University of Colorado Boulder

Department of Mathematics
395 UCB
Boulder, Colorado 80309-0395

t 303 492 7664
f 303 492 7707

Kempner Colloquium

The Prime Number Theorem

Daniel Stroock

(MIT)

More or less at the same time, in 1896 Hadamard and de la Vallée proved that

$$\lim_{n\to\infty} \frac{\pi(n)\log n}{n} = 1$$

where $\pi(n)$ denotes the number of prime numbers $p \leq n$, a famous result known as the prime number theorem. Their proofs were magnificent examples of the power of analytic function theory to solve problems in number theory, and to understand their proofs one has to have the mastery of complex analysis that they had. Over the course of time, their proofs were simplified and other proofs were given. However, the first proof that could be called "elementary" was given by D.J. Newman in a MAA article that appeared in 1980. Newman's proof requires only that one know that the Riemann zeta function has no zeroes in the half space $\{z \in \mathbb{C} : R(z) \geq 1\}$, and the way that he gets away with so little information is that he applies a novel Tauberian theorem, one that he invented himself. Newmans argument was further refined by D. Zagier on the 100th birthday of the prime number theory, and it Zagier's article on which my lecture is based. Unfortunately, elementary as Newman's proof is, it cannot be given in 40 minutes. Thus, in this lecture, I will concentrate on his Tauberian theorem and will only sketch the rest of the argument.

Tuesday October 28, 2014
12:10 PM - 12:50 PM
MATH 350