TRITHORIUM CLUSTERS: DISCOVERY OF ACTINIDE-ACTINIDE BONDING, EXALTED DIAMAGNETISM, AND SUPERATOM JELLIUM AROMATICITY

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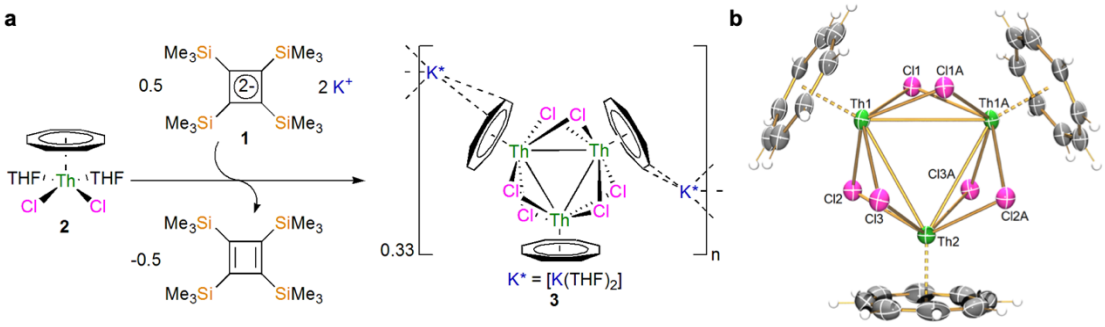
Molecular metal-metal bonding is a widely studied cornerstone of chemistry, and over the majority of two centuries it has become a mature field. However, in almost the entire history of metal-metal bonding isolable actinide-actinide bonding remained elusive under regular experimental conditions, with examples restricted to matrix isolation, gas-phase transients, or endohedral fullerene species.



While testing the reactivity of a diuranium(V)-arenetetraide [1], and establishing f-element cyclobutadienyl chemistry [2-5], we discovered that actinide-actinide bonding can be accessed in a trithorium cluster (**a**, **b**) that has three-centre two-electron (3c2e) bonding [6]. This work then evolved to include 3c1e clusters [7], leading to the discovery that all these Th_3 clusters exhibit exalted diamagnetism [8] which is an experimentally observable consequence of aromaticity. Quantum-crystallography has enabled experimental visualisation of the thorium-thorium bonding [9]. This has led to the recognition that these 3c1e and 3c2e clusters are superatoms, specifically superalkalis and superalkalines, respectively, and hence they open- and closed-shell Jellium aromats.

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