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Visualizing Chemical Bonds in Synthetic Molecules LAURA C. COLLINS, ANTHONY RUTH, DAVID B. GREEN, BOLDIZSAR JANKO, KENJIRO K. GOMES, Univ of Notre Dame — The use of synthetic quantum systems makes it possible to study phenomena that cannot be probed by conventional experiments. We created synthetic molecules using atomic manipulation and directly imaged the chemical bonds using tunneling spectroscopy. These synthetic systems allow us to probe the structure and electronic properties of chemical bonds in molecules, including those that would be unstable in nature, with unprecedented detail. The experimental images of electronic states in our synthetic molecules show a remarkable match to the charge distribution predicted by density functional theory calculations. The statistical analysis of the spectroscopy of these molecules can be adapted in the future to quantify aromaticity, which has been difficult to quantify universally thus far due to vague definitions. We can also study anti-aromatic molecules which are unstable naturally, to illuminate the electronic consequences of antiaromaticity.

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