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Abstract for an Invited Paper  
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### **Low-Energy Electron-Molecule Collision Experiments**

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The talk will report on the recent improvements of the techniques to measure elastic and inelastic electron-molecule cross sections. Emphasis will be given on the measurement of the cross sections as a function of scattering angle over a large angular range using the ‘magnetic angle changer’ (MAC) invented by Frank Read and co-workers, and on the measurements at low energies. It will be shown that measurement of cross sections in general and the use of the MAC device in particular require complex strategies to control instrumental drift and to determine the instrumental response function over wide ranges of energies and scattering angles, and that the results may to some degree depend on the details of these strategies. The procedures will be illustrated with measurement of elastic and vibrational cross sections in  $N_2$ . The  $v = 0 \rightarrow 1$  cross section in the resonance region was measured in the full angular range  $0^\circ - 180^\circ$ , elastic cross sections in the range of about  $10^\circ - 180^\circ$ , the lower limit being dependent on the electron energy. The results agree well with high quality theoretical results of Morrison, Sun and Hao. The integral and momentum transfer cross sections derived from the differential data agree well with swarm data. The talk will then present applications of these experimental techniques to study elastic and vibrational cross sections in NO,  $CH_4$ , cyclopropane and other molecules. Emphasis will be given on threshold peaks and near threshold structures due to vibrational Feshbach resonances. The vibrational excitation of NO *via* the low-lying shape resonances will also be presented and compared to the recent theoretical results {C. S. Trevisan, K. Houfek, Z. Zhang, A. E. Orel, C. W. McCurdy, and T. N. Rescigno, *Phys. Rev. A* **71**, 052714 (2005)}.