

Institut für Diskrete Mathematik

**Vortrag im Seminar für Kombinatorik und Optimierung**

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## **Non-uniform random simplicial complexes**

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Random simplicial complexes have received considerable attention in the last years as a higher-dimensional analogue of random graphs. Two models of “binomial” random simplicial complexes of dimension  $d$  have been studied. In both models, the vertex set is  $\{1, \dots, n\}$  and each  $d$ -simplex is present with some global probability  $p = p(n)$  independently. The first model, due to Linial, Meshulam, and Wallach, furthermore contains all simplices of dimension smaller than  $d$ . By contrast, the other model, recently introduced by Cooley, Del Giudice, Kang, and Sprüssel, only contains those simplices of dimension 1 up to  $d - 1$  that are contained in some  $d$ -simplex. For both models, higher-order connectivity of the complex can be defined via the vanishing of cohomology groups, and sharp thresholds for these properties have been determined for various choices of coefficients for cohomology.

Both models mentioned above are “uniform” in the sense that the randomness lies only in the choice of the  $d$ -simplices. In this talk, we present a “non-uniform” model in which the simplices of all dimensions from 1 up to  $d$  are chosen randomly. In particular, both uniform models are special cases of the non-uniform model. We determine a sharp threshold for the aforementioned notion of higher-order connectivity in the non-uniform model, where the coefficients of the cohomology groups are chosen from any abelian group. This result implies the corresponding results for the uniform models.

This talk is based on joint work with Oliver Cooley, Nicola Del Giudice, and Mihyun Kang.

Mihyun Kang