Argonne NATIONAL LABORATORY

Member of the US Nuclear Data Program

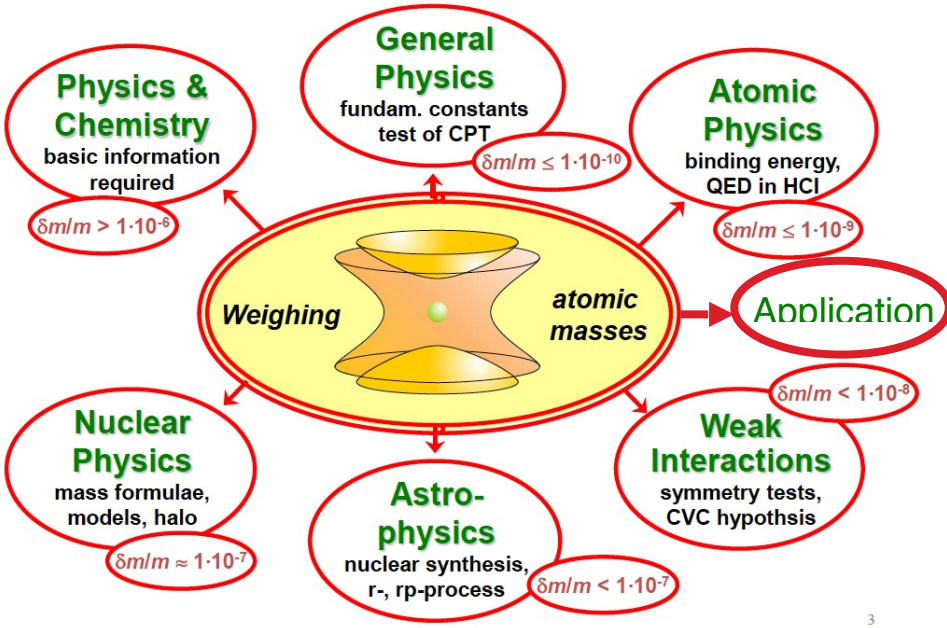
The Atomic Mass Evaluation & NUBASE

on behalf of the AME & NUBASE collaboration

Meng Wang (IMP), G. Audi (CSNSM), F.G. Kondev (ANL), W.J. Huang (CSNSM), S. Naimi (RIKEN) and Xing Xu (IMP)

Atomic Mass Evaluation & NuBase

- Binding energies
  - ✓ mass models
  - ✓ shell structure
- Correlations
  - ✓ pairing
  - ✓ p-n
- Reaction & decay phase space
  - ✓ Q values
  - ✓ decay & reaction probabilities
- The limits of existence
  - ✓ drip lines
  - ✓ specific configurations and topologies

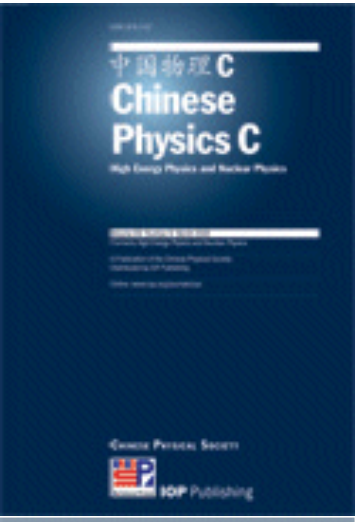


- combines the experimental results from mass and energy measurements produced in many nuclear physics laboratories using a procedure established by A.H. Wapstra in the early 1950's
  - ✓ recommended (best) values for the atomic masses and their uncertainties
  - ✓ extrapolation to the extremes using the smoothness of the mass surface

AME & NuBase - historical perspective

- **long & rich history**

  Ame1955, Ame1961, Ame1964, Ame1971, Ame1977
  Ame1983, Ame1993, Ame2003 -> A.H. Wapstra & G. Audi



CPC(HEP & NP), 2012, **36**(12): 1603–2014 **Chinese Physics C** Vol. 36, No. 12, Dec., 2012

