Abstract

Apollonius’s Theorem states that given three mutually tangent circles, there are exactly two circles which are tangent to all three. Apollonian circle packings are produced by repeating the construction of mutually tangent circles to fill all remaining spaces. A remarkable consequence of Descartes’ Theorem is if the initial four tangent circles have integral curvatures, then all of the circles in an Apollonian circle packing will have integral curvatures. This process results a sequence of integers with fascinating arithmetic properties.

In this talk, we will investigate the arithmetic properties of Apollonian circle packings. We will describe the Apollonian group action on the set of Descartes quadruples. We will talk about modular restrictions and density conjectures and theorems. Finally, we will show a correspondence between the root quadruples and reduced binary quadratic forms and answer an open question about finding the root quadruple of a given Descartes quadruple.