We investigate the confinement of charged particles in an oscillating electromagnetic field, intending to trap electrons and calcium ions simultaneously. The theoretical part of this thesis focuses on the derivation of exact and effective potentials in a single frequency quadrupole trap. We show a general treatment of stability in such a field. Passing attained knowledge onto two-frequency trapping, which is much more suitable for confining two species with widely different charge-to-mass ratios. We follow up by studying the stability of electrons, employing computer simulations in the ideal two-frequency Paul trap. Our ambition is to identify a stable configuration minimizing electrons' temperature. We create multiple ion Coulomb crystals and examine the effect of their presence on electrons' stability. These efforts support the development of an experiment with the ambition to create and study quantum plasma. The composition of this experiment is outlined here as well.