Digital Signal Processing Group
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**Mission Statement**
The research mission of DSPG is to creatively advance signal processing algorithms, gaining inspiration from new mathematics and unrelated physical disciplines. The educational mission of DSPG is to foster creativity and confidence through unconventional intellectual adventures.

The Future of Signal Processing: Can You Imagine?
• Analog and digital algorithms interacting seamlessly together
• Signal processing implemented using a combination of living cells, photons, and electrons
• Nonlinear mathematics for new classes of signal processing algorithms and systems
• Smart signals that “know” what processing needs to be done on them
• New ways of defining and manipulating the information in signals

**Approach**
Our approach is often described as ‘solutions in search of problems.’ We often start with “How interesting and unexplored is this?” rather than “What is it going to be useful for?” We let interesting problems architect their own course by pursuing speculative ideas inspired by virtually anything surrounding us. Nothing is off limits.

Our group meetings consist of a relaxed, high energy environment where creativity is cultivated through brainstorming with our colleagues. The most unique tool that we use and enjoy in the DSPG group is the opportunity to think aloud without being judged and having the comfort of an “intellectual family” listening to and thinking with you. The research in DSPG is motivated primarily by what is interesting, intellectually stimulating, and fun.

**What can…**
- Nature
- A Matryoshka doll
- Quantum Physics
- Chemistry
- Thermodynamics
- Random Matrices
- Chaos
- Biology

…teach us about signal processing?

**Random Matrix Theory in Signal Processing**

Example: Wigner’s Semicircle Law

**Key Questions**
- How can we exploit composition and decomposition more fully in signal processing, computer science, machine learning, artificial intelligence, etc?
- How can we recover a wideband signal from the output of a low pass filter?

**Conservation in Signal Processing**

Weak conservation (pairwise orthogonality)

Strong conservation (vector space orthogonality)

**Tunneling in Signal Processing**

Initial thought: Can wideband signals ‘tunnel’ through lowpass filters?

Goal: Use quantum tunneling as inspiration for recovery algorithms of decaying signals.

**Key Question:** How to perform optimum adaptive filtering with deficient sample support?

**Circuits, Systems, Signal and Communications**