

15 April, 2010

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# Alumni and Friends of the School of Mathematics

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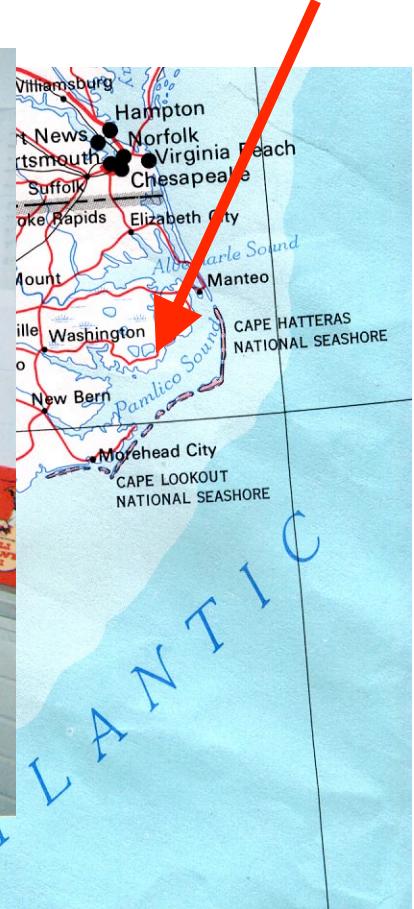
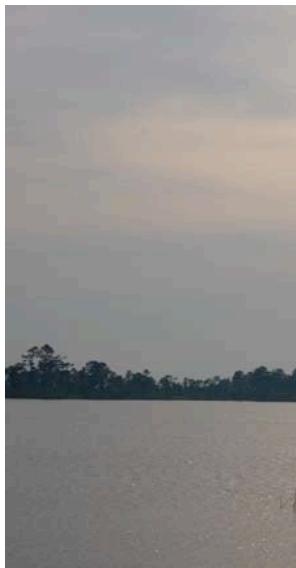
# Outline

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- Who I am
  - Some research questions in applied analysis
  - Outreach opportunities
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# Who I am... background

- Teacher K-6 grade students with emotional and learning disabilities



# Background, continued

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- Teacher 9-12 grade students with mild learning disabilities or English as a second language





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and then...

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# Background, continued

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- 2000: MS degree, Rensselaer Polytechnic Institute (RPI)
  - 2004: PhD, Courant Institute (NYU)
  - 2004-2005: NSF Postdoctoral Fellowship in Bonn, Germany
  - 2005-2006: NSF Postdoc at Princeton University
  - 2006-present: Assistant professor at GA Tech
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# My research

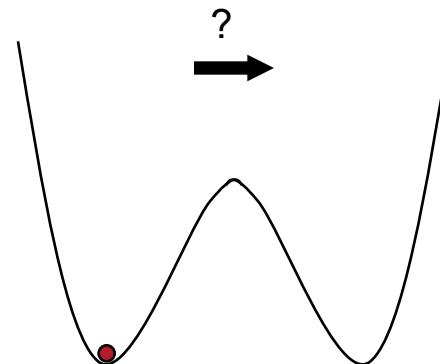
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- Applied mathematics
- Rare events
- Partial differential equations (PDE)
- Calculus of variations
- Logarithmic Sobolev inequalities

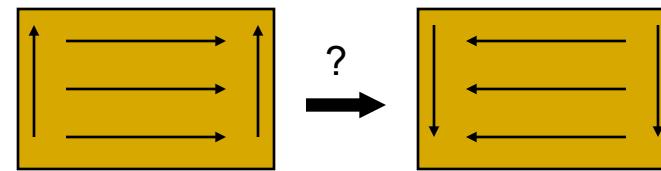
# Noise-driven rare events

- Simplest example

Switching in a  
double well potential



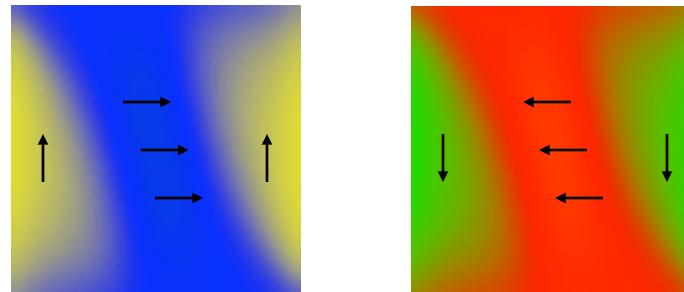
- Magnetic switching



*Rare but important events. e.g., failure of a hard drive*

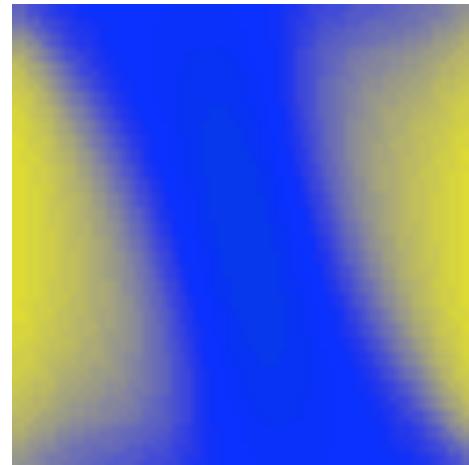
# Switching pathway via large deviation theory

