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Negative Ions

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The attachment of a free electron to an atom can occur via radiative attachment ($e + A \rightarrow A^- + h\upsilon$) or through short-lived "shape" or electronically excited Feshbach resonances. The attachment of a free electron to a molecule primarily occurs through a nuclear excited Feshbach resonance ($e + M \rightarrow M^{*-}$) or through dissociative electron attachment ($e + AB \rightarrow A^- + B$)[1]. An electron can also attach to some negative ions and be trapped through a "shape" resonance provided by the so-called coulomb barrier provided by the long-range coulomb repulsion and short range polarizability of the electron-negative ion system[2]. Multiply-charged anions (MCAs) have received considerable experimental and theoretical attention following the development of the electro-spray method introduced by John Fenn for producing MCAs. The electron affinity of an atom or molecule can be related to the energy of the lowest unoccupied molecular orbital (LUMO). Electron affinities can range from as low as a few tens of meV for the calcium atom to greater than 10 eV for the gold hexafluoride molecule[2]. Electrons can also be permanently attached to polar molecules possessing dipole moments above ~ 2.5 Debye[3]. These anions have been appropriately termed dipole-bound anions and are weakly-bound (EA ~ 1 meV) and very diffuse. This presentation will attempt to give an overview of the formation and properties of gas phase singly- and multiply-charged negative ions.

1. Mirsaleh-Kohan N, Robertson WD, Compton RN, "Electron ionization time-of-flight mass spectrometry: Historical review and current applications" *Mass Spectroscopy Reviews*, **2008,** 27, 237-285.
2. M. K. Scheller, R. N. Compton, L. S. Cederbaum, "Gas Phase Multiply Charged Anions," *Science* **270**, 1160-1166 (1995).
3. Hammer, NI, Diri, K, Jordan, KD, Desfrancois, C., Compton, R.N., "Dipole-bound anions of carbonyl, nitrile, and sulfoxide containing molecules", *J. Chem. Phys.,* **2003**, 119, 3650.