

ATELIER « LES GRAPHS ET L'ARITHMÉTIQUE »
8–12 MARS 2010

WORKSHOP ON GRAPHS AND ARITHMETIC
MARCH 8–12, 2010

Counting problems in Apollonian circle packings

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The curvatures in an Apollonian circle packing (ACP) can be associated with coordinates of vectors in an orbit of an infinite index subgroup A of $O_R(3, 1)$ acting on a vector of curvatures of any four mutually tangent circles in the packing. Remarkably, if the original four circles have integer curvature, all of the circles in the packing will have integer curvature as well. The number theoretic properties of an integral ACP can be studied by considering integral orbits of A . Since A acts on hyperbolic space with infinite volume fundamental domain, this problem is a lovely example of a situation where using the recently developed affine linear sieve is both effective and necessary. In this talk, we will see how much we can learn about the arithmetic structure of ACP's using this and other methods, as well as how one would extend this to more general problems.