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Circle-squaring with low Borel complexity

Laczkovich famously showed in 1990—answering a long-standing question of Tarski—that a circle and a square of the same area are equidecomposable using only translations. This has been steadily improved upon over the past decade by a series of results showing that the pieces, originally chosen in a non-constructive way, can have stronger regularity properties. The first completely constructive equidecomposition is due to Marks and Unger, who proved that the pieces can be Borel; Máthé, Noel, and Pikhurko later improved this to pieces with low Borel complexity (Δ^0_3). In this talk, I will sketch an argument that, in fact, the pieces can be as low complexity as Δ^0_2. The main new idea in our proof comes from a recent paper of Gao, Jackson, Krohne, and Seward. We generalize their definition of a weakly orthogonal decomposition to construct a low complexity (Δ^0_2) "toast", and then use network flows and graph theory (as in previous works) to achieve a low complexity equidecomposition.

This talk is based on joint work with Spencer Unger and Felix Weilacher.