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*Poisson geometry and representation theory of root of unity quantum cluster algebras*

We will show that all root of unity quantum cluster algebras have canonical structures of Cayley-Hamilton algebras (in the sense of Procesi) and Poisson orders (in the sense of De Concini-Kac-Procesi and Brown-Gordon). The first result allows to transfer finiteness properties between the quantum and classical situations. The second result relates the representation theory of these algebras to the Poisson geometry of the Gekhtman-Shapiro-Vainshtein brackets. We will then prove that the spectrum of each upper cluster algebra equipped with the GSV Poisson structures has an explicit Zariski open torus orbit of symplectic leaves, which is a far reaching generalization of the Richardson divisor of a Schubert cell in Lie theory. At the end we will combine the above results to describe explicitly the fully Azumaya loci of the root of unity quantum cluster algebras. This classifies their irreducible representations of maximal dimension. This is a joint work with Shengnan Huang, Thang Le, Greg Muller, Bach Nguyen and Kurt Trampel.