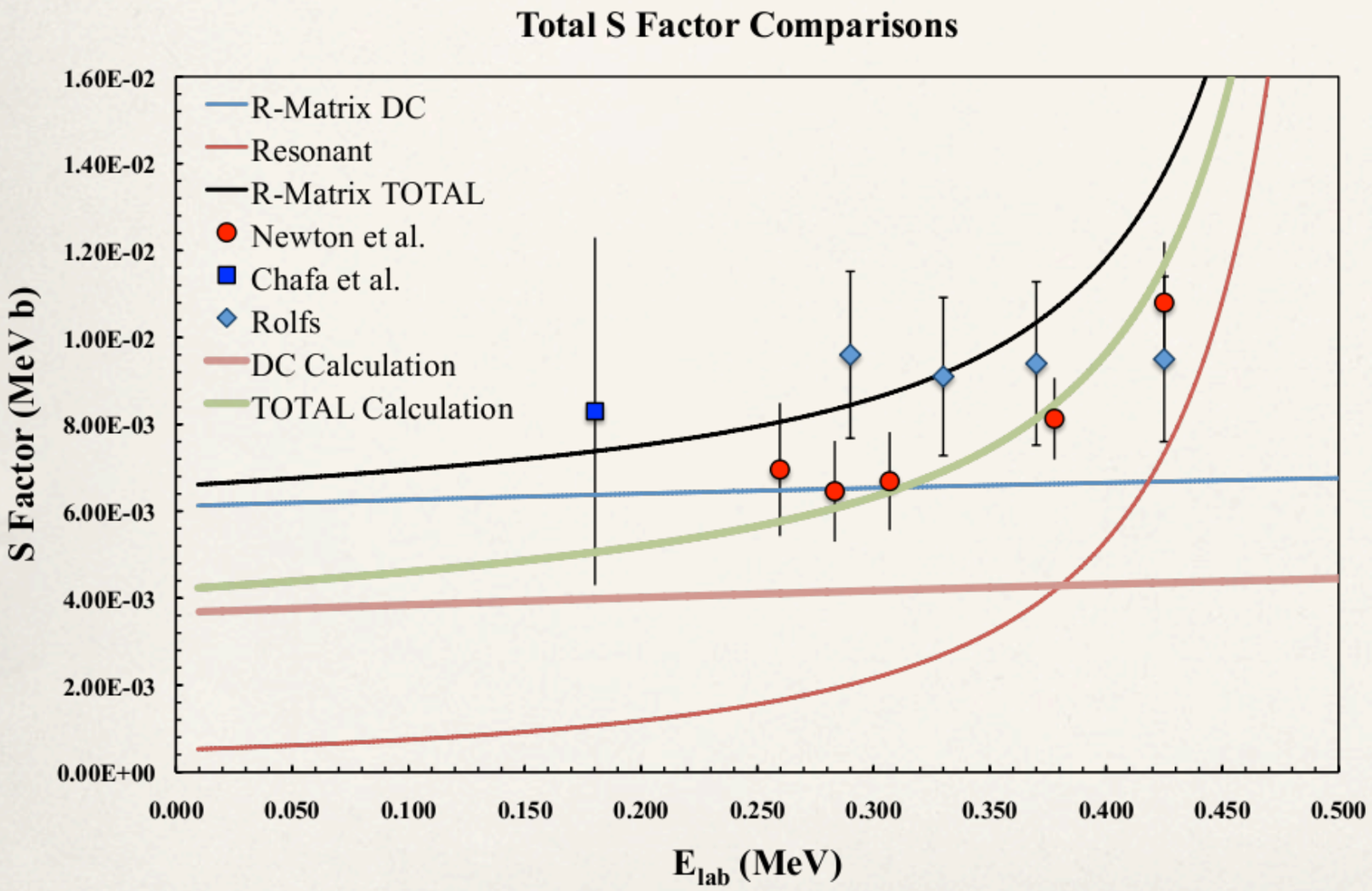
R. Azuma, E. Uberseder et al.
PHYSICAL REVIEW C **81**, 045805 (2010)

S-Factor Comparisons



	$S_{DC}(0)$ (keV b)
Newton et al.	(4.6±1.1)e-3
Chafa et al.	(6.2±3.1)e-3
Fox et al.	(3.7±1.3)e-3
Rolfs	(9.4±1.9)e-3
Present	(6.1±1.3)e-3

