Undergraduate Research at Georgia Tech

Matt Baker

Associate Professor

School of Mathematics

About me

- Ph.D. in Mathematics in 1999 from U.C. Berkeley
- Benjamin Peirce Assistant Professor, Harvard University 1999-2002
- Currently Associate Professor at GT
- Research interests: number theory, algebraic geometry, combinatorics, algebraic dynamics
- Coach of the Putnam team
- Undergraduate research coordinator for the SoM since 2005
- Member of the International Brotherhood of Magicians

Overview of REU program

- 10-15 REU students per summer for the last six summers
- NSF currently funds 10 REU students per summer at $5K each (MCTP grant)
- Intensive one-on-one mentoring
- Competitive application process
- Most participants are GT students

Awards and publications

- Three SoM REU students have won the prestigious Georgia Tech Sigma Xi Undergraduate Research Award in the last six years

- Many of our undergraduate students have published research papers in professional math journals

Selected REU publications

- Brian Benson: "G-parking functions and acyclic orientations of graphs", with P. Tetali, to appear in Discrete Mathematics)

- Reginald McGee (Florida Atlantic University): "Optimizing a fin ray for stiffness", with S. Alben, Journal of the Mechanics and Physics of Solids 58, 656-664 (2010).

- Ander Steele: "Carmichael Numbers in Abelian Extensions of **Q**", Journal of Number Theory 128, no. 4 (2008), 910-917. **Sigma Xi Award.**

- Ioana Soran, "Weights whose Biorthogonal Polynomials admit a Rodrigues Formula", with D. Lubinsky, Journal of Mathematical Analysis and Applications, 324 (2006), 805-819.) **Sigma Xi Award.**

Profile: Ander Steele

- REU in 2005-2006, currently a Math Ph.D. student at Boston University
- Research on Carmichael numbers and primality testing, with applications to cryptography

Carmichael numbers

- If p is a prime number then for any integer a, p divides $a^p - a$ (Fermat).
- So if N does *not* divide $a^N - a$ for some integer a, then N is *not* prime.
- Question: if N divides $a^N - a$ for all integers a, must N be prime?
- Answer: No. (Carmichael numbers "masquerade" as primes.)

Carmichael numbers (cont.)

- Ander's idea: use "*Gaussian integers*" $a = x+iy$ instead of regular integers.

- Many Carmichael numbers reveal themselves to be composite using this "extended Fermat primality test". But there are still impostors…

- Follow-up idea: Use other "cyclotomic integers".

- *Conjecture:* Every composite number will reveal itself as composite for some suitably chosen cyclotomic integer a.

Profile: Daniel Connelly

- 2008 REU, currently working for MIT's Lincoln Labs.
- Generated computer images of some new fractals…