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The Bures metric and the quantum metric on the density space of a C-algebra: the non-unital case*

Building off work of Farenick and Rahaman, we extend the definition of the density space and the Bures metric to the setting of non-unital C*-algebras equipped with a faithful trace and prove that the Bures metric is a metric in this case and that its topology is weaker than the topology induced by the C*-norm. Furthermore, we prove a Heine-Borel type theorem for C*-algebras and the density space, where we prove that for any C*-algebra (unital or non-unital) equipped with a faithful trace, the density space equipped with the Bures metric topology is not compact if and only if the C*-algebra is infinite dimensional. Next, building off work from some of the authors, we extend the definition of the quantum metric on the density space to the non-unital C*-algebra case by introducing the notion of a quantum Lipschitz triple, which form a subclass of quantum locally compact metric spaces of Latrémolière that utilize Rieffel's notion of a quantum metric. Furthermore, we prove that this quantum metric topology is weaker than the topology induced by the C*-norm and finish the article with an analysis of matrix-valued functions on the quantized interval, where the quantum metric topology on the density space is not compact and the quantum metric is not uniformly equivalent to both the Bures metric and the C*-norm induced metric. This is joint work with Karina Behera, Katrine von Bornemann Hjelmborg, Tron Omland, Gregory Wickham, Nicole Wu, and Adam M. Yassine. This work is partially supported by NSF grant DMS-2316892.