Abstract

Knots, links and three-dimensional manifolds have been an object of mathematical studies since the 19th century. However, only in the 1970's William Thurston noticed that three-dimensional manifolds can be approached using geometry. This new perspective made geometric topology develop rapidly, and allowed to solve the long-standing Poincaré conjecture. Soon it was realized that one particular type of manifolds is prevalent and the least understood: the hyperbolic manifolds. Moreover, the hyperbolic metric on many three-dimensional manifolds is unique and therefore it gives rise to powerful invariants. The talk will briefly introduce an approach to hyperbolic structures that provides a close connection with a combinatorial or topological description of a manifold. I will then outline recent results giving an insight into the interplay between the intrinsic geometry of hyperbolic 3-manifolds and the invariants coming from other areas of mathematics, such as quantum topology, number theory and algebraic geometry.