Midshipman 1st Class Michael A. Woulfe
Theory of a Nearly Two-Dimensional Dipolar Bose Gas
We develop a theory to describe a gas of dipolar bosonic atoms at finite temperature, where both a Bose-Einstein condensate and a thermal gas exist. The focus is on a nearly two-dimensional geometry, where the gas possesses anomalously low-energy excitations.

Midshipman 1st Class Timothy E. Tracey
Measurement and Modeling of High Energy Laser (HEL)-Droplet Interactions
A series of experiments investigated the interaction of a high energy laser and large water droplets. Single drops were acoustically levitated and shot with an IR laser. Measurements of the drop during irradiation and the fate of the beam elucidate the dynamics of coupled optical and thermodynamic processes.

Midshipman 1st Class Ian E. Shaw
Construction of Rational Maps on the Projective Line with Given Dynamical Structure
Is there a way by which to construct a rational map by specifying degree, fixed points, and periodic points? We have developed a method by which to do this for degree 2, quadratic rational maps for all but a few sets of period two points.

Midshipman 1st Class Thomas J. Wester
Mathematical Modeling: Immune System Dynamics in the Presence of Cancer and Immunodeficiency in vivo
We utilize systems of nonlinear ordinary differential equations to analyze the dynamics of the Human Immunodeficiency Virus (HIV) and the interaction of cancer and HIV within the immune system. Mathematical analysis allows us to better understand interactions between populations and determine if treatment can delay disease progression or prevent the proliferation of cancer.

Midshipman 1st Class Alvin A. Abes
Modeling and Control of the Cobelli Model as a Personalized Prescriptive Tool for Diabetes Treatment
There are 29 million people in the United States afflicted with diabetes and thousands more within danger of acquiring the metabolic disease. This research hopes to assist physician care of diabetic patients through predictive dosing methods. These predictions aim to remedy the symptoms before they occur rather than after.

Midshipman 1st Class Forrest Cooke
Uncalibrated Three-Dimensional Microrobot Control
This project creates an uncalibrated, magnetically actuated control system for a microrobot acting in a three-dimensional, fluidic workspace. Such a system further the field of microrobots by facilitating autonomous microrobot operation in a three-dimensional system with unknown or variable environmental factors.

Midshipman 1st Class Ryan J. Burmeister
Fast, Distributed Algorithms in Deep Networks
Neural nets frequently outperform other approaches in classification and regression, but training often requires substantial computation. We speed up this training in two ways. First, we introduce informed parameter initialization. Second, we introduce an optimization algorithm that demonstrates linear speedup when parallelized, allowing vastly shorter training times.

Midshipman 1st Class Spencer C. Shabshab
Virtual Oscillator Control for Communication-Free Synchronization of Paralleled 3-Phase Inverters
A method of synchronizing parallel-connected three-phase power converters by controlling them to emulate the dynamics of a nonlinear dead-zone oscillator is validated through simulation and hardware testing. The design of a testbed for hardware validation and the results of experimental testing are presented.

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