

# The SUMO Speaker Series for Undergraduates

Thursday, April 28  
4:30 – 5:20pm, Bldg. 380, room 384H

(Food Provided)

Elementary integration and differential Galois theory



Liouville



Kolchin

Professor Brian Conrad

## Abstract

Every calculus textbook says that  $\int e^{-x^2} dx$  cannot be “computed in elementary terms”. But the textbooks never indicate how one can *prove* such a statement, or even precisely define what an “elementary” function is, without which we cannot make a proof!

We will give a reasonable definition of elementarity, state Liouville’s necessary criterion for an integral of an elementary function to be elementary, and explain how this implies  $\int e^{-x^2} dx$  really is not elementary. At the end we’ll give some indications about differential Galois theory, which puts these matters into a broader context.

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