

Presented at the 8<sup>th</sup> International Conference on Cold Fusion, Univ. Misso. Columbia 22-27 July.  
2013

# Model of Two-Picometer Deuteron Clusters for LENR Supported by Laser Emission of Nuclear Reactions Products

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# Absolute confirmation of Nuclear Fusion

from deuterated titanium using shock  
procedure:

Mark Prelas et al.:

62 Million Neutrons within five  
minutes

# Fully reproducible

M.A. Prelas et al. 17th Internat. Conference on Cold fusion, Aug. 2012 in Korea  
(earlier indications by Izimida et al., and Arata et al.)

Based on experiment of neutron emission and LENR-element generation: concluded models:

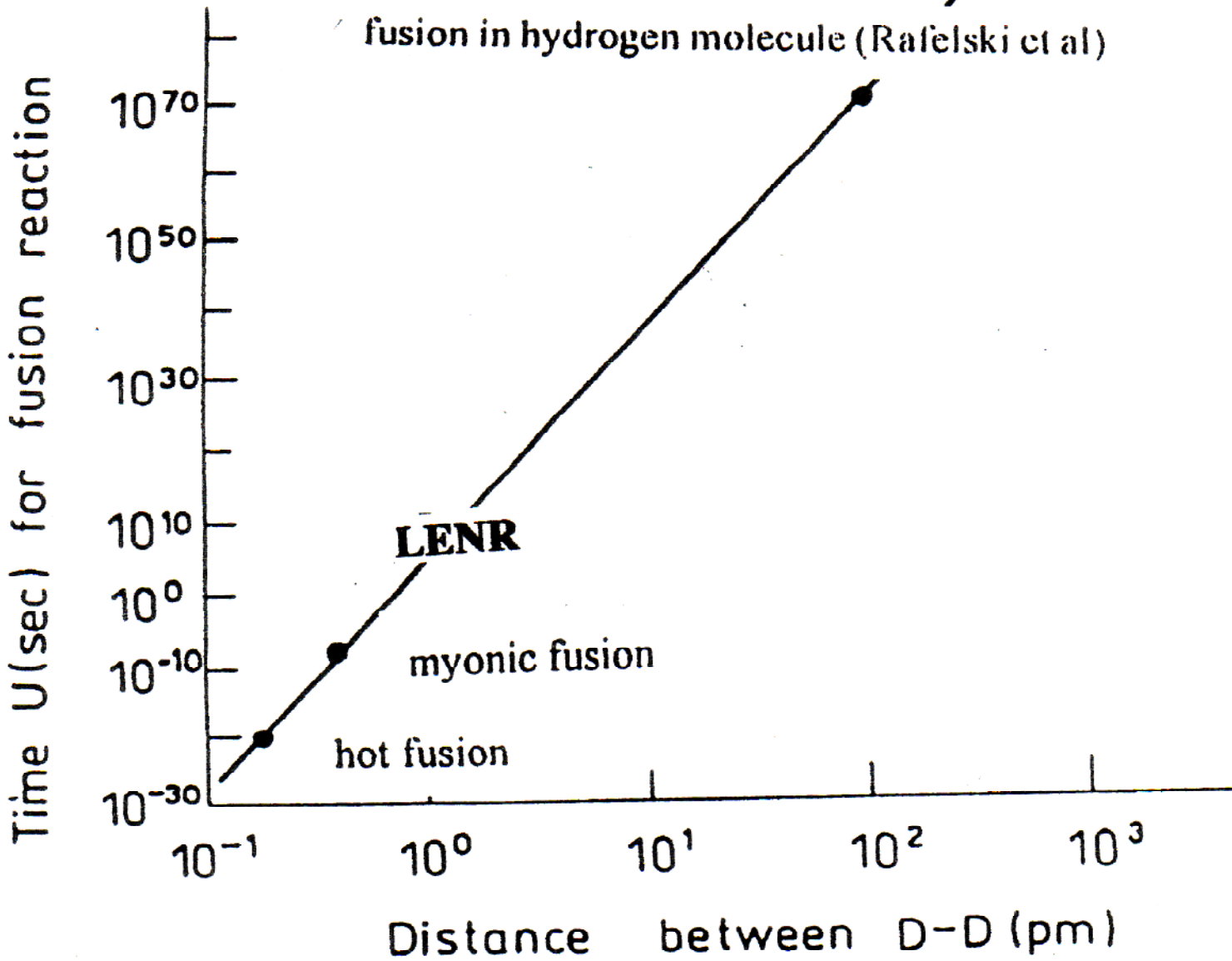
