

# Bottom Line Up Front

Neutron and Radiation Production Panel, ICCF-18  
Frank Gordon, Pam Boss, Larry Forsley

- In addition to “anomalous” heat production, multiple LENR experiments with different experimental protocols and instrumentation produced anomalous radiation including charged particles and neutrons.
- Much lower than expected flux rates don’t negate the fact that radiation is produced.
- Additional experiments and theoretical developments are required to understand the physics involved.

# Experimental Evidence of Nuclear Radiation

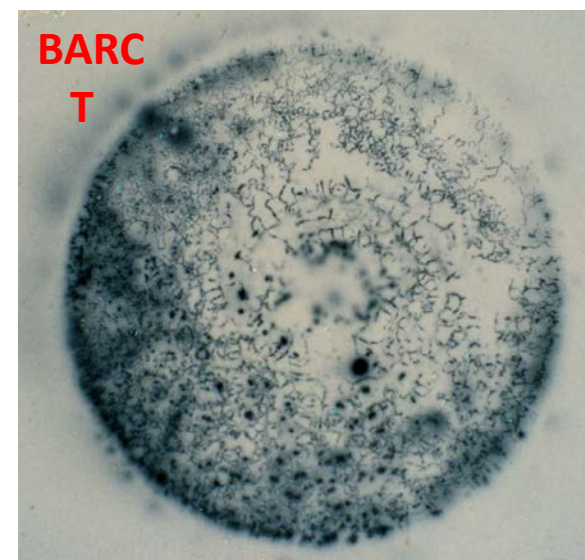
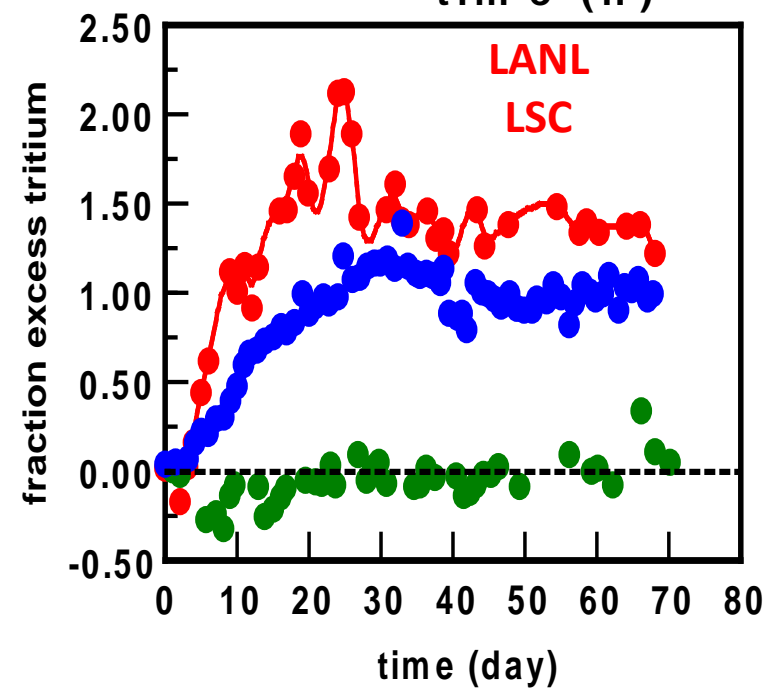
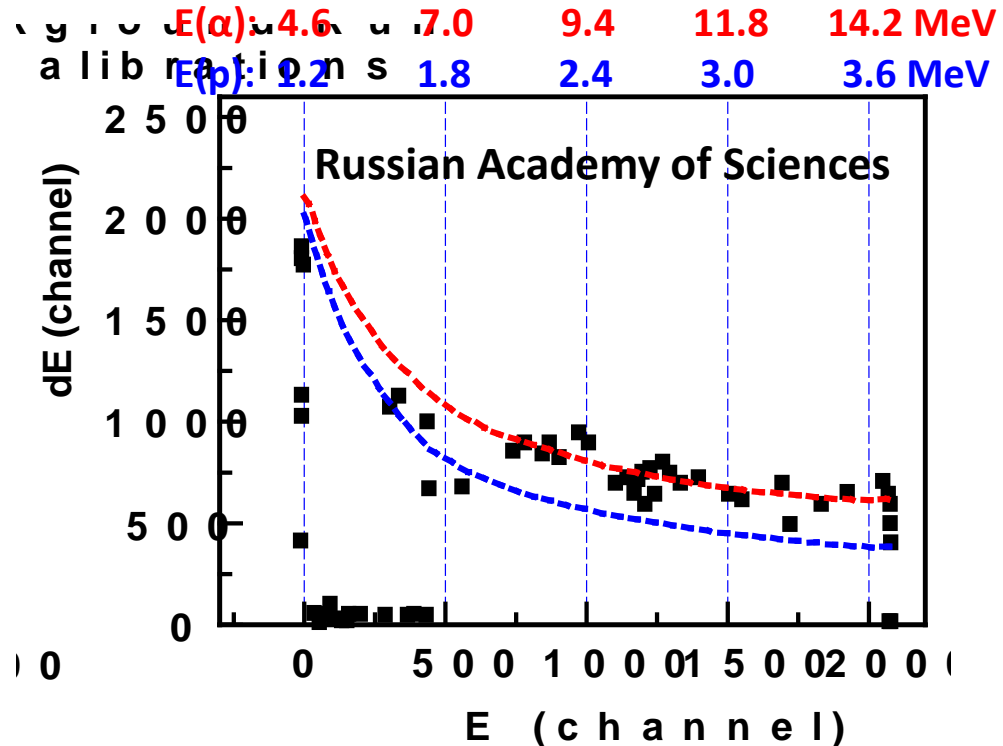
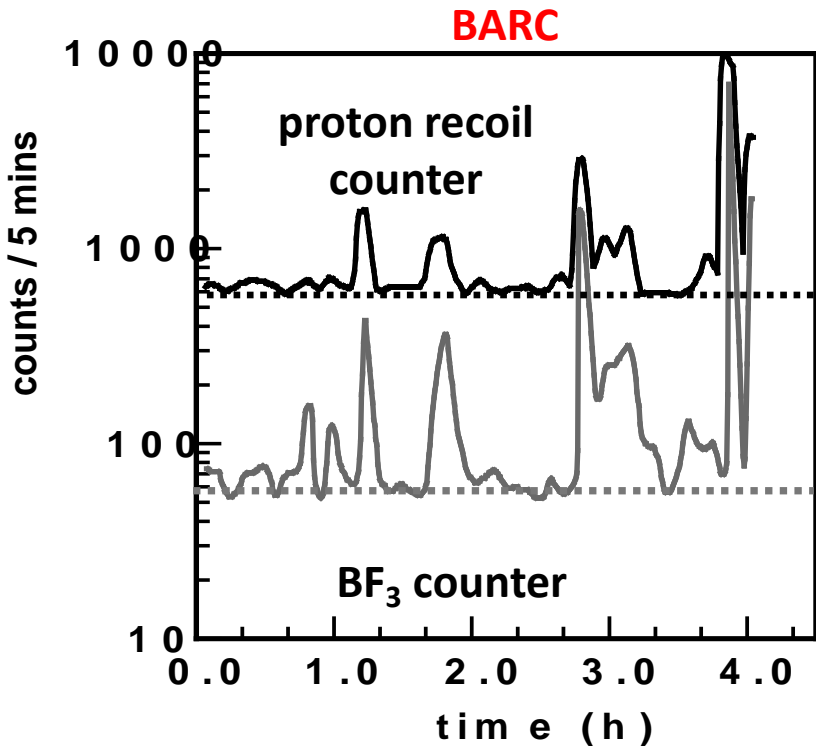
## a partial list

