

Light Element Evaluations for ENDF/B-VII.1

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New R-Matrix Evaluation Work for Light Elements

- Covariances for n-p scattering
 - New evaluation, covariances for n- α scattering
- New evaluation, covariances for n+ ^6Li reactions
 - New evaluation, covariances for n+ ^{16}O reactions
 - New evaluation for n+ ^9Be total cross section

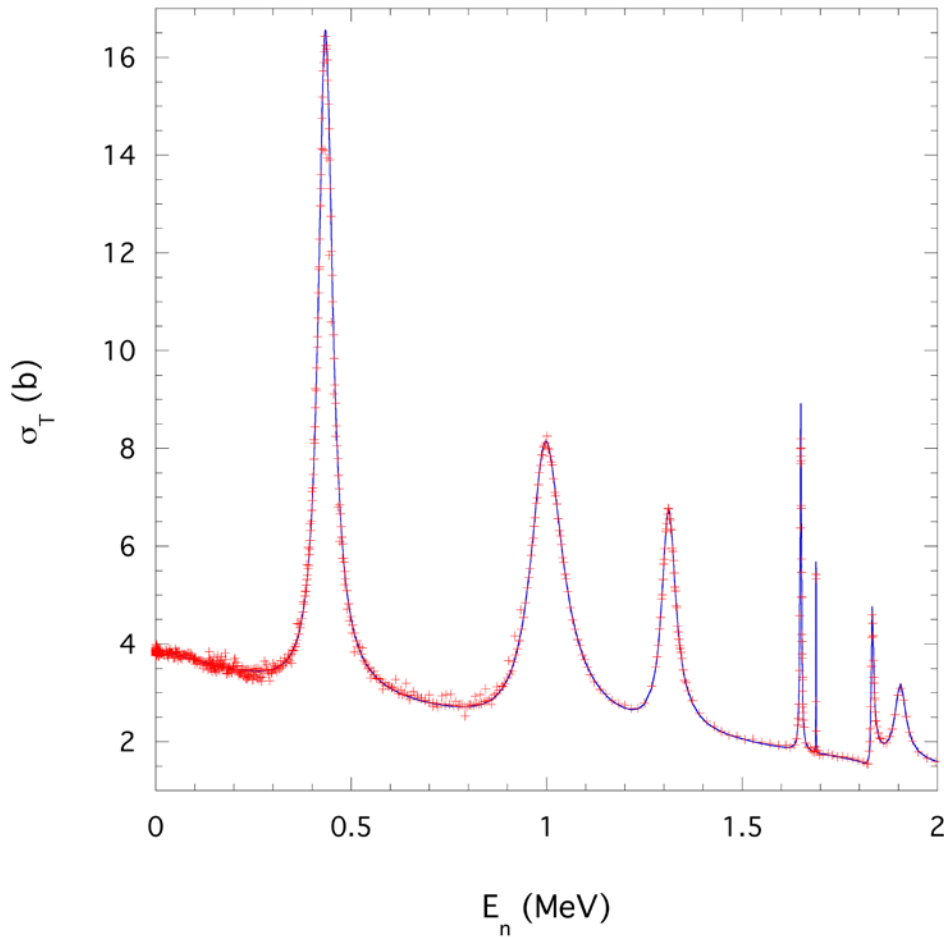
R-Matrix Analysis of Reactions in the ^{17}O System