S-Factor Comparisons



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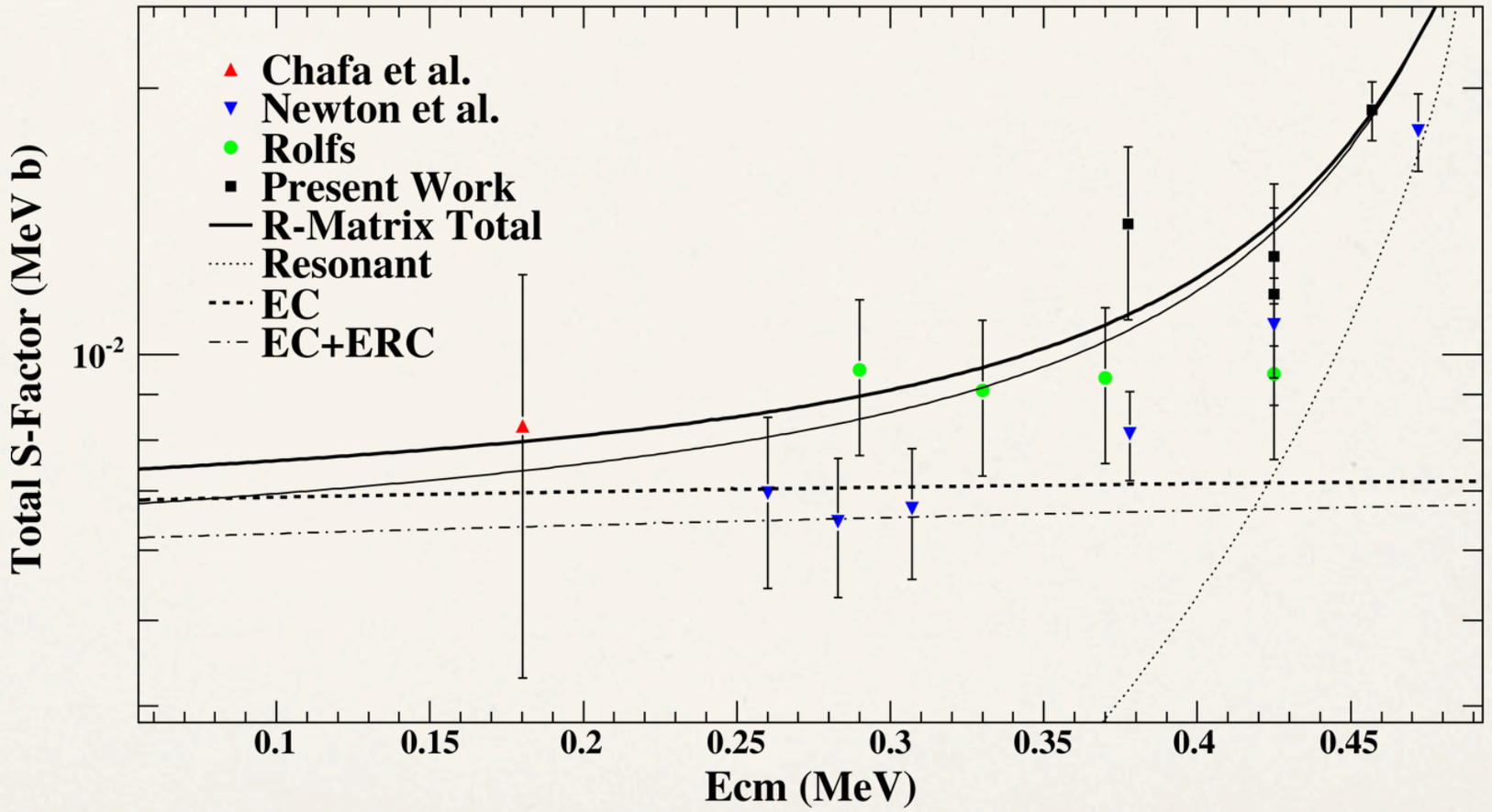
