

**The MARCO FENA Center is Proud to Present its Student-Hosted  
Tutorial Series, Featuring:**

**Theme 5: Nanoscale Architectures & Information Processing Paradigms**

**"Reinforcement Training of Nanoelectric Neuromorphic Networks"**

**Thursday, June 22nd  
5401 Boelter Hall (FENA Conference Room)  
9:00AM (Pacific), 12:00PM (Eastern)**

**\*\*Refreshments Served\*\***

**\*\*For those who plan on attending remotely, please find remote conference details below**

**[\\*\\*Click Here to Join Live Meeting](#)**

**Meeting URL: <https://www.livemeeting.com/cc/src/join>**

**Meeting ID: FNQWW8**

**Meeting Key: RW4HW8**

**Audio Conferencing (Toll-free): +1 (888) 296-1938**

**Participant Code: 829752**



**THE MARCO FENA CENTER IS  
PROUD TO PRESENT ITS TUTORIAL  
SERIES FEATURING**

**Theme 5: Nanoscale Architectures &  
Information Processing Paradigms**

**Professor Konstantin Likharev &  
Xialong Ma of Stonybrook University**

**TITLE: Reinforcement Training of Nanoelectric  
Neuromorphic Networks**

**ABSTRACT:** Hybrid CMOS/nanoelectronic "CMOL" circuits may extend the Moore-Law progress of microelectronics well into the sub-10-nm size range. One of major applications of CMOL technology are mixed-signal neuromorphic networks ("CrossNets") using binary latching switches as elementary synapses. Such synapses are by their physics noisy, and enable a natural implementation of stochastic exploration of phase space, necessary for advanced information processing techniques such as reinforcement learning. In this particular work we have generalized R.Williams' arguments to derive several simple learning rules for such learning. For the popular MONK's set of benchmark problems, the generalization performance of at least two suggested rules (A2 and A3) is on a par with the renowned Ar-p rule for networks with random somas which are less convenient for nanoelectronic hardware implementation. We will also describe two possible ways to implement rule A3 in CMOL hardware.

**THURSDAY, JUNE 22 AT 9:00 AM  
5401 BOELTER HALL (FENA CONFERENCE ROOM)**

**REFRESHMENTS PROVIDED**

