

From Rogue Waves to Lump Waves

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Rogue waves were once regarded as incredible as sea monsters and ghost ships; occasional reports of a ship that somehow survived a hundred-foot wave were put down to hyperbole and grog. After all, the standard statistical models predicted that such tall waves would be incredibly rare — especially out at sea. But then, on 1 January 1995, rogue wave hit the Draupner E platform off Norway:



It was 85 feet high.

Since then, satellites have confirmed that rogue waves are a common phenomenon, and indeed, Professor Nail Akhmediev of Australian National University estimates that at any given time, there are about ten rogue waves somewhere out there.

Outside of human curiosity, rogue waves pose a continuing threat to human life and property, so the theory needs to catch up with empirical science. We begin at the beginning. Oceanic rogue waves are surface gravity waves with wave heights much larger than expected (according to the standard <u>Gaussian model</u>); by surface gravity wave, we mean that it moves on the surface, unlike sound waves that move *through* water. Oceanographers used to think that wave heights would be normally distributed — which would mean that very tall rogue waves would be extremely rare.

Waves were classically understood as manifestations of various wave equations, the most famous of which is

$$\frac{\frac{2}{2} + x}{2} = 0!$$
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Wen-Xiu Ma

Yuan Zhou

(Their paper is posted online.)

There is still a long way to go in testing these differential equations as descriptions of rogue waves. For example, suppose that a solution for a more sophisticated (and hopefully more accurate) model is a rational function whose denominator is not quadratic: we still do not have a good criterion for when non-quadratic polynomials are always positive.

Meanwhile, somewhere, out there, right now, ten rogue waves roam the seven seas...

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Faculty News

Last Fall we welcomed two new faculty members:

Giacomo Micheli received his Ph.D. from the University of Zurich in 2015 and undergraduate degrees from University of Rome. Then he was a Postdoctoral Fellow at Massachusetts Institute of Technology, a Research Fellow at University of Oxford, and a Scientist at the École Polytechnique Fédérale de Lausanne. He works in algebraic number theory and cryptography and coding theory.

Joel A. Rosenfeld received his Ph.D. from the University of

The MAA math club also co-hosts the annual Math Picnic every fall semester at the USF Riverfront Park.

The officers are Alexander Mercier (President), and Keller Blackwell (Vice President).

USF Students Will Soar to Cross the Karman Line

One of the vibrant and active student organization at USF in Tampa, is the Society of Aeronautics and Rocketry (SOAR). The genesis of SOAR goes back to 2010. At the time, USF had a "Science Club" with Matthew Chrzanowski as president. Professor Manoug Manougian was asked to serve as faculty advisor. The Science Club was renamed the Society of Aeronautics and Rocketry (SOAR), and the rockets were labelled *Bull-istic*, a name stemming from the university's mascot, a bull.

SOAR team and Bull-istic

The goal is to perfect the launching of rockets into space to put satellites into orbit for scientific

During the Base 11 Space Challenge, university students in the U.S. and Canada will design, build, and launch a one-stage liquid-propelled rocket. The university whose rocket reaches 63 miles above sea level (the Karman line) first, will receive the grand prize of \$1 million dollars. Additional prizes and accolades are also awarded. The competition will take place in New Mexico. The devotion and passion shown by this group of students gives USF's SOAR program an edge to come back to USF with the grand prize.

Board members of SOAR