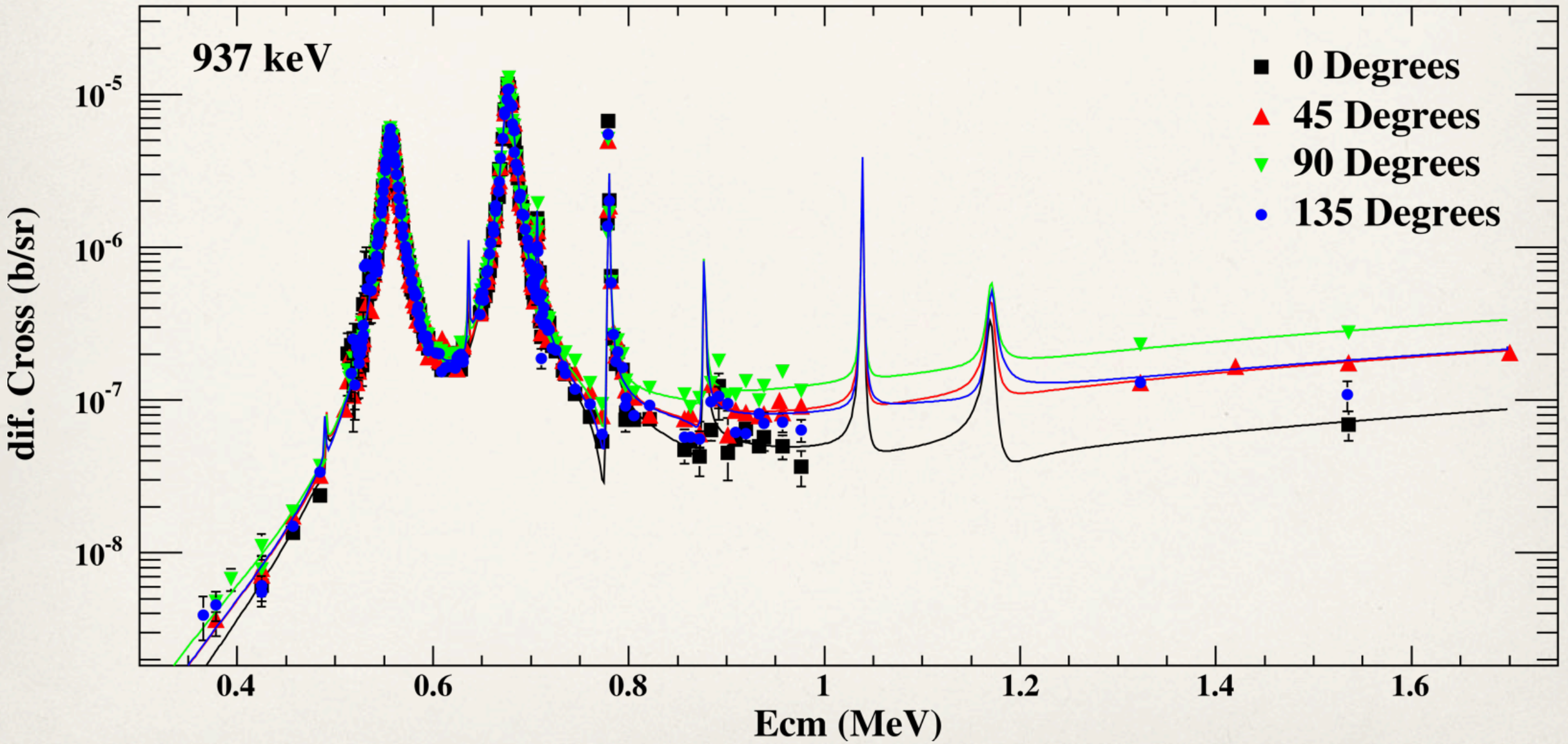
Fox et al.	(3.7±1.3)e-3
Rolfs	(9.4±1.9)e-3
Present	(4.2±1.5)e-3