The AME2012 atomic mass evaluation *

(II). Tables, graphs and references

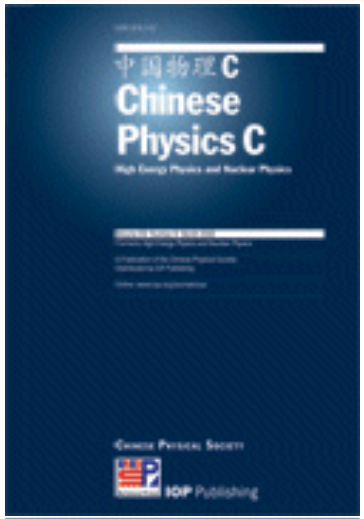
M. Wang[1,2,3], G. Audi[2,§], A.H. Wapstra[4,†], F.G. Kondev[5], M. MacCormick[6], X. Xu[1,7], and B. Pfeiffer[8,‡]

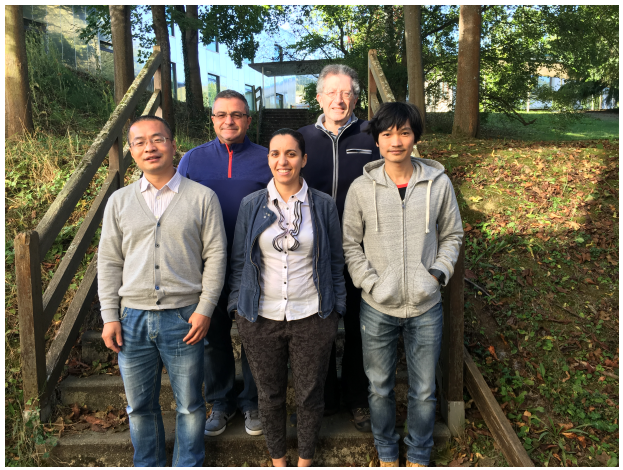
Ame2012

citations: >1750

collaborative effort led by G. Audi

AME2016





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The AME2016 atomic mass evaluation *

Meng Wang (王猛)[1,2;1)] G. Audi (欧乔治)[3] F.G. Kondev[4] W.J. Huang(黄文嘉)[3] S. Naimi[5] Xing Xu(徐星)

✓ **led by M. Wang (AME) and G. Audi (NuBase)**

- **AME2016**: continuing impact of direct mass spectrometry techniques using Penning Traps & Storage Rings spectrometers - high precision & far from stability … also new data in the region of heavy elements …

NUBASE2016

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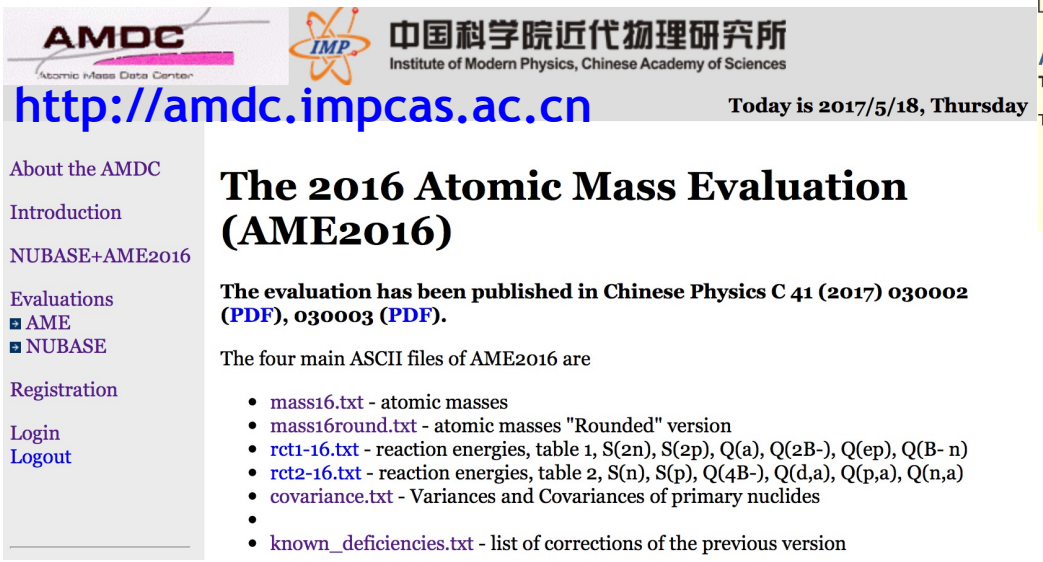
The NUBASE2016 evaluation of nuclear properties *

