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Introduction to cluster ensembles and the cluster duality conjecture (Lecture 1 & 2)

In early 2000s, Fock and Goncharov introduced cluster varieties as geometric counterparts of Fomin and Zelevinskys cluster algebras, and they formulated an important conjecture in cluster theory called the cluster duality conjecture. The cluster duality conjecture asserts the existence of certain canonical bases for the algebras of regular functions on pairs of cluster varieties. In 2014, Gross, Hacking, Keel, and Kontsevich proved a weak version of the cluster duality conjecture and gave a sufficient condition for the full cluster duality conjecture. This sufficient condition is implied by the existence of cluster Donaldson-Thomas transformation defined by Goncharov and Shen. In these two lectures I will give an introduction to the relevant topics and state some of the known results.