AZURE2: An R-matrix code for Nuclear Astrophysics

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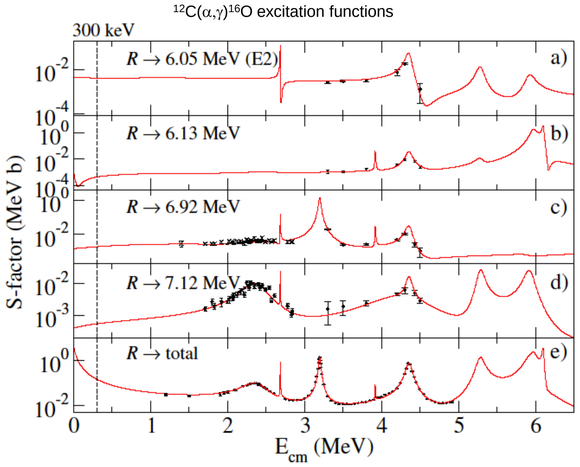
Background

AZURE2 is an *R*-matrix code designed to analyze charged particle capture reactions in the resolved resonance region for the field of nuclear astrophysics. However, its versatility makes it useful for a wide verity of nuclear reactions and applications in different fields. The code was developed by a JINA sponsored collaboration under the leadership of R.E. Azuma. The AZURE2 code, written by Ethan Uberseder, has become one of the most widely used R-matrix codes among the nuclear astrophysics community both in JINA and in the wider community. It has also been used even be groups outside the nuclear astrophysics community for structure and applied physics applications. Future plans are to also include unobserved primary reactions and the calculation of polarization observables. AZURE2 is one of the codes under review by the IAEA to become a standard tool for the analysis of reactions in the resolved resonance region for charged particle analysis. JINA recently co-sponsored the 2016 R-matrix workshop on Methods and Applications held in Santa Fe, NM last June. The workshop was well received, with over 50 attendees from across the fields of nuclear astrophysics and applied physics. AZURE2 is publically available at azure.nd.edu.

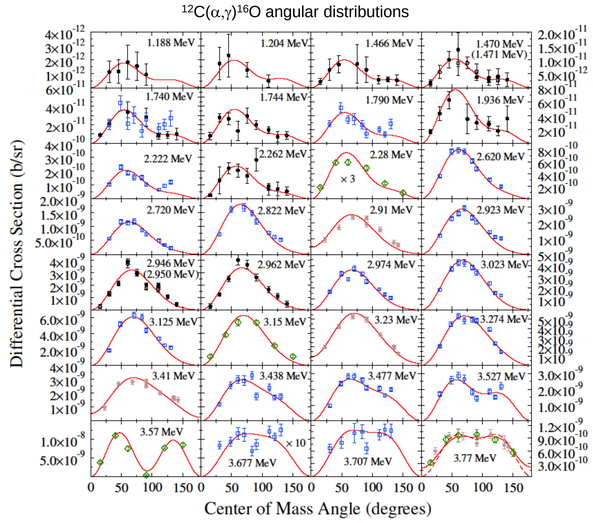
Recent Analysis Projects

$^{12}C(\alpha,\gamma)^{16}O$ global analysis of ^{16}O compound nucleus, deBoer et al. (submitted to RMP)

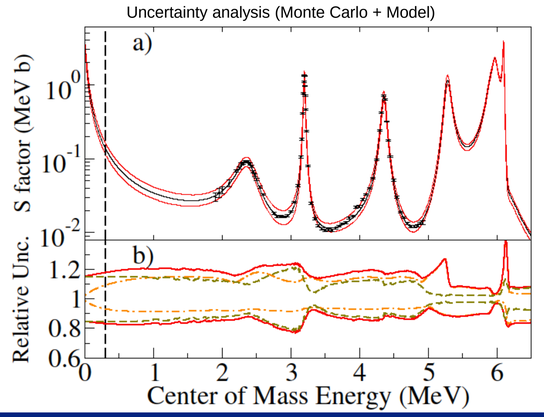
$^{12}C(\alpha,\gamma)^{16}O$ excitation functions



