"Knowing What is Unknowable: Things Gödel Proves a Computer Will Never Do"

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Tuesday, April 15, 2008, Rogers Building 109. Open to the public.
Pizza and beverages at 5:30. The lecture starts soon after.

Abstract: **Computing has no *theory of everything*** (T.O.E.). We're uncertain whether physics has a T.O.E. as revealed in M-theory but, due to the genius of Kurt Gödel 75 years ago, smart people like Stephen Hawking are starting to doubt it. This is because of a new startling mathematical idea from algorithmic information theory (AIT): There exist things that are true that cannot be derived from fundamental principles. **Some things are true simply because they are true**. Many claim God cannot be proved. (Although I'll show you Gödel's short mathematical proof of God's existence). **There are some things we know exist that we can *prove* we will never know.** Most doubt a computer program will ever write a deeply meaningful poem or a classic novel. How about something simpler? Can we look at an arbitrary computer program and decide whether or not it will ever print out the number 3? We can for some programs. But Alan Turing, the founder of computer science, proved it is impossible to write a program to analyze another arbitrary program to tell us whether or not a 3 will be printed. In fact, **we can't write a computer program to determine *anything* another arbitrary computer program will do**. (This is called Rice's theorem.) To find out, we need to run the program. We can also prove there are numbers of finite precision numbers a computer can't compute. One of these is Chaitin's number, an astonishing constant between zero and one we know exists. **If we knew Chaitin's constant to finite precision - one single number - we could solve a many of open problems in mathematics.** These include the Riemann hypothesis, Goldbach's conjecture and whether or not there is an odd perfect number. **Chaitin's constant exists, but we can prove we will never know it.** These and other mind bending properties in the field of AIT seem too far fetched to be true, but with a minimum of math, I will convince you otherwise.

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