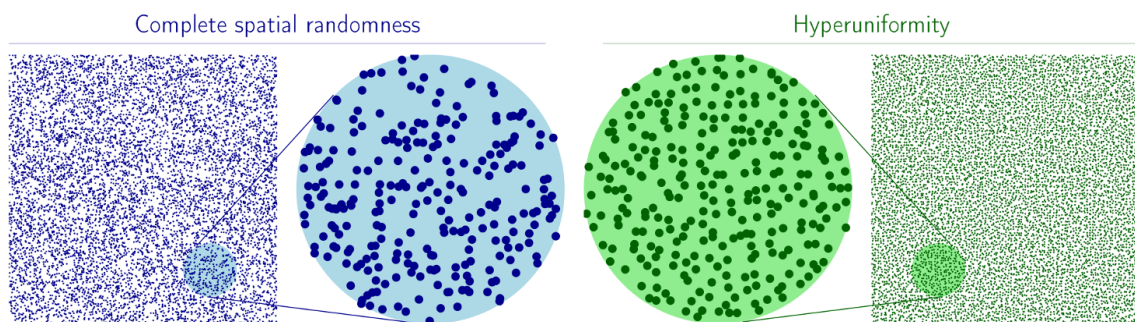Michael A. Klatt (Princeton University)

Finding Hyperuniformity – a Hidden Order among Disorder

From the eyes of chicken to exotic many-particle ensembles and random matrices, the concept of hyperuniformity has shed light on a variety of seemingly unrelated fields. It is defined as the anomalous suppression of density fluctuations on large length scales [1]. For disordered structures, this implies a hidden order such that the system remains macroscopically uniform, despite not being crystalline.

The unique properties of hyperuniform amorphous materials have recently led to intense research in physics, mathematics, material science, and biology; for example, see [2,3,4]. Aiming for an intuitive understanding of the rigorous mathematical definitions, this talk presents both basic concepts and recent examples.

Motivating that questions concerning hyperuniformity naturally arise in stereology, an outlook addresses questions of ongoing research: How can hyperuniformity be detected from cross sections that are themselves not hyperuniform? Can hyperuniformity be attained in cross sections of different dimensions?

References

[1] Torquato, Stillinger. Physical Review E, 68 (2003)

[2] Ghosh, Lebowitz. Indian J. Pure Appl. Math. 48 (2017)

[3] Torquato. Physics Reports, 745 (2018)

[4] Klatt, Last, Yogeshwaran. arXiv:1810.00265 (2018)