channel	a_c (fm)	l_{\max}
$n+^{16}\text{O}$	4.3	4
$\alpha+^{13}\text{C}$	5.4	5

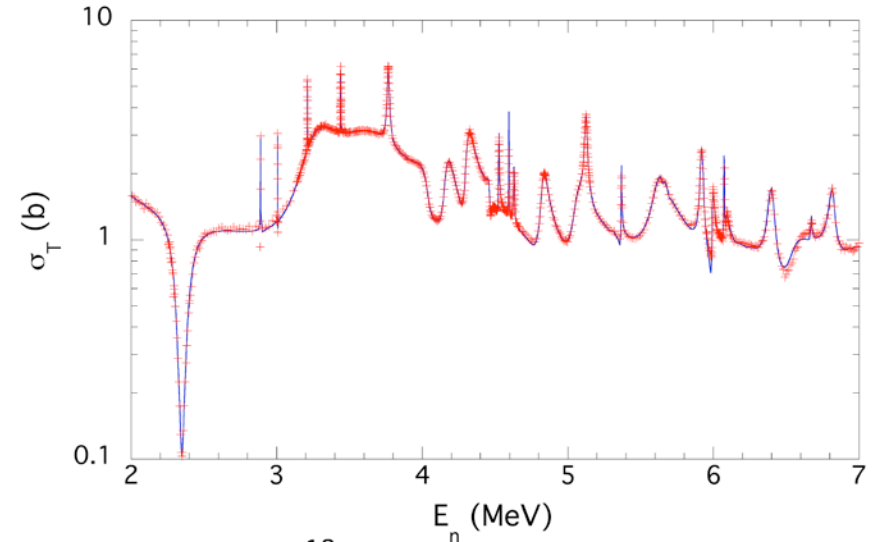
Reaction	Energies (MeV)	# data points	Data types
$^{16}\text{O}(n,n)^{16}\text{O}$	$E_n = 0 - 7$	2718	$\sigma_T, \sigma(\theta), P_n(\theta)$
$^{16}\text{O}(n,\alpha)^{13}\text{C}$	$E_n = 2.35 - 5$	850	$\sigma_{\text{int}}, \sigma(\theta), A_n(\theta)$
$^{13}\text{C}(\alpha,n)^{16}\text{O}$	$E_\alpha = 0 - 5.4$	874	σ_{int}
$^{13}\text{C}(\alpha,\alpha)^{13}\text{C}$	$E_\alpha = 2 - 5.7$	1296	$\sigma(\theta)$
total		5738	8

