



Next Generation Experiments to Measure the Neutron Lifetime: Proceedings of the 2012 Workshop

Susan J Seestrom

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There is a great interest in improving the limits on neutron lifetime to the level of a precision of 0.1 s. The neutron lifetime is both an important fundamental quantity as well as a parameter influencing important processes such as nucleosynthesis (Helium production in the early universe) and the rate of energy production in the Sun.

Aiming to create a roadmap of R&D for a next generation neutron lifetime experiment that can be endorsed by the North American neutron community, the focus of the workshop was on experiments using traps that utilize ultracold neutrons and confinement by a combination of magnetic and/or gravitational interaction in order to avoid systematic uncertainties introduced by neutron interactions with material walls. The papers in this volume summarize the limitations of present experiments, the discussion of new experiments in planning stage, and the discussion of systematic effects that must be addressed to achieve a lifetime measurement at an accuracy of 0.1 second.

Cover image courtesy of Elena Fernández, Los Alamos National Laboratory.

Contents:

- Neutron Lifetime Theory (*W J Marciano*)
- Neutron Lifetime Experiments Using the Beam Method: Past, Present, and Future (*F E Wietfeldt*)
- Overview of Magnetic Trapping Neutron Lifetime Experiments (*P R Huffman*)
- Some Thoughts Concerning the Statistics and Ultracold Neutron Source Requirements for the UCN τ Experiment (*A R Young*)
- Phase Space Evolution in Neutron Traps for Measurements of the Neutron Beta-Decay Lifetime (*C-Y Liu, D Salvat and E Adamek*)
- Chaos in a Gravo-Magneto Neutron Trap (*J D Bowman and S I Penttila*)
- Stochastic Modeling and Simulation of Marginally Trapped Neutrons (*K J Coakley*)
- Spin Flip Loss in Magnetic Storage of Ultracold Neutrons (*A Steyerl, C Kaufman, G Müller, S S Malik and A M Desai*)
- Vibration-Induced Loss of Ultra-Cold Neutrons in a Magneto-Gravitational Trap (*D J Salvat and P L Walstrom*)
- Blind Analysis in Physics Experiments: Is this Trip Necessary? (*R Golub*)
- A Technique for Determining Neutron Beam Fluence to 0.01% Uncertainty (*A T Yue, M S Dewey, D M Gilliam, J S Nico, N Fomin, G L Greene, W M Snow and F E Wietfeldt*)
- A New Method of Neutron Detection for UCN Lifetime Measurements (*C L Morris, D J Salvat, E Adamek, D Bowman, S Clayton, C Cude, W Fox, G Hogan, K Hickerson, A T Holley, C-Y Liu, M Makela, G Manus, S Penttila, J Ramsey, A Saunders, S Sawtelle, S J Seestrom, K Solberg, J Vanderwerp, B Vorndick, P Walstrom, Z Wang and A R Young*)
- Measuring the Neutron Lifetime with Magnetically Trapped Ultracold Neutrons (*H P Mumm, M G Huber, A T Yue, A K Thompson, M S Dewey, C R Huffer, P R Huffman, K W Schelhammer, C O'Shaughnessy and K J Coakley*)

- UCN τ : Study of Lifetime Measurement in a Magneto-Gravitational Trap (*A Saunders, D Salvat, E Adamek, D Bowman, S Clayton, C Cude, W Fox, G Hogan, K Hickerson, A T Holley, C-Y Liu, M Makela, G Manus, C Morris, S Penttila, J Ramsey, S Sawtelle, K Solberg, J Vanderwerp, B Vorndick, P Walstrom, Z Wang and A R Young*)
- A Comparison of Two Magnetic Ultra-Cold Neutron Trapping Concepts Using a Halbach-Octupole Array (*K Leung, S Ivanov, F Martin, F Rosenau, M Simson and O Zimmer*)
- Polarizing Ultra-Cold Neutrons for the Superconducting Trap PENeLOPE (*R Picker, W Schreyer, F Haas, F J Hartmann, M Losekamm, S Paul, R Stoepler and C Tietze*)
- Summary of Workshop on Next Generation Experiments on the Neutron Lifetime (*D Dubbers, K S Kumar and J M Pendlebury*)

Readership: Graduate students and researchers in nuclear and particle physics.

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