GROUP	COUNTRY	EXPERIMENT	RADIATION	METHOD OF DETECTION
ENEA (Scaramuzzi)	Italy	Ti gas loading	neutrons	BF <sub>3</sub>
BARC (Srinivasen)	India	PdAg <sub>0.25</sub> electrolysis	Tritium, neutrons	LSC, BF <sub>3</sub> , proton recoil
Texas A&M (Bockris)	USA	Pd electrolysis	tritium	LSC
SRI (McKubre)	USA	Pd electrolysis	tritium	LSC
SRI (Tanzella)	USA	Pd/D co-dep	protons, neutrons, long range alphas	CR-39
Lebedev (Roussetski)	Russia	Pd/PdO heterostructures, electrolysis; Ti gas loading	Neutrons	CR-39
Russian Academy of Sciences (Lipson)	Russia	Pd/PdO heterostructures, electrolysis	Protons, tritons, neutrons, alphas	CR-39, SSB, n-LSC
Tsinghua University (Li)	China	Pd gas loading	Charged particles	CR-39
Los Alamos (Menlove)	USA	Ti gas loading	neutrons	<sup>3</sup> He
Los Alamos (Storms)	USA	Pd electrolysis	tritium	LSC
Los Alamos (Claytor)	USA	Pd low voltage discharge	tritium	LSC, Femtotech Tritium Gauge

# Experimental Evidence of Nuclear Radiation

## a partial list, continued

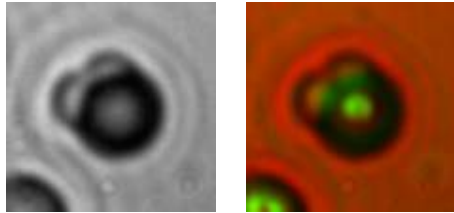
GROUP	COUNTRY	EXPERIMENT	RADIATION	METHOD OF DETECTION
Hokkaido Univ. (Mizuno)	Japan	D <sub>2</sub> gas magnetic field	neutrons	<sup>3</sup> He
Colorado School of Mines (Cecil)	USA	D irradiation of Pd	Tritons, neutrons	SSB
Osaka University (Arata)	Japan	Pd electrolysis	neutrons	<sup>3</sup> He, BF <sub>3</sub>
Dresden (Bittner)	Germany	Pd electrolysis	neutrons	n-LSC
LUTCH (Karabut)	Russia	Pd low voltage discharge	neutrons	<sup>3</sup> He
Osaka University (Takahashi)	Japan	Pd electrolysis	neutrons	n-LSC, <sup>3</sup> He
China Institute of Atomic Energy (Jiang)	China	U gas loading	neutrons	electronic
University of Science and Technology China (Jin)	China	YBCO gas loading	Energetic particles	CR-39
SSC-Pacific (Szpak)	USA	Pd/ co-dep	Tritium, charged particles, neutrons	LSC, CR-39



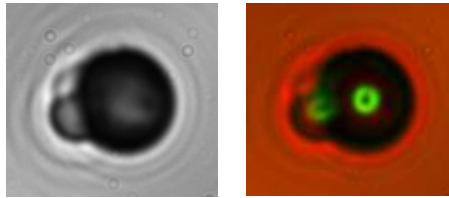
# Triple Tracks in CR-39: Evidence of $> 9.6$ MeV Neutrons

Johan Frenje, MIT, "I must say that the data and their analysis seem to suggest that energetic neutrons have been produced," (ACS, 2009)