Comparisons with Exptl. Data

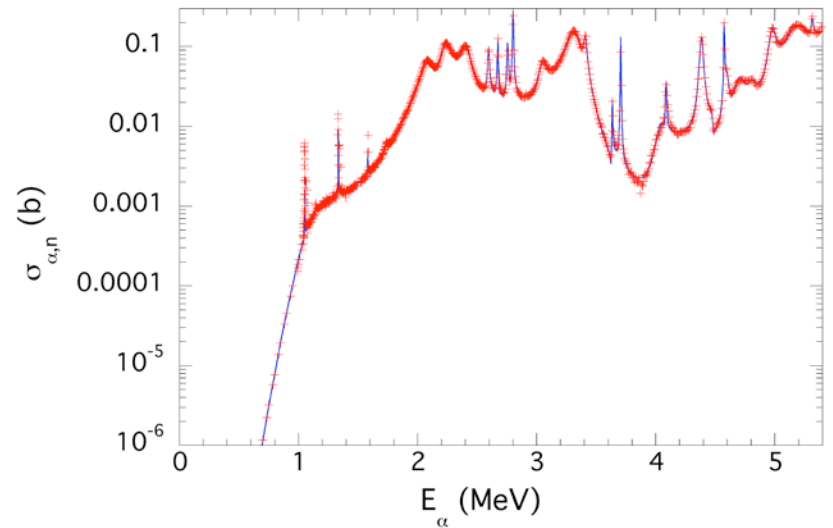
$n+^{16}\text{O}$ Total Cross Section



$n+^{16}\text{O}$ Total Cross Section

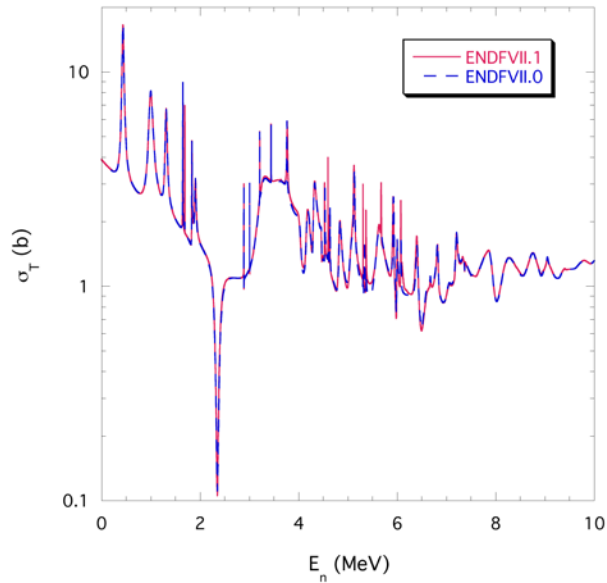


$^{13}\text{C}(\alpha,n)$ Cross Section

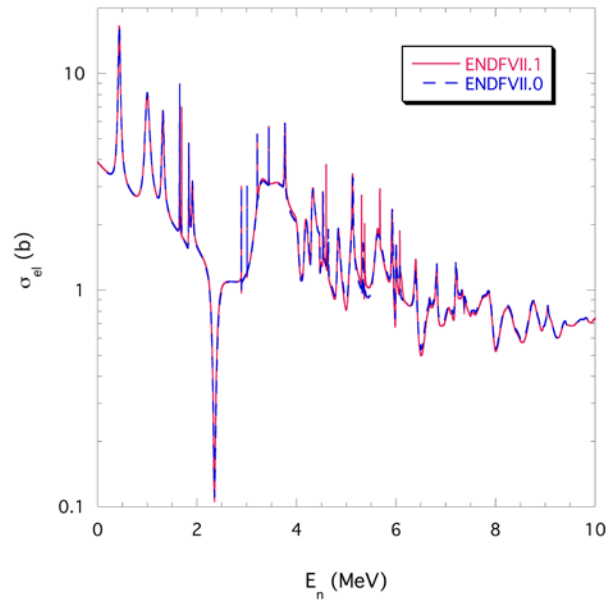


Comparisons with ENDF/B VII.0

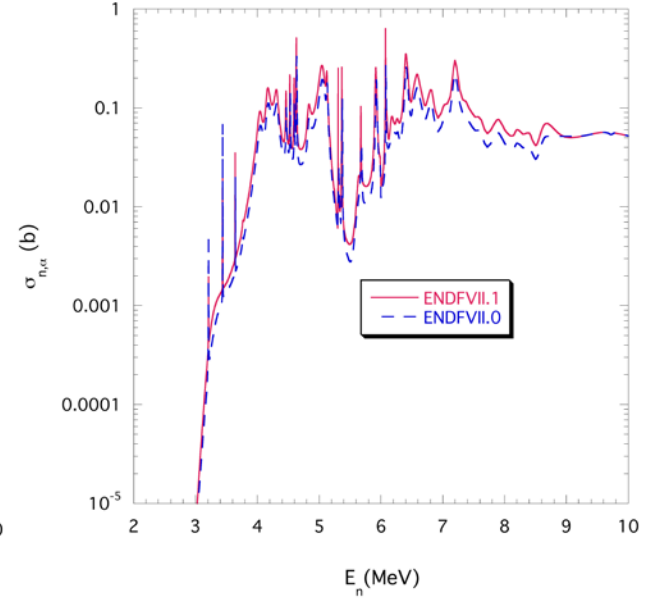
$n+^{16}\text{O}$ Total Cross Section



$^{16}\text{O}(n,n)^{16}\text{O}$ Cross Section



$^{16}\text{O}(n,\alpha)^{13}\text{C}$ Cross Section



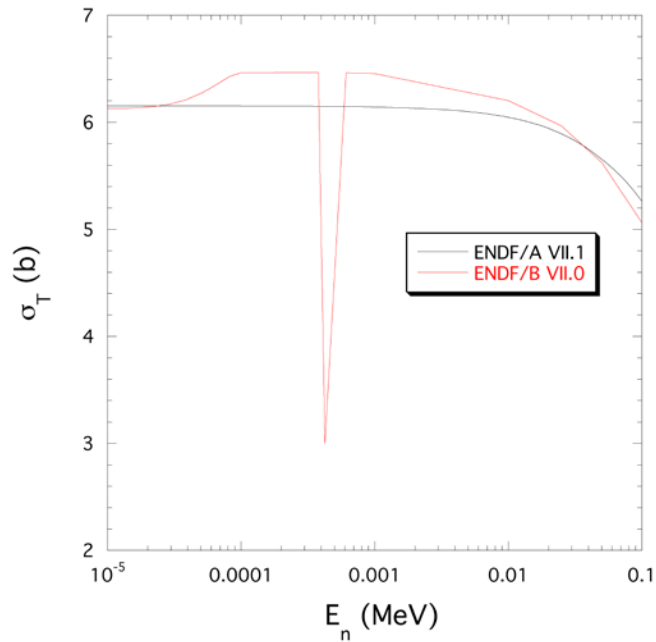
Status of VII.1 for ^{16}O

- Small changes in σ_{el} and σ_{tot} at energies below 7.5 MeV.
- Scale of $\sigma_{\text{n}\alpha}$ cross section increased about 35% below 9 MeV, putting it back about where it was before the previous change.
- All cross sections unchanged above 9 MeV.
- Preliminary testing in aqueous solutions gives little change in the crits; “broomstick”, especially sensitive to the cross sections in the 2.35-MeV window, is yet to be completed.
- Detailed covariances are given for the major cross sections, and for the first Legendre coefficient (μ -bar).