## Reactions in 2 pm distance

due to **Coulomb screening by factor 13** (5 for hot plasmas: Ichimaru) derived from Prelas et al. experiments: Hora, H.; Kelly, K. C.; Patel, J. U.; Prelas, M. A.; Miley, G. H.; Tompkins, J. W. *Phys. Letters A*, 175, 138 (1994) , and

from quantum mechanics: Czerski, K. Huke, A. et al  
Screening of deuterons in metals for fusion *Europhys. Letters*, 2001, 54, 449; Huke & Czerski, *Phys. Rev. C* 2008, 78, 015803

## Increased reactions at surface

or interface (measured with Pd-Ni layers) by **swimming electron layer**



# Gas loading of deuterium D in palladium grains

**LENR (Miley et al.1995): D-D  
Element generation up to lead**

**Proof by Maruhn-**

**Greiner local maximum**

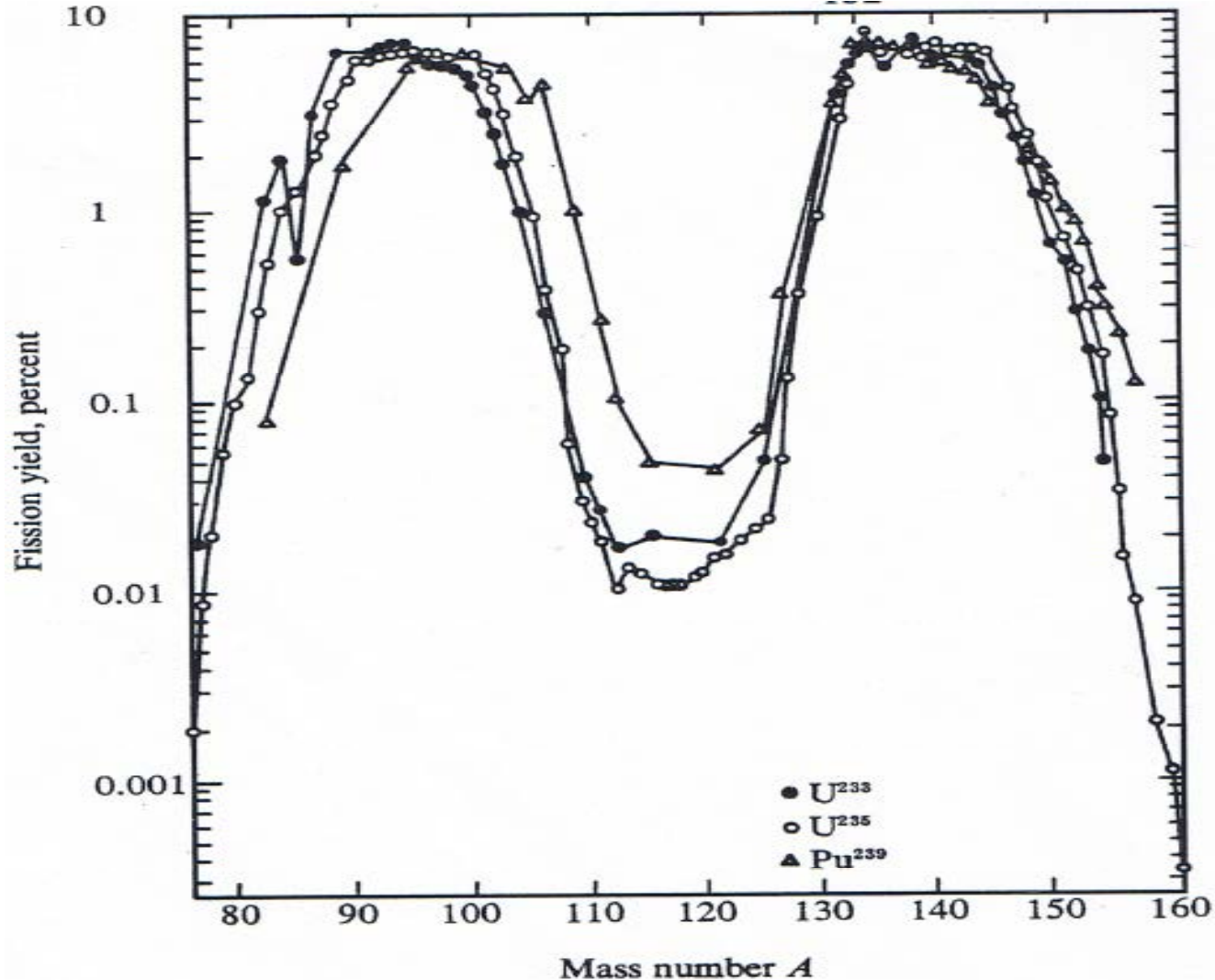
Surface effect measured with Pd nano-grains:

