CCSU

DEPARTMENT OF MATHEMATICAL SCIENCES

COLLOQUIUM

Friday, September 14

2:00 – 3:00 PM

Maria Sanford, Room 101

DIRICHLET PROBLEM IN A BALL OR IN ITS EXTERIOR, ELEMETARY APPROACH

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ABSTRACT In this talk we shall see the extended geometric interpretation of the two-dimensional Poisson Kernel, originally introduced by Herman Schwarz and then, we introduce the geometric proof of the following integral identity,

$$\int_{S^k} \omega^\alpha dS_y = \int_{S^k} \omega^\beta dS_y \iff \alpha + \beta = k,$$

where S^k is the k-dimensional sphere of radius R centered at the origin; $x \in R^{k+1} \backslash S^k$; α, β are two different real numbers and $\omega = \omega(x, y)$ is the two-dimensional Poisson kernel used to solve Dirichlet Problem in a planar disk. We shall see that this integral equivalence written in coordinate form gives the direct relationship between Newtonian potential and Poisson kernel in a multidimensional space. Therefore, we can derive a new approach to the classical Dirichlet problem in (k+1)-dimensional ball of radius R or in its exterior. This derivation does not involve Green's function and relies only on the integral equivalence above. If time permits, we shall also see a new algebraic way to compute certain integrals arising in electrostatics and some non-trivial inequalities. In addition, we shall see that the integral identity applied in a two-dimensional space, let us compute a few a non-trivial integrals from calculus usually computed in complex analysis by residue theory.

For further information:

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