ESTIMATION OF THE CRITICAL CHARGE FOR ATOMIC ISOELECTRONIC SERIES

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Almost all elements in the Periodic Table, except rare gases and a few other atoms, have stable ground state negative ion configurations in the gas phase. These singly charged negative ions have attracted considerable attention over the past decades. However, there is no experimental or theoretical evidence of any doubly charged atomic negative ions in the gas phase. Although several experiments gave support for long lived ($\geq 10^{-5}$ sec) doubly charged atomic negative ions, these results remained a matter of some controversy. Here we used quantum methods to estimate the critical nuclear charge, the minimum charge necessary to bind *N* electrons, for *N*-electron atoms with $N \leq 86$. Results show that, at most, only one electron can be added to a free atom in the gas phase. However, doubly charged atomic negative ions might exist in a strong magnetic field ($\geq 10^{9}$ G).