*George H. Miley, Xiaoling Yang and Heinrich Hora. Small Power Cells Based on Low Energy Nuclear Reactions (LENR) – A new Type of “Green” Nuclear Energy. Transactions of the Fusion Science and Technology 61, (T1 Jan) 458-462 (2012)*

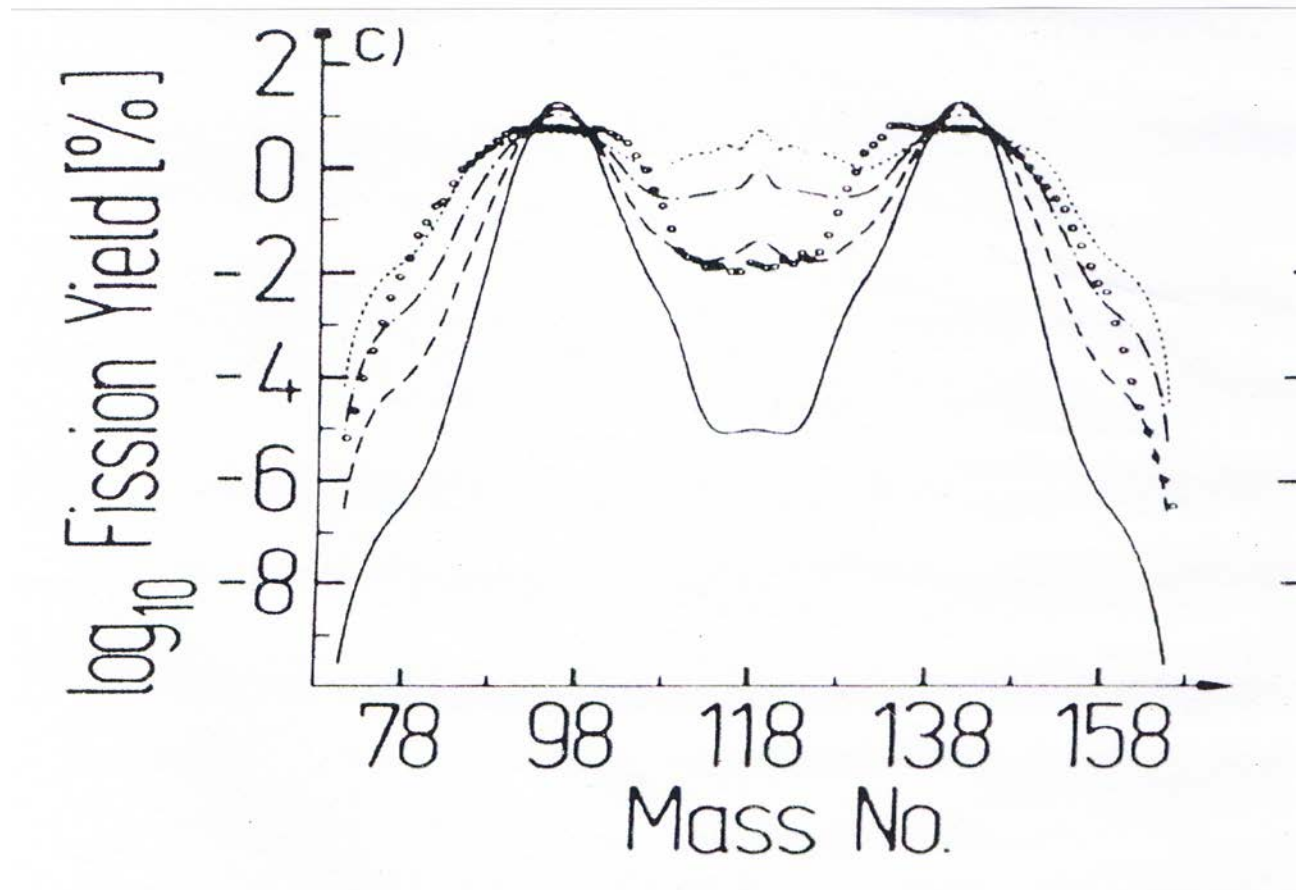
Swimming electron layer from Pd-Ni layers:

*H. Hora, J.C. Kelly, J.U. Patel, Mark A. Prelas, G.H. Miley, and J.W. Tompkins, Screening in cold fusion derived from D-D reactions, Physics Letters, A175, 138-143 (1993).*

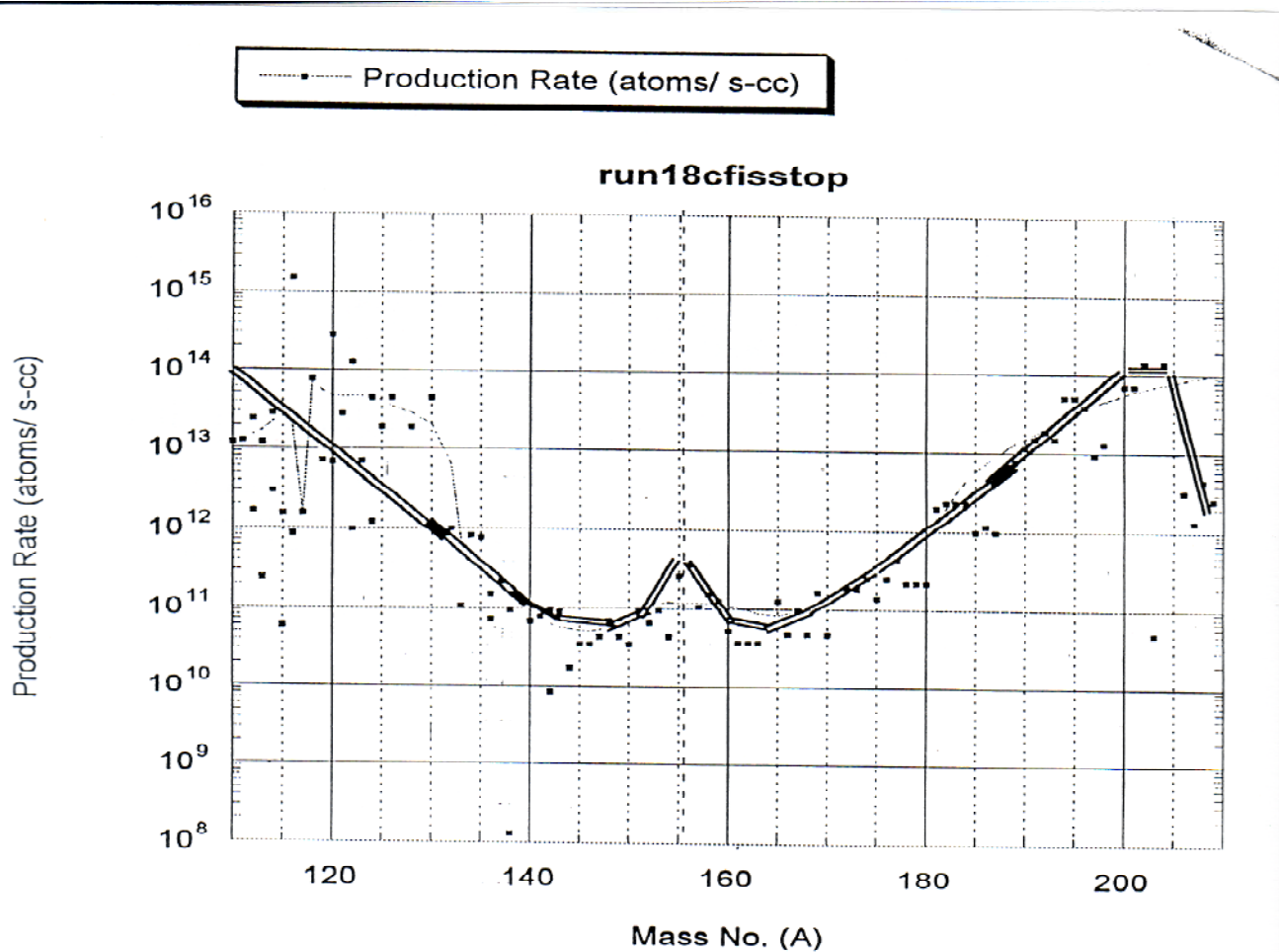
Probability  $P(A)$  for Nuclear generation at **fi**sson depending on the nucleon number  $A$  for **ur**anium and plutonium (M.A. Feltus, Encyclopaedia of Physical Science and Technology, vol. 5, 3rd edn. (Academic Press, San Diego CA, 2002)



