Abtract: Diagonalizing a square matrix (usually over the real or complex numbers) is a powerful idea that has widespread applications beyond Linear Algebra. We can make an enumeration problem out of this idea by assuming that the entries of a given square matrix come from a finite ring or field. In this talk, we investigate this problem in the context of the ring of integers modulo a power of a prime number. I will outline how my REU group from a couple of summers ago approached this problem and gave a rather surprising method to effectively solve it.