Contribution ID: **50** Type: **not specified**

Quantum statistics in Network Geometry with Fractional Flavor

Thursday, 12 December 2019 17:15 (15 minutes)

Quantum statistics have been shown to emerge to describe the statistical properties of growing networks when nodes are associated to a fitness value [1]. Recently it has been shown that quantum statistics emerge also in a growing simplicial complex model called Network Geometry with Flavor (NGF) which allows for the description of many-body interactions between the nodes [2,3]. This model depends on an external parameter called flavor that is responsible for the underlying topology of the simplicial complex. When the flavor takes the value s=−1 the d-dimensional simplicial complex is a manifold in which every (d−1)-dimensional face can only have an incidence number $n_\alpha \in \{0, 1\}$. In this case the faces of the simplicial complex are naturally described by the Bose–Einstein, Boltzmann and Fermi–Dirac distribution depending on their dimension. In this paper we extend the study of NGF to fractional values of the flavor $s = -1/m$ in which every (d−1)-dimensional face can only have incidence number $n_\alpha \in \{0,1,2,\ldots,m\}$. We show that in this case the statistical properties of the faces of the simplicial complex are described by the Bose–Einstein or the Fermi–Dirac distribution only. Finally, we comment on the spectral properties of the networks constituting the underlying structure of the considered simplicial complexes [4].

References

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Session Classification: Session 8