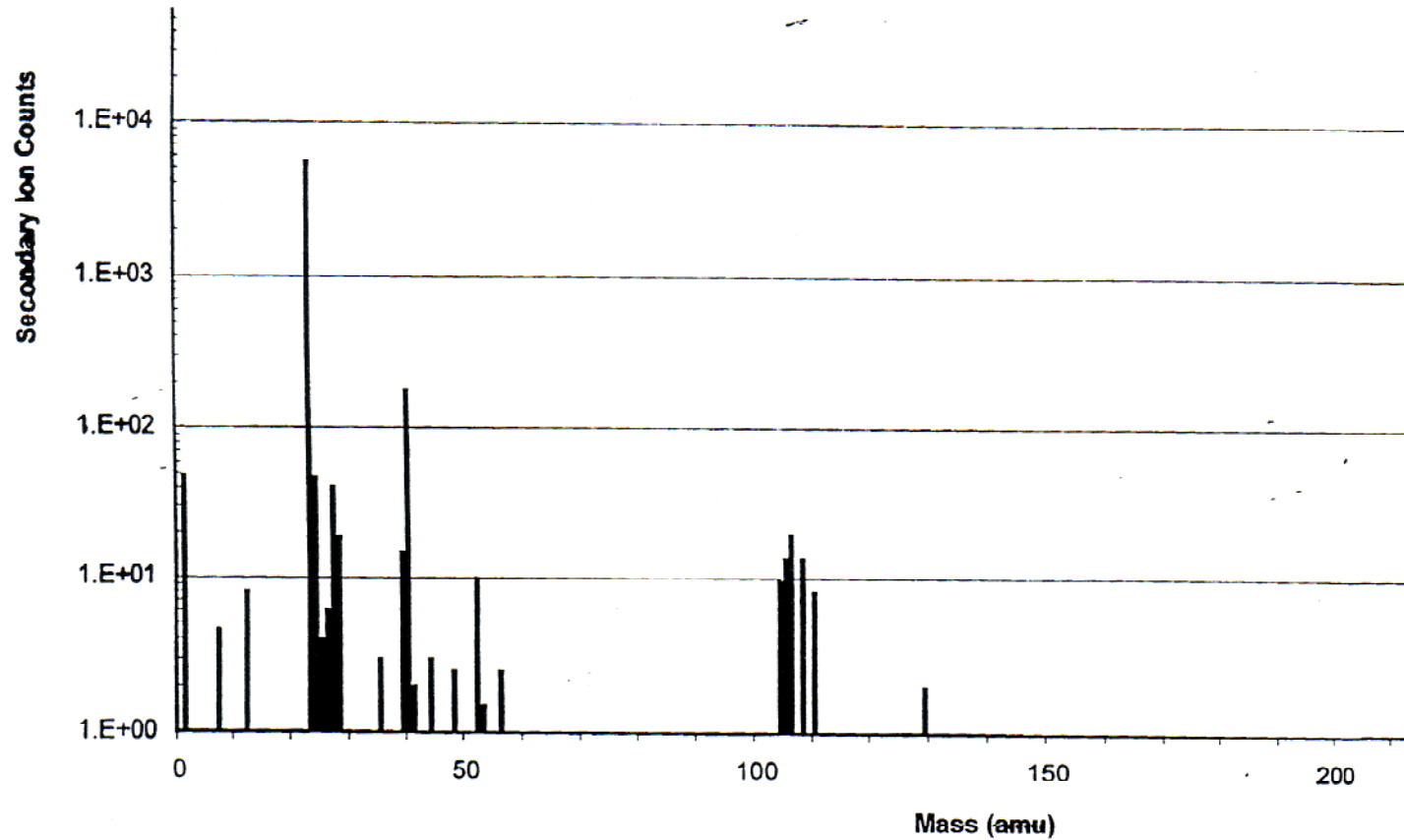
P(A) fission distribution, if uranium is in excited state with local maximum at  $A=118$  (Maruhn-Greiner PRL 1974)