Status of n+⁹Be Evaluation

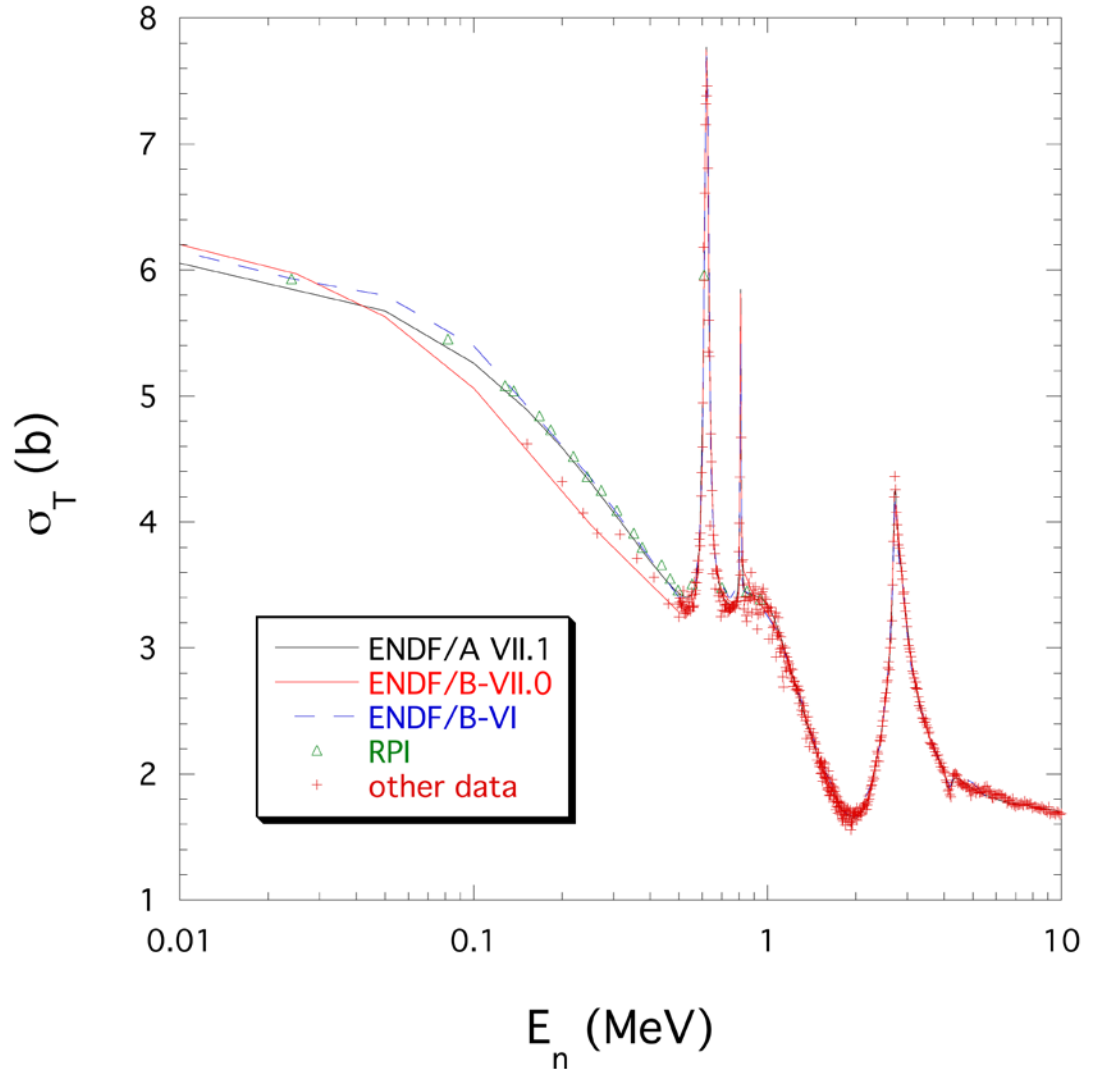
- Single-channel fit to the total cross section (including new RPI data) has been performed at energies up to 14 MeV.
- Revised total cross section was included in a new evaluation submitted to ENDF/A at the end of 2009. Preliminary testing indicates deviations for Be-reflected assemblies that had been improved by ENDF/B VII.0 are now back to ENDF/B VI levels.
- Full multi-channel R-matrix analysis of reactions in the ¹⁰Be system will be completed during 2011. This will include revisions of the elastic scattering angular distributions that could affect the integral data testing, and the addition of covariances for all cross sections.

n+⁹Be Total Cross Section



ENDF/A VII.1:

- “Glitch” in σ_{tot} removed
- Better fit to RPI data below 500 keV

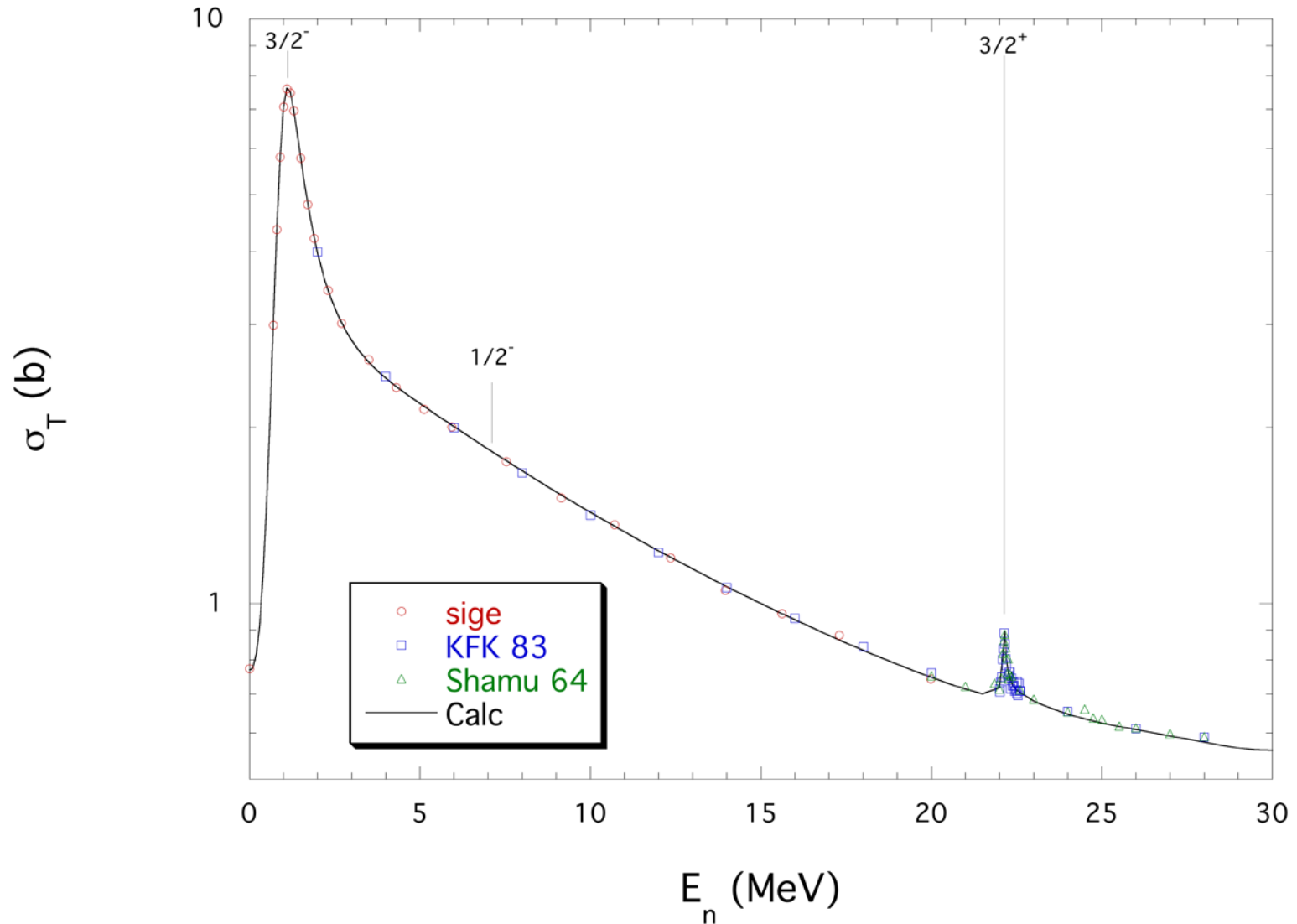


R-matrix Analysis of Reactions in the ^5He System

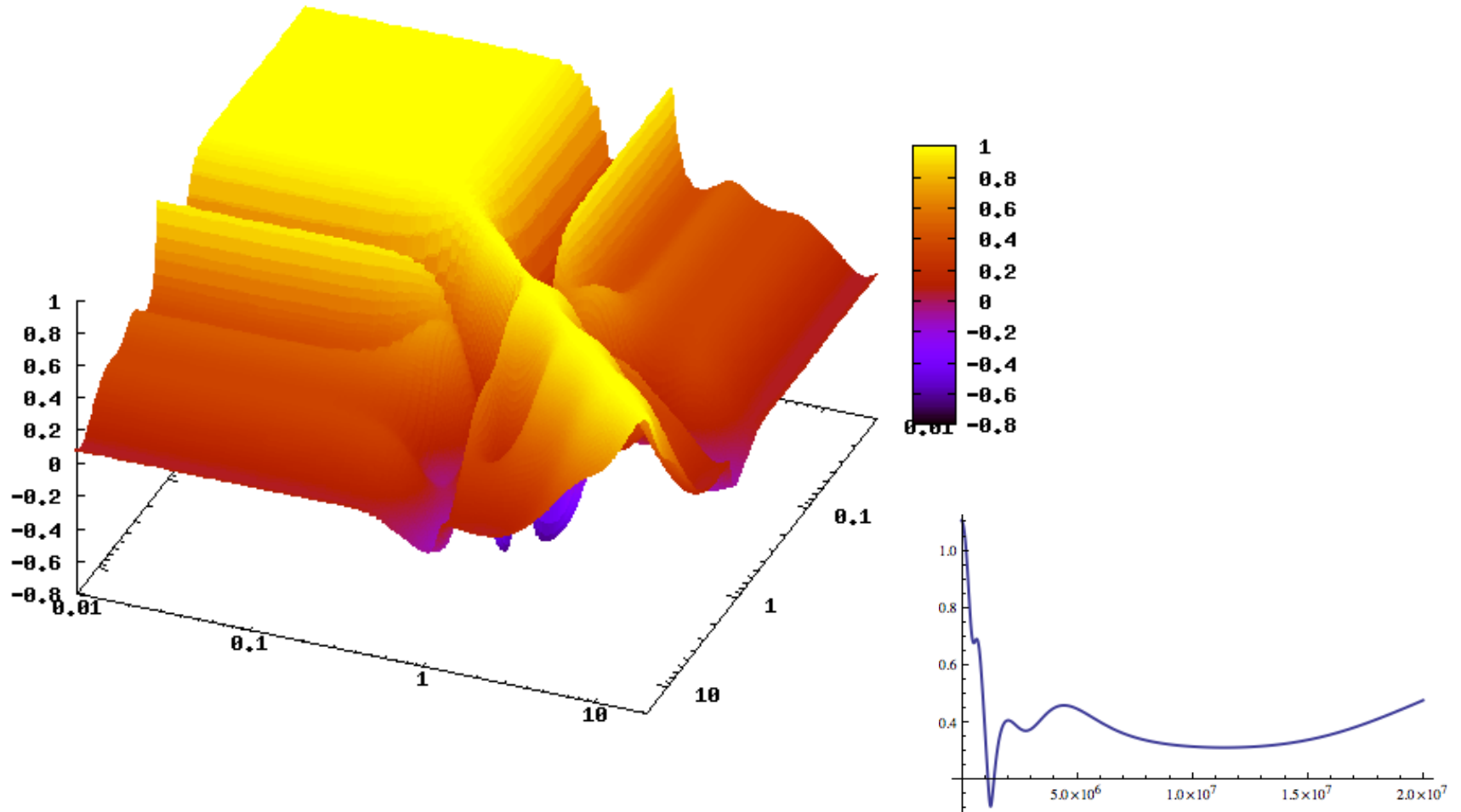
channel	a_c (fm)	l_{max}
$n+^4\text{He}$	3.0	5
$\gamma+^5\text{He}$	60	1
$d+^3\text{H}$	5.1	5
$n+^4\text{He}^*$	5.0	1

Reaction	Energies (MeV)	# data points	# data types
$^4\text{He}(n,n)^4\text{He}$	$E_n = 0 - 28$	817	2
$^3\text{H}(d,d)^3\text{H}$	$E_d = 0 - 8.6$	700	6
$^3\text{H}(d,n)^4\text{He}$	$E_d = 0 - 11$	1185	14
$^3\text{H}(d,\gamma)^5\text{He}$	$E_d = 0 - 8.6$	17	2
$^3\text{H}(d,n)^4\text{He}^*$	$E_d = 4.8 - 8.3$	10	1
total		2729	25