Many local  
energy minimizers



blue = right, red = left, yellow = up, green = down

Probability of switching?  
Average time to switch?  
Most likely pathway?

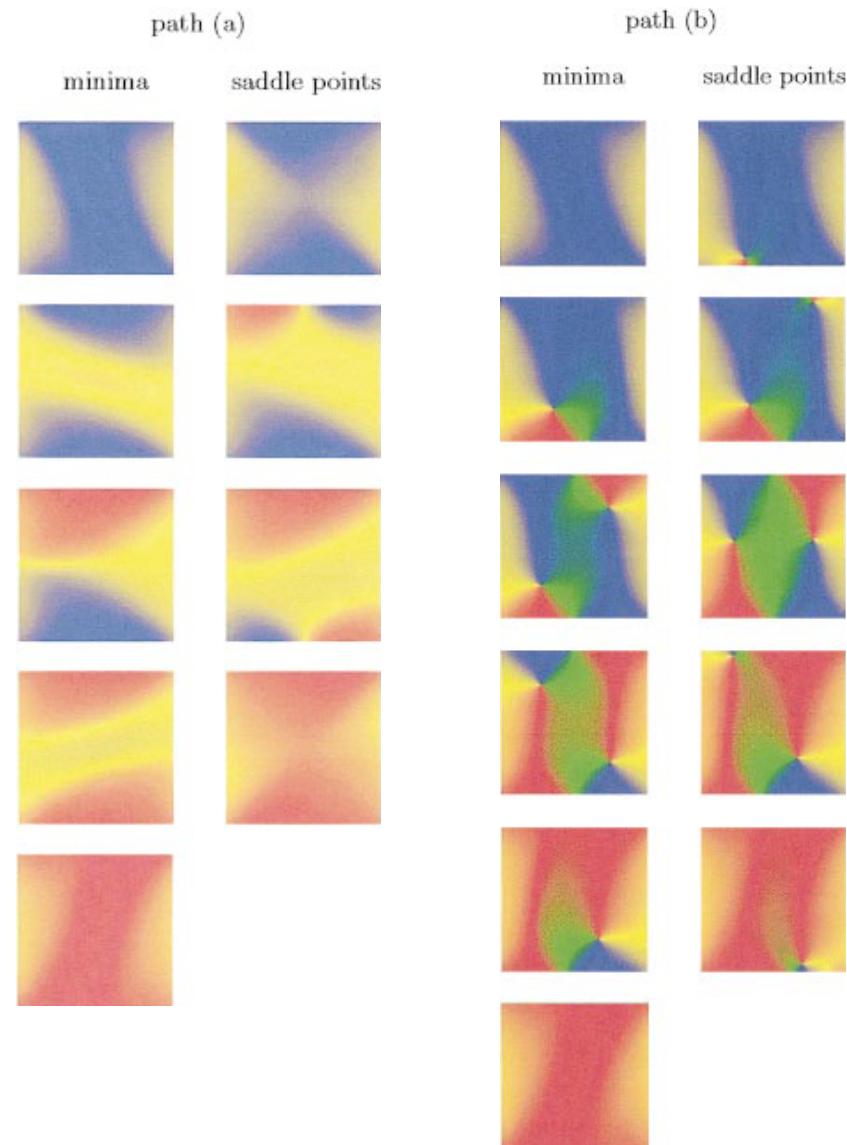


From Weiqing Ren's webpage <http://www.cims.nyu.edu/~weiqing>

# Many pathways!

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- Pathway tells us about the timescales and the nature of the most probable path
- Reduced model that captures leading behavior?



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From E, Ren, and Vanden-Eijnden, J Appl Phys (2003)

# Summary

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- Rare events are *important*
  - Pathways help to predict when and how rare events happen
  - In certain parameter regimes, powerful *reductions* are possible (vortices, sharp interface limits,...)
  - Interplay among physics, applied math modeling, numerics, probability, PDE
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# Outreach

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- K-12: CEISMC, GIFT high school teachers
  - Undergrads: Tech, REU students, area colleges
  - Students who are women or minorities
  - National and international networking
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*Thank you for your attention!*