$^{12}C(\alpha,\gamma)^{16}O$ angular distributions

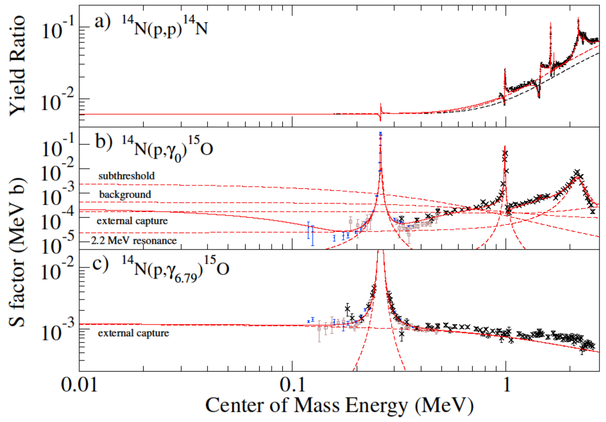


Uncertainty analysis (Monte Carlo + Model)

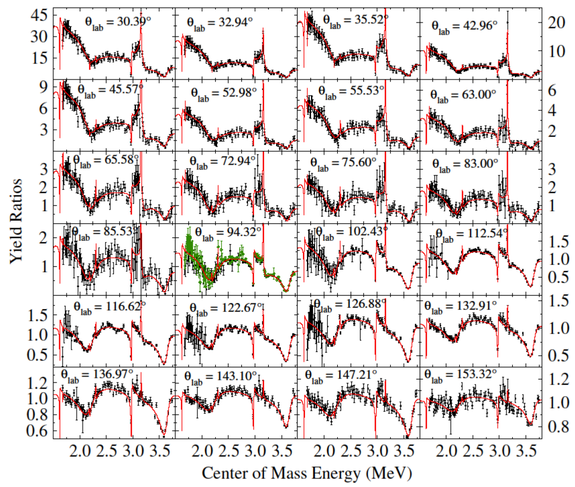


$^{14}N(p,\gamma)^{15}O$, global analysis of ^{15}O, deBoer et al. (2015)

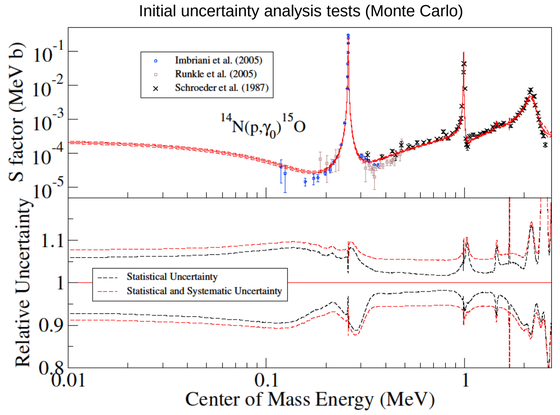
$^{14}N(p,\gamma)^{15}O$ and $^{14}N(p,p)^{14}N$ fits



$^{14}N(p,p)^{14}N$ fits



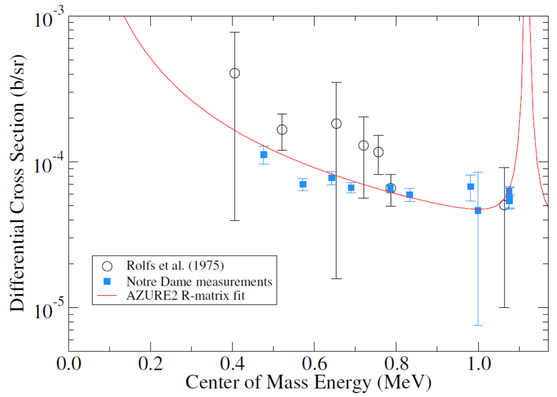
Initial uncertainty analysis tests (Monte Carlo)



