# VCU Discrete Mathematics Seminar 

## Paley Graphs and Quadratic Residues

Robert Jacobs (VCU!)

Wednesday, Apr. 3<br>1:00-1:50 EDT

In person in 4145 Harris Hall, and on Zoom @
https://vcu.zoom.us/j/92975799914 password=graphs2357


In this talk we will discuss Paley graphs, their properties, and related research on quadratic residues. A Paley graph $P$ is defined on a finite field of order $p$ (where $p$ is a $4 k+1$ prime), with vertices $\{0,1, . . p-1\}$. A number $x$ is a quadratic residue (or square) if there is a number $y$ in the field with $y^{2}=$ $x$. Vertices $x, y$ are adjacent in $P$ if $x-y$ is a quadratic residue. We will review basic properties of Paley graphs, and discuss our investigation of their "independence structure".

We have developed formulas for, among other things, counts of triangles. We will also present conjectures involving the numbers $x, y$ in the famous Fermat/Euler sum of squares representation of $4 k+1$ primes - these appear in formulas for the number of edges of subgraphs of P !