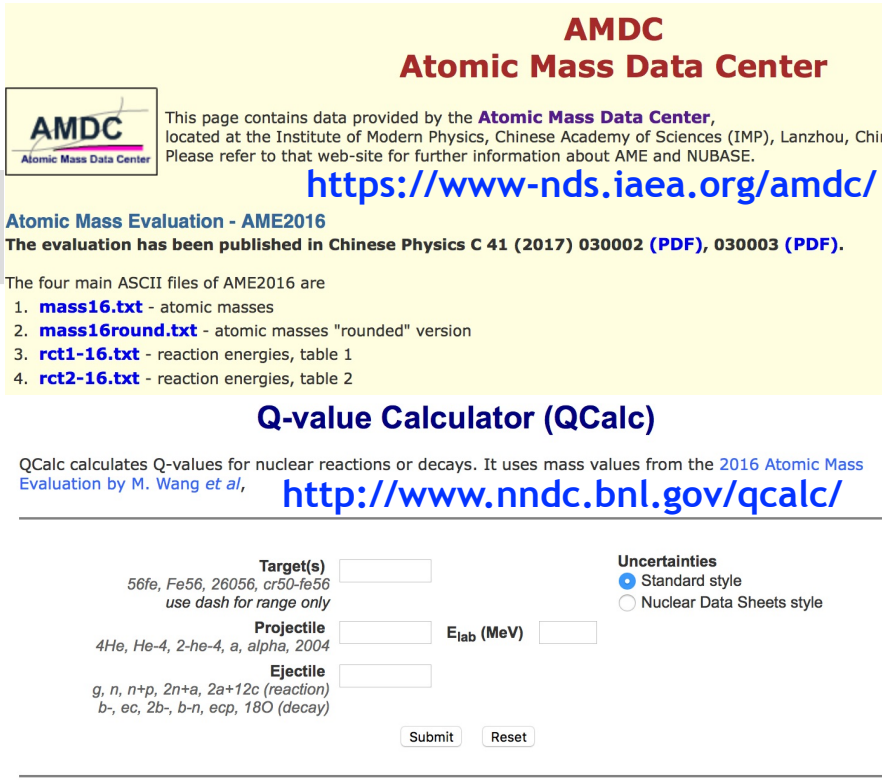
G. Audi (欧乔治)[1] F.G. Kondev[2] Meng Wang (王猛)[3,4;1)] W.J. Huang(黄文嘉)[1] S. Naimi[5]

- basic nuclear level properties of relevance to AME: Ex, J^{π}, $T_{1/2}$, decay modes: β−n, β−2n, ECp, EC2p,…
- independently evaluated; based on ENSDF, but includes new data from the most recent references

	ground state		isomer ($T_{1/2}$>100 ns)	
	NUBASE12	NUBASE16	NUBASE12	NUBASE16
# of cases	3379	3436	1769	1839
stable	286	286	1	1
with Jπ	3043 (92%)	3138 (93%)	1647 (93%)	1724 (94%)
with firm Jπ	1816 (55%)	1866 (55%)	724 (41%)	747 (41%)
with T1/2	3288 (99%)	3371 (100%)		
with T1/2 (exp)	2892 (87%)	3027 (90%)	1664 (94%)	1734 (94%)
β−	1343	1376	205	220
β+	1236	1259	334	343
α	852	872	194	205
p	63	74	26	27
SF	192	203	40	45
β-n	583	609	20	27
β+p	243	265	28	29

Dissemination





- the end users are recommended to use the data in the rct1-16.txt and rct2-16.txt files
  - ✓ take into account correlations (explained in the 2nd AME paper)
  - ✓ uncertainties for the most precise values are listed as '0.00' - the end users need to calculate them using the correlation matrix (2nd AME paper) and non-rounded mass data (mass16.txt)