Thank You!

Collaborators

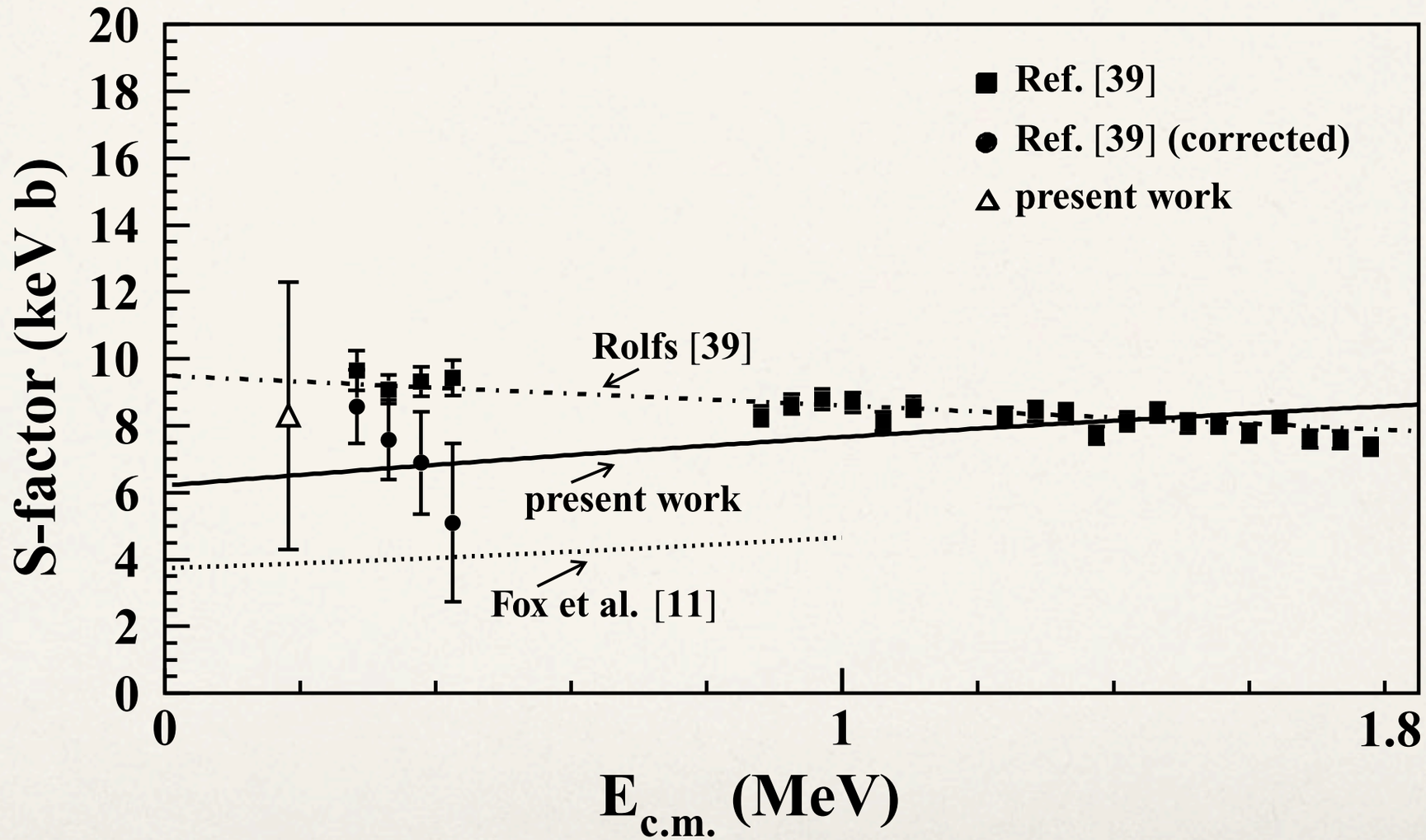
- J. Görres (University of Notre Dame)
- A. Best (University of Notre Dame)
- Q. Li (University of Notre Dame)
- D. Schürmann (University of Notre Dame)
- E. Uberseder (University of Notre Dame)
- G. Imbriani (Universita di Napoli and INFN
- M. Wiescher (University of Notre Dame)
- Richard Azuma (University of Toronto)


Chafa et al.
Newton et al.
Rolfs
Present Work
R-Matrix Total
Resonant
EC
EC+ERC
Total S-Factor (MeV b)
10-2
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Ecm (MeV)


937 keV
0 Degrees
45 Degrees
90 Degrees
135 Degrees
dif. Cross (b/sr)
Ecm (MeV)
10^-5
10^-6
10^-7
10^-8
0.4
0.6
0.8
1
1.2
1.4
1.6

Miscellaneous

PHYSICAL REVIEW C **75**, 035810 (2007)



Miscellaneous