CCSU
DEPARTMENT OF MATHEMATICAL SCIENCES

COLLOQUIUM

Friday, September 20
2:00 – 3:00 PM
Maria Sanford, Room 101

ASYMPTOTIC BEHAVIOUR OF RADIAL EIGENFUNCTIONS OF THE HYPERBOLIC LAPLACIAN FOR THE POSITIVELY LARGE EIGENVALUES

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Abstract: A radial eigenfunction of the Hyperbolic Laplacian is a solution of the following system

$$\begin{cases} \varphi''(r) + \dfrac{k}{\rho}\coth\left(\dfrac{r}{\rho}\right)\varphi'(r) + \lambda\varphi(r) = 0, \ \ \lambda \in \mathbb{C} \\ \varphi(0) = 1, \end{cases}$$

written in the geodesic polar coordinates of the hyperbolic space of constant sectional curvature $\kappa = -1/\rho^2$. It is known that for every $\lambda \in \mathbb{C}$ there exists a unique solution $\varphi_\lambda(r)$. Our goal is to investigate the behavior of $\varphi(r)$ as $\lambda \longrightarrow +\infty$.

First, we obtain the integral form of $\varphi_\lambda(r)$ and then, introduce the Stationary Phase Theorem as the basic tool to investigate the asymptotic behavior of integrals depending on a parameter. We shall see some elementary examples related to the Stationary Phase Method and then obtain the general form of the leading term of $\varphi(r)$ as $\lambda \longrightarrow +\infty$. In particular, we compute the leading term explicitly for $k = 1, 2, 3,$ and 4.

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