

CCSU
DEPARTMENT OF MATHEMATICAL SCIENCES
COLLOQUIUM

Friday, April 12
3:00 – 4:00 PM
Maria Sanford, Room 101

**A COMBINATORIC/GEOMETRIC/
ALGEBRAIC CURIOSITY**

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Abstract: If (a, b) is an arbitrary real vector, we can see that the vector $(b, -a)$ is orthogonal under the usual dot product for all values of the variables a and b , and only vanishes when both variables vanish. This leads to the question:

“For what positive integers, n , do there exist n permutations of n real variables, x_1, x_2, \dots, x_n such that after appropriate minus signs are inserted, these n permutations form the coordinates of n real vectors that are mutually orthogonal for all values of the variables?”

The answer is that such a set of n real vector functions exists in n dimensions for $n = 1, 2, 4,$ and $8,$ and only in those dimensions. The solutions have implications for number theory, but the main focus of the talk will be to quickly find the solutions and to show how they imply the existence of the complex numbers, the quaternions and the octonians, and how they can be used to efficiently derive their properties and multiplication tables.

For further information:
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