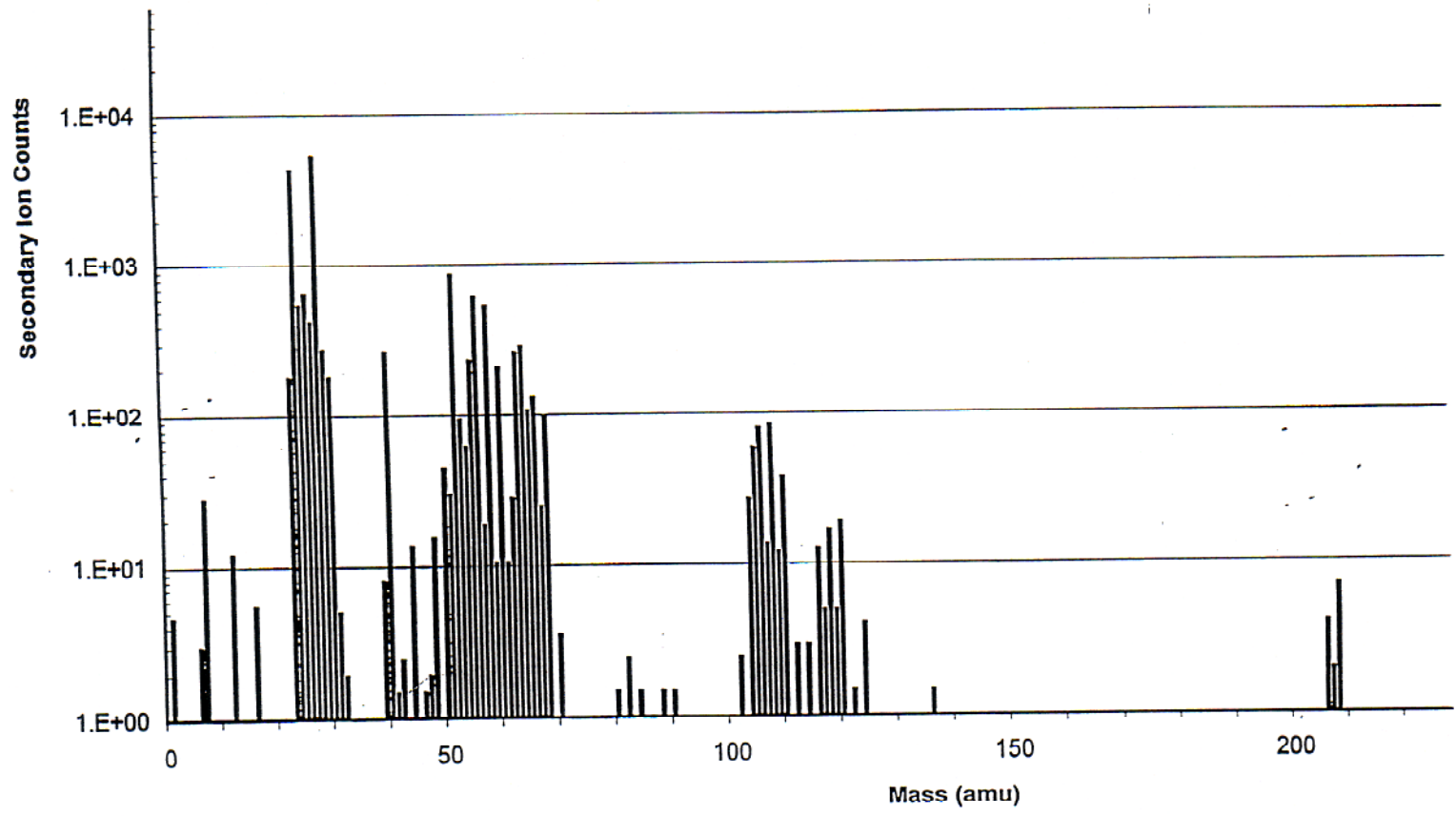


Probability  $P(A)$  for **LENR** nucleons production on nucleon number  $A$  measured by Miley et al (1995, 1996) **with Maruhn-Greiner Maximum at  $A=155$ , from experiments (2 next slides)**









Clusters with 164 deuterons (10pm diameter) with **2 pm** DD distance **non-localized Bose-Einstein** state react with Pd nucleus (or inverted Rydberg state) for element production via **compound nucleus** element A = 310 with **two magic numbers 126 & 184.**

