



To whom it may concern

Statement on Scientific Contributions by Dr. Georgi R a i n o v s k i

Ladies and Gentlemen,
Dear colleagues,

Herewith I certify that in the period 2004 – 2011 I have co-authored with Dr. Georgi Rainovski more than 20 scientific peer-reviewed publications in highest-ranked scientific journals such as *Physics Letters* and *Physical Review Letters*. Our publications addressed new insights in the structure of heavy atomic nuclei.

Most of these papers (see the attached list) are devoted to experimental studies of proton-neutron mixed-symmetry states of vibrational nuclei. We have been quite successful in this enterprise mostly due to the success of our experimental program to study proton-neutron mixed symmetry states in projectile-Coulomb excitation reactions which we have initiated together at Argonne National Laboratory near Chicago, IL, USA. Using projectile-Coulomb excitation reactions and large arrays of HPGe detectors to study mixed-symmetry states of low-abundant nuclei was a major methodological breakthrough in which Dr. Rainovski had a significant and leading contribution. The previous expertise of Dr. Rainovski with large HPGe detector arrays, such as Gammasphere, turned out to be crucial for the success of this program.

Since the pioneering experiment on mixed-symmetry states of ^{138}Ce we have performed more than 8 experiments in which we have studied 12 different isotopes. In all of these experiments Dr. Rainovski has played a leading role in formulating the physics goals, writing and defending the experiment proposals, running the experiments, analyzing the data, and writing the scientific publications. He personally has developed the procedure and the necessary programs for analyzing the data from these experiments. In addition, Dr. Rainovski also made a significant contribution to the experiments we have performed at the State University of New York (SUNY), Stony Brook, NY, USA. As the senior scientist in my group he was in charge of planning and performing all experiments of my academic group at the Nuclear Structure Laboratory at SUNY.

The success of our experimental program at Argonne National Laboratory is due not only to the use of our newly developed experimental technique but also to the fact that we have managed to solve experimentally some important physics questions. Here I would like to mentioned two of them for example. The formulation of the

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mechanism of shell stabilization, which relates the properties of mixed-symmetry states to the underlying shell structure, and the quantitative prove that the O(6) symmetry is broken in the isotope ^{124}Xe which revolutionized the view at the entire region of the nuclear chart around mass number $A=130$. Dr. Rainovski has played an extremely important role in the process of formation and developing the physics ideas behind these two phenomena. In fact, most of the papers we have produced within the experimental program at Argonne National Laboratory, exploit the physics ideas initially defined in relation with the shell stabilization and O(6) symmetry breaking and formulated in the benchmark papers (G. Rainovski *et al.* Physical Review Letters 96, 122501 (2006), and G. Rainovski *et al.*, Physics Letters B683, 11 (2010)). Finally I would like to add that the studies of mixed-symmetry states have evolved towards experiments based on radioactive ion beams. Dr. Rainovski and I have already initiated an experimental program to study mixed-symmetry states in radioactive nuclei at REX-ISOLDE (and in the near future at HIE-ISOLDE), CERN. The evolution towards radioactive nuclei is driven by both the physics and the methodological progress we have achieved in the studies of mixed symmetry states in stable nuclei. Dr. Rainovski has been one of the leaders in this process and hopefully he will continue to play such role.

Sincerely

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Common publications related to studies of mixed-symmetry states

1. Physical Review C (2012) in press

Identification of the $2^+_{1,ms}$ mixed-symmetry state of ^{136}Ce

T. Ahn, G. Rainovski, N. Pietralla, L. Coquard, A. Costin, R.V.F. Janssens, C.J. Lister, M.P. Carpenter, S. Zhu

2. Physical Review C 84, 061306(R) (2011)

One-phonon isovector $2^+_{1,MS}$ state in the neutron-rich nucleus ^{132}Te

M. Danchev, G. Rainovski, N. Pietralla, A. Gargano, A. Covello, C. Baktash, J. R. Beene, C. R. Bingham, A. Galindo-Uribarri, K. A. Gladnishki, C. J. Gross, V. Yu. Ponomarev, D. C. Radford, L. L. Riedinger, M. Scheck, A. E. Stuchbery, J. Wambach, C.-H. Yu, and N. V. Zamfir

3. Physical Review C 83, 044318 (2011)

$O(6)$ -symmetry breaking in the γ -soft nucleus ^{126}Xe and its evolution in the light stable xenon isotopes

