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Haagerup's Inequality in Free Probability

In 1978, Uffe Haagerup introduced an important inequality in the context of the left-regular representation of a free group. While its original intent was to furnish an important counter-example in the theory of C^*-algebras, Haagerup's inequality quickly found numerous important applications in other fields: geometric group theory, Lie theory, random walks on groups, the Baum–Connes conjecture, and more.

The free group, or rather the von Neumann algebra generated by its left-regular representation, is the natural arena for *free probability*, a field which incorporates operator algebraic, probabilistic, and combinatorial techniques. In this talk, I will discuss a strengthened version of Haagerup's inequality, and a generalization thereof to R-diagonal operators—a wide class of non-normal operators important in free probability.

This is joint work with Roland Speicher.