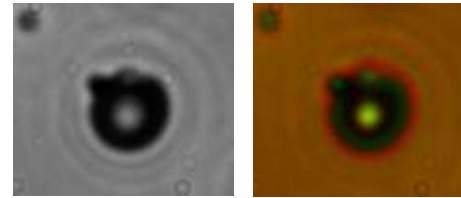
Pd/D Co-dep



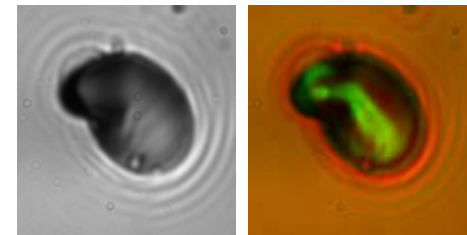
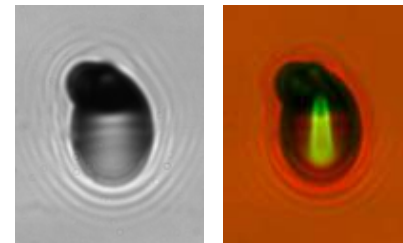
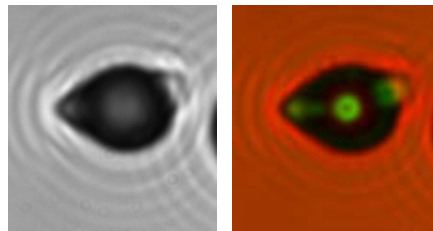
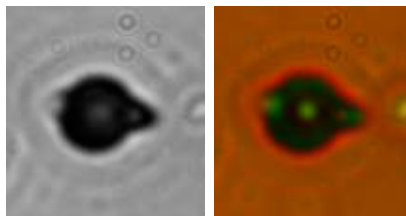
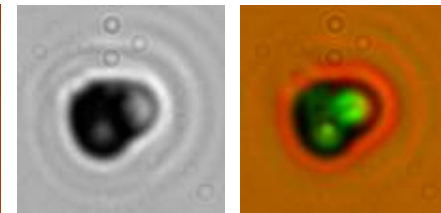
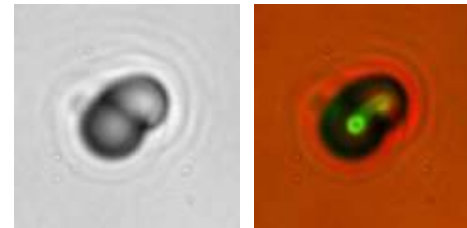
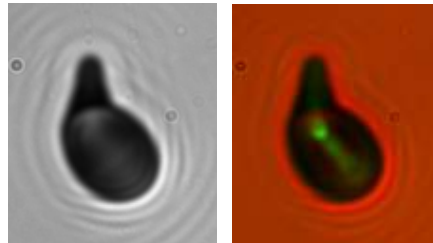
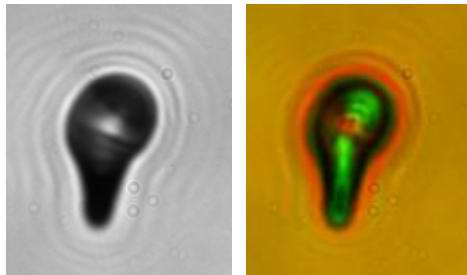
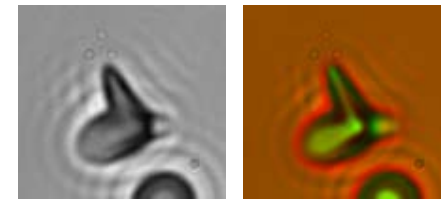
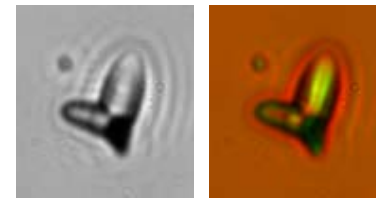
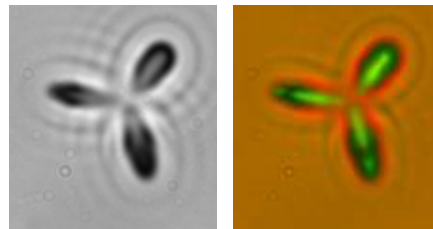
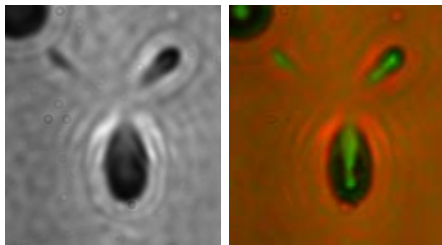
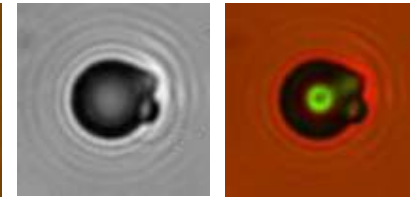
DT neutron



