Contribution ID: **5** Type: **not specified**

# Network geometry

*Thursday, December 10, 2015 9:00 AM (40 minutes)*

Networks are mathematical structures that are universally used to describe a large variety of complex systems such as the brain or the Internet. Characterizing the geometrical properties of these networks has become increasingly relevant for routing problems, inference and data mining. In real growing networks, topological, structural and geometrical properties emerge spontaneously from their dynamical rules. Here we show that a single two parameter model of emergent network geometry,constructed by gluing triangles, can generate complex network geometries with non-trivial distribution of curvatures, combining exponential growth and small-world properties with finite spectral dimensionality. In one limit, the non-equilibrium dynamical rules of these networks can generate scale-free networks with clustering and communities, in another limit 2 dimensional manifolds with non-trivial modularity. These properties of the geometrical growing networks are present in a large set of real networks describing biological, social and technological systems. When manifold of arbitrary dimension are constructed, and energies are assigned to their nodes these networks can be mapped to quantum network states and they follows quantum statistics despite they do not obey equilibrium statistical mechanics.

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**Session Classification:** Session 3