L. Coquard, G. Rainovski, N. Pietralla, T. Ahn, L. Bettermann, M.P. Carpenter, R.V.F. Janssens, J. Leske, C.J. Lister, O. Möller, T. Möller, W. Rother, V. Werner, S. Zhu

4. Physical Review C 82, 037302 (2010)

Search for one-phonon mixed-symmetry states in the radioactive nucleus ^{140}Nd

K.A. Gladnishki, G. Rainovski, P. Petkov, J. Jolie, N. Pietralla, A. Blazhev, A. Damyanova, M. Danchev, A. Dewald, C. Fransen, M. Hackstein, D. Karagoyozov, O. Möller, T. Pissulla, M. Reese, W. Rother, R. Topchiyska

5. Physical Review C 82, 024317 (2010)

Evolution of the mixed-symmetry $2^+_{1,ms}$ quadrupole-phonon excitation from spherical to γ -soft Xe nuclei

L. Coquard, N. Pietralla, G. Rainovski, T. Ahn, L. Bettermann, M.P. Carpenter, R.V.F. Janssens, J. Leske, C.J. Lister, O. Möller, W. Rother, V. Werner, S. Zhu

6. Physics Letters B 683, 11 (2010)

How close to the $O(6)$ symmetry is the nucleus ^{124}Xe ?

G. Rainovski, N. Pietralla, T. Ahn, L. Coquard, C.J. Lister, R.V.F. Janssens, M.P. Carpenter, S. Zhu, L. Bettermann, J. Jolie, W. Rother, R.V. Jolos, V. Werner

7. Physical Review C 80, 061304 (2009)

Robust test of $E(5)$ symmetry in ^{128}Xe

L. Coquard, N. Pietralla, T. Ahn, G. Rainovski, L. Bettermann, M.P. Carpenter, R.V.F. Janssens, J. Leske, C.J. Lister, O. Moller, W. Rother, V. Werner, S. Zhu

8. Physics Letters B 679, 19 (2009) (Erratum Phys.Lett. B 682, 490 (2010))

Evolution of the one-phonon $2^+_{1,ms}$ mixed-symmetry state in $N=80$ isotones as a local measure for the proton-neutron quadrupole interaction

T. Ahn, L. Coquard, N. Pietralla, G. Rainovski, A. Costin, R.V.F. Janssens, C.J. Lister, M. Carpenter, S. Zhu, K. Heyde

9. Physical Review C 76, 034325 (2007)

Microscopic restoration of proton-neutron mixed symmetry in weakly collective nuclei

J.D. Holt, N. Pietralla, J.W. Holt, T.T.S. Kuo, G. Rainovski



10. Nuclear Physics A 788, 85c (2007)

Isovector quadrupole excitations in the valence shell studied in projectile Coulomb excitation

N. Pietralla, G. Rainovski, T. Ahn, A. Costin

11. Physical Review C 75, 014313 (2007)

γ -ray multipolarimetry between low-spin states of ^{136}Ce : Search for the $2^+_{1,ms}$ one-phonon mixed-symmetry state

T. Ahn, N. Pietralla, G. Rainovski, A. Costin, K. Dusling, T.C. Li, A. Linnemann, S. Pontillo

12. Physical Review Letters 96, 122501 (2006)

Stabilization of nuclear isovector valence-shell excitations

G. Rainovski, N. Pietralla, T. Ahn, C.J. Lister, R.V.F. Janssens, M.P. Carpenter, S. Zhu, C.J. Barton III

13. Physical Review C 73, 054306 (2006)

First evidence for spin-flip $M1$ strength in ^{40}Ar

T.C.Li, N. Pietralla, A.P. Tonchev, M.W. Ahmed, T. Ahn, C. Angell, M.A. Blackston, A. Costin, K.J. Keeter, J. Li, A. Lisetskiy, S. Mikhailov, Y. Parpottas, B.A. Perdue, G. Rainovski, W. Tornow, H. R. Weller, Y. K. Wu

14. Physical Review C 71, 044318 (2005)

One-phonon $2^+_{1,ms}$ mixed-symmetry state of ^{148}Sm observed in nuclear resonance fluorescence

T.C. Li, N. Pietralla, C. Fransen, H. von Garrel, U. Kneissl, C. Kohstall, A. Linnemann, H.H. Pitz, G. Rainovski, A. Richter, M. Scheck, F. Stedile, P. von Brentano, P. von Neumann-Cosel, V. Werner