



# PHYSICS COLLOQUIUM:

## Probabilistic modeling of ReRAM networks

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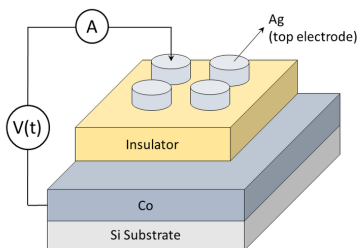
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### About The Speaker:

Yuriy V. Pershin is a professor of Physics at the University of South Carolina. He received his Ph.D. degree in theoretical physics in 2002 from the University of Konstanz, Germany. His research interests include the physics of electronic devices with memory, spintronics, and unconventional computing. Prof. Pershin has published about 140 research papers, contributed to several books, and has been awarded one U.S. patent. He is a Fellow of the Institute of Physics and a senior member of IEEE.

### Abstract:

As the stochasticity is not captured by the standard Kirchhoff's laws, the analysis of electronic circuits with stochastic resistive random-access memory (ReRAM) cells (such as electrochemical metallization (ECM) cells) requires different modeling approaches. Conceptually, the dynamics in such circuits can be imagined in terms of transitions between discrete circuit states. To describe these transitions mathematically, we pioneered the use of a master equation, which is suitable for circuits combining linear and/or non-linear resistors, binary and/or multi-state memristors, current and/or voltage sources. In my talk, I will also discuss a generalization of the master equation approach to the circuits involving reactive components (capacitors and/or inductors). The mathematical description of such circuits is more involved as it relies on occupation probability functions of reactive variables satisfying the Chapman-Kolmogorov equation. Moreover, an innovative realization of ECM cells will be presented.



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