**Possible compound reaction with cluster D<sub>164</sub>**



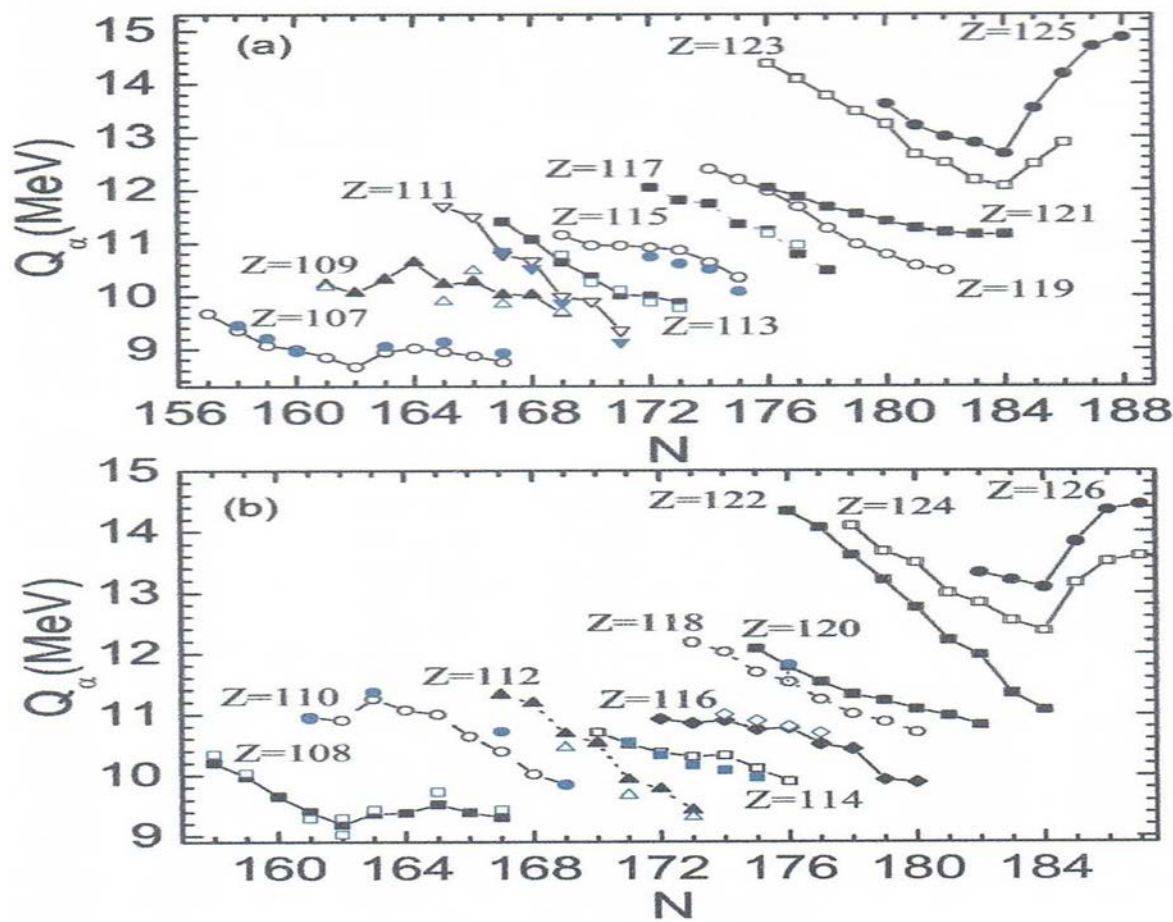
X-element with **double magic numbers**

George H. Miley, Heinrich Hora, Karl Philberth, Andrei Lipson & P.J. Shrestha. Radiochemical Comparisons on Low Energy Nuclear Reactions and Uranium. In *Low-Energy Nuclear Reactions and New Energy Technologies Source Book (Vol. 2)* Jan Marwan and Steven B. Krivit eds., ACS Symposium Series No. 1029, American Chemical Society/Oxford University Press, Washington DC, ISBN 978-0-8412-2454-4 (2009) p. 235-252.

Problem about higher nuclear magic numbers above 126: solved by Scheid et al. and LENR experimental discovery of Maruhn-Greiner maximum (Miley et al. 1995) LENR needed higher magic numbers for compound nucleus with more than 300 nucleons. Clarification of number 180 differing from 184. Confirmation from predicted nucleus with  $Z=120$  with half life of 0.6 seconds (following figure) .

W. Scheid et al. Phys. Rev. C 82 (2012) 014319; Nuclear Physics A 834 (2010) 345c; G.H. Miley et al. J. New Energy 1 (1996) 11; H. Hora & G.H. Miley J. Fusion Energy 26 (2007) 349

**Theoretical evaluation** of alpha decay energies  $Q_\alpha$  for SHE (superheavy elements) for conclusions with measured proton numbers  $Z$  above 118 resulting in significant minima at nucleon magic numbers  **$N=A-Z=184$  and  $Z=126$**  as **concluded for LENR compound reactions.