Pd/D Co-dep



DT neutron



# Boss, et. al. Patent

(12) **United States Patent**  
**Boss et al.**

(10) **Patent No.:** **US 8,419,919 B1**  
(45) **Date of Patent:** **Apr. 16, 2013**

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(54) **SYSTEM AND METHOD FOR GENERATING PARTICLES**

(75) Inventors: **Pamela A. Boss**, San Diego, CA (US);  
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**Stanislaw Szpak**, Poway, CA (US);  
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San Diego, CA (US)

2001/0019594	A1	9/2001	Swartz
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(Continued)

(73) Assignees: **JWK International Corporation**,  
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(US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 1036 days.

(21) Appl. No.: **11/859,499**

(22) Filed: **Sep. 21, 2007**

## OTHER PUBLICATIONS

J. O'M. Bockris, R. Sundaresan, Z. Minevski, D. Letts. "Triggering of heat and sub-surface changes in Pd-D Systems." The Fourth International Conference on Cold Fusion. Transactions of Fusion Technology, Dec. 1994. vol. 25, No. 4T. p. 267.\*

(Continued)

*Primary Examiner* — Keith Hendricks

*Assistant Examiner* — Steven A. Friday

(74) *Attorney, Agent, or Firm* — Ryan I. Friedl, Kyle Ennele

# George Miley Patent

(12) **United States Patent**  
**Miley**

(10) **Patent No.:** **US 8,227,020 B1**

(45) **Date of Patent:** **Jul. 24, 2012**

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(54) **DISLOCATION SITE FORMATION  
TECHNIQUES**

2003/0144151 A1 7/2003 Tripodi  
2007/0059452 A1 3/2007 Debe et al.  
2008/0070397 A1\* 3/2008 Lochtefeld et al. .... 438/597

(75) Inventor: **George H. Miley**, Champaign, IL (US)

## OTHER PUBLICATIONS

(73) Assignee: **NPL Associates, Inc.**, Champaign, IL  
(US)

Lipson, A, et al.; Transport and Magnetic Anomalies Below 70 K in a Hydrogen-Cycled Pd Foil with a Thermally Grown Oxide; Physical Review B 72, 212507 (2005); The Amer. Physical Society.

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1057 days.

Nagel, D.J., et al.; Energetics of Defects and Strains in Palladium; Tenth International Conference on Cold Fusion, 2003; Cambridge, MA.

(21) Appl. No.: **12/080,011**

Kim, Y.E., et al.; Proposal for New Experimental Tests of the Bose-Einstein Condensation Mechanism for Low Energy Nuclear Reaction and Transmutation Processes in Deuterium Loaded Micro- and Nano-Scale Cavities; 11th Internat'l Conf. on Condensed Matter Nuclear Science, 2004, Marseille, France.

(22) Filed: **Mar. 31, 2008**

Kim, Y.E., et al.. Mixtures of Charged Bosons Confined in Harmonic

**“Several tracks from the CR-39 film after etching were observed. Analysis of the track sizes correspond to 1.7 MeV protons and 14.7 MeV alpha particles”**

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# Significance of Radiation and Particles

- Experiments provide compelling evidence that nuclear reactions are occurring.
- Low flux rates, (7 orders of magnitude below expected for neutrons), reduce the safety hazard and minimize shielding requirements.
  - Flux rates may not be commercially useful but they said the same thing about the excess heat 24 years ago!
- Low flux rates suggest new/unidentified channels including possibly a-neutronic reactions exist.
- This should be a fertile area for additional experiment and theoretical development with potential for very significant scientific impact.