Connected cubic graphs with the maximum number of perfect matchings

01.06 **Peter Horak**
(*University of Washington, Tacoma*)
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Abstract: In 2008 Alon and Friedland showed that a simple cubic graph G on $2n$ vertices has at most $6^{n/3}$ perfect matchings, and this bound is attained by taking the disjoint union of bipartite complete graphs $K_{3,3}$. In other words, the above theorem says that the complete bipartite graph $K_{3,3}$ has the highest "density" of perfect matchings among all cubic graphs; thus the disjoint union of its copies constitutes the extremal graph. However, this result does not provide any insight into the structure of extremal connected cubic graphs.

In this talk it will be presented that for $n \geq 6$, the number of perfect matchings in a simple connected cubic graph on $2n$ vertices is at most $4f_{n-1}$, with f_n being the n-th Fibonacci number, and a unique extremal graph will be characterized as well. In addition, it will be shown that the number of perfect matchings in any cubic graph G equals the expected value of a random variable defined on all 2-colorings of edges of G.

This is joint work with Dongryul Kim.