**



**Compound nuclear reaction** with clarified magic number 184: 2 pm D-distant Bose-Einstein clusters reacting with Pd nucleus



confirming significant **emission of helium** as long known from reactions in palladium with very high deuterium concentrations. Conclusion of exceptionally long half life for nucleus X as first double magic number nucleus above stable  $^{208}\text{Pb}$

# **Model for 62 Million DD- fusion neutrons measured by Prelas et al.:**

Crystal shock with phase transitions increases the thermal motion of the Coulomb screened 2 pm deuterons by thermal interaction for DD nuclear reactions

# DD Cluster generation measured

- 1) In palladium crystal void (Schottky defect) **>100 D in one atomic void (superconducting)**: *A. Lipson, B. J. Heuser, C. Castano, G. Miley, B. Lyakhov, and A. Mitin, Phys. Rev. B 72, 212507 (2005).*
- 2) In surface void defects deuterium in inverted Rydberg state with ultrahigh **densities  $>10^{28}\text{cm}^{-3}$** : *Holmlid, Hora, Miley & Yang Laser and Particle Beams 27, 529 (2009); Holmlid Nucl. Instr. Meth. B 295 (2013) 66.*  
  
Emission of very high DD fusion neutron numbers by very low intensity laser irradiation: *Andersson & Holmlid J. Fusion Energy 31, 249 (2012)*
- 3) Similarity to >Million neutrons per 5 minutes *Prelas...*



# **Model for 62Million DD- fusion neutrons measured by Prelas et al.:**

Crystal shock with phase transitions increases the thermal motion of the Coulomb screened 2 pm deuterons by thermal interaction for DD nuclear fusion

**Conclusion: Request for  
measurements of extended  
properties of Maruhn-  
Greiner maximum**

End

Thank You