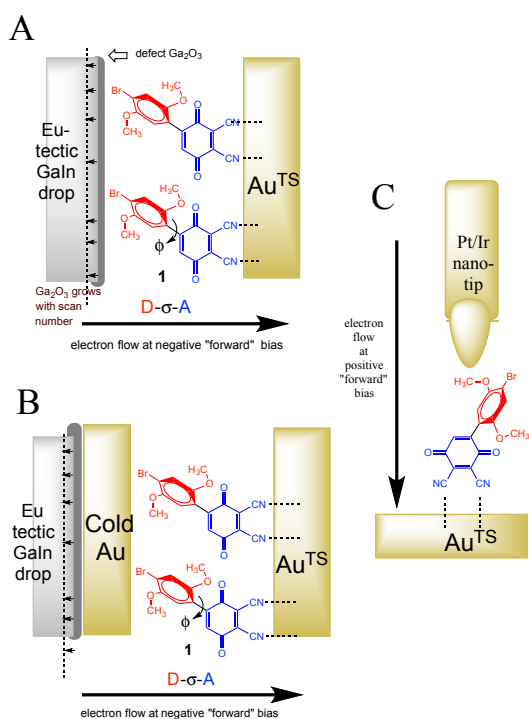


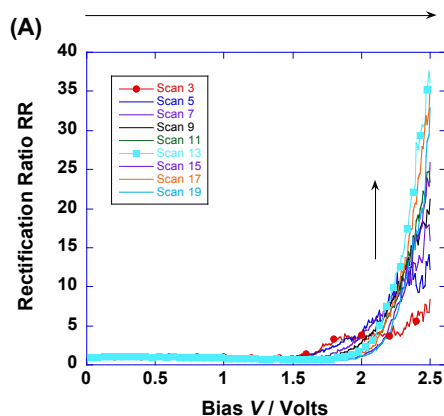
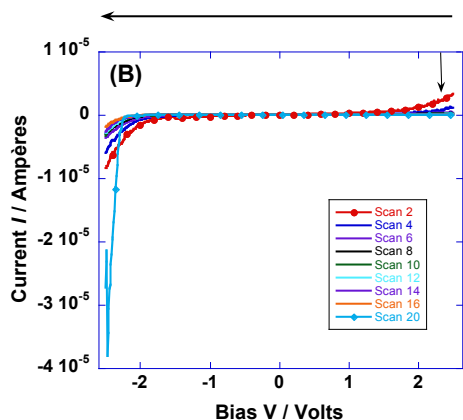
The Smallest Unimolecular Rectifier and Present Status of Unimolecular Electronics

Robert M. Metzger
 Department of Chemistry, University of Alabama
 Tuscaloosa, AL 35487-0336, USA



HBQ is a twisted hemibiquinone (weak electron donor + weak electron acceptor with a large intramolecular twist angle $\phi \approx 30^\circ$); **it is only 1.1 nm long** (by AFM nanodozing) [1]. HBQ chemisorbs onto Au. The DC electrical current is asymmetric, because HBQ rectifies in the “reverse Aviram-Ratner direction”. The rectification ratios are RR= 150 to 200 at 2.5 Volts when studied (**A**) as a monolayer between Au and an eutectic GaIn drop; this RR grows upon repeated scans because an interfacial Ga₂O₃ thickens. When an **HBQ** monolayer is measured between Au and cold Au (**B**), (see plots below) RR is smaller, RR=5 to 40 at 2.5 Volts (but still grows somewhat with scans). When a **single HBQ molecule** is measured by scanning tunneling spectroscopy (**C**) between Au and a PtIr nanotip, RR= 3 to 8 at 1.5 Volts. HBQ is the

smallest rectifier known to date [1].



I will also review the present status of how to measure molecular wires and rectifiers in “metal | monolayer | metal” sandwiches [2].

- [1] J. E. Meany, M. S. Johnson, S. A. Woski, and RMM, subm. to *Angew. Chemie Int. Ed.*
 [2] R.M.M, “Unimolecular Electronics”, *Chem. Revs.* **115**: 5056-5115 (2015).