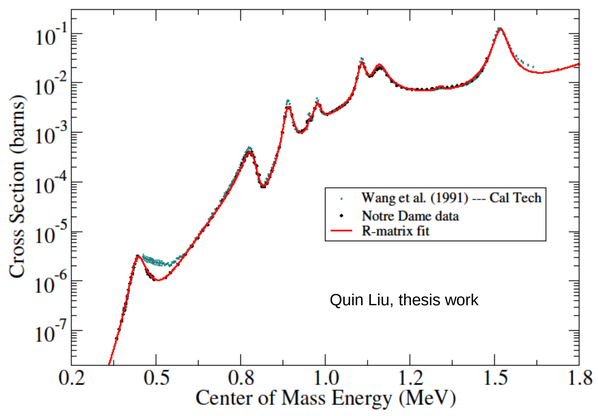
Unpublished recent measurements

$^{20}Ne(p,\gamma)^{21}Na$, Stephanie Lyon's Thesis

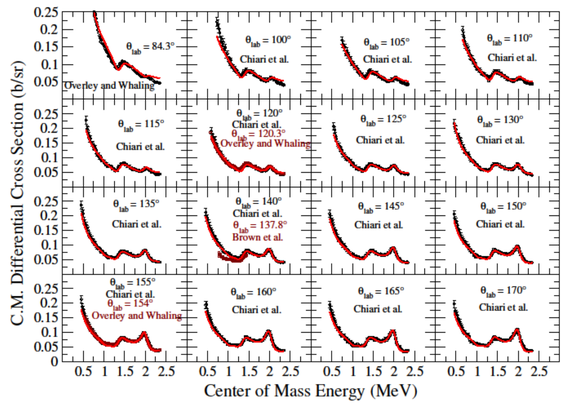
$^{20}Ne(\alpha,\gamma_0)^{21}Na$



$^{11}B(\alpha,n)^{14}N$

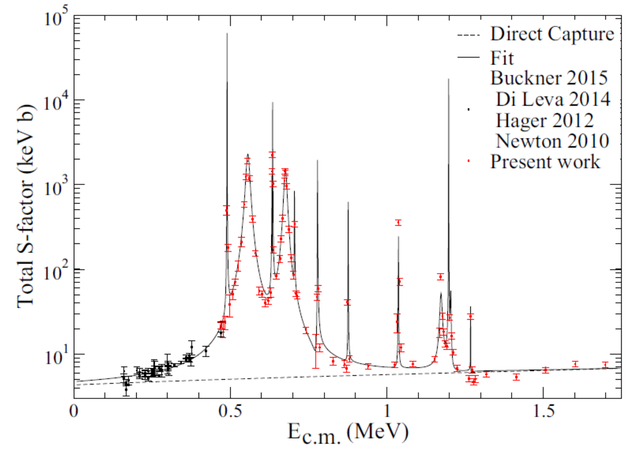


$^{10}B(p,p)^{10}B$, Wiescher et al. (submitted)

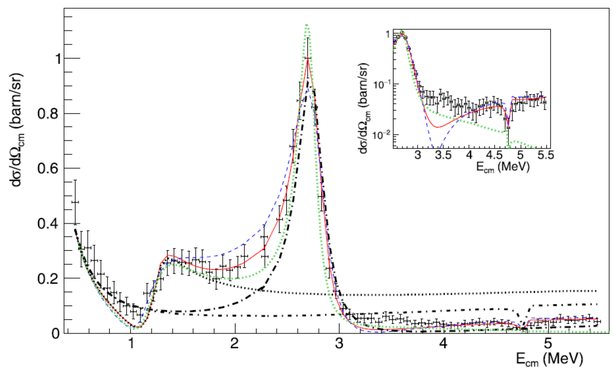


Recent works outside JINA

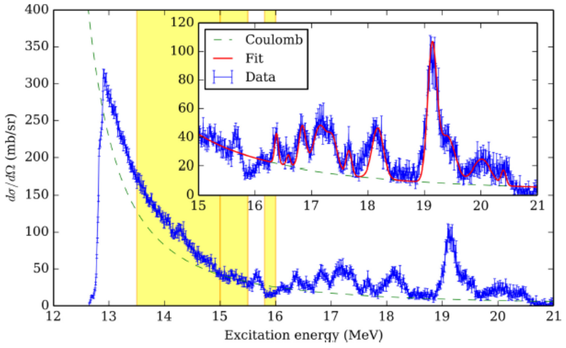
Gyürky et al. (2017), $^{17}O(p,\gamma)^{18}F$



de Grancey et al. (2016), $^{14}O(p,p)^{14}O$



Walshe et al. (2016), $^{24}Ne(\alpha,\alpha)^{24}Ne$



This material is based upon work supported by the National Science Foundation under Grant No. PHY-1430152 (JINA Center for the Evolution of the Elements).