GEC16-2016-000055

Abstract for an Invited Paper
for the GEC16 Meeting of
the American Physical Society

Developments in the kinetic theories of ion and electron swarms in the 1960's and 70's

HELGE REDVALD SKULLERUD, Retired

The two decades from 1960 to 1980 saw a quite fantastic development in diverse areas in physics, and so also in the quantitative treatment and deeper understanding of the behaviour of isolated electrons and ions in gases – that is "charged particle swarm physics". This evolution was strongly correlated with the contemporary advances in computer technology, and of new and accurate experimental methods for finding the charged particle transport parameters, as drift velocities, diffusion coefficients and reaction rates', as well as with development in neighbouring fields as plasma physics and the physics of electronic and molecular collisions. In 1960, low energy electron behaviour could already be calculated with reasonable accuracy in the so-called two-term approximation, while ion behaviour could only be treated at very weak elecric fields. By 1980, though, reasonably complete theories had been developed for perhaps most cases in interest - which is reflected in a number of reviews, books and journal articles published in the early 80's. We will give a guided tour through the developments in this period and the basic theories behind; The Boltzmann equation in difference-differential form (for electrons), or in integral equation form (preferred by mathematicians), and the Maxwell transfer equations ("moment theories"). We will also indicate how the interaction between different studies of the same basic processes have led to the elimination of shortcomings, and a better understanding, choosing a few test cases for illustration.