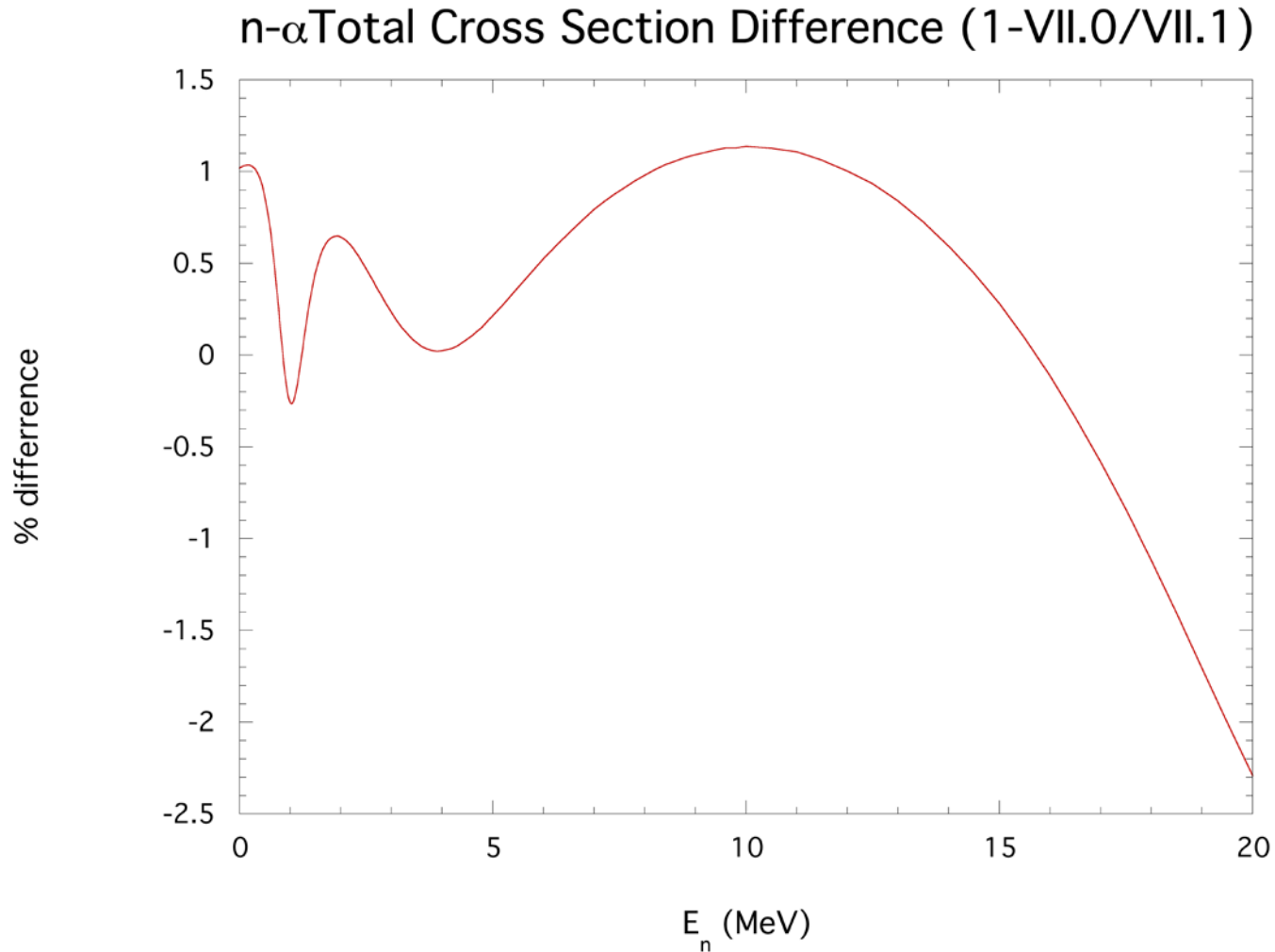
n+⁴He Total Cross Section



$n+^4\text{He}$ Elastic Scattering Covariances



Changes in n- α Total Cross Section for VII.1



Further Covariance Work on Light Elements for VII.1

- Complete mu-bar covariances at 7-20 MeV for $n+^{16}\text{O}$
- Provide covariances for ^2H , ^3H , ^3He , ^{10}B
- On a longer time scale, ^7Be , ^9Be , C