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*The Cuntz semigroup and the structure of  $C^*$ -algebras*

In the early 2000s, Rordam and Toms constructed examples of non-isomorphic  $C^*$ -algebras, which cannot be distinguished using  $K$ -theory, tracial simplexes and natural pairings, summed up as the Elliott invariant. Toms's algebras can be distinguished by their Cuntz semigroup. In subsequent work, Perera and Toms conjectured that adding Cuntz semigroup to the Elliott invariant classifies the class of simple, separable and nuclear  $C^*$ -algebras. To date, no counter-examples to this conjecture are known. In my talk, I will explore various properties of the Cuntz semigroup. The ultimate goal is to make progress in the Perera-Toms conjecture.