Abstract Submitted
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Important Research by Art Phelps in the 1950s J.E. LAWLER, Univ. of Wisconsin — Art Phelps made major contributions to the field of Gaseous Electronics. This talk is a review of some of Art's most important papers from the 1950s while he was a young scientist at Bell Labs and then at Westinghouse. The earliest theories of a simple discharge plasma, a positive column, incorporated the assumption of single-step electron-impact ionization. Both the ionization and power balance of most discharges are dominated by multi-step processes. Art's early studies of helium metastable atoms [1,2] were tremendously clever applications of the experimental technology available in the 1950s. His studies laid the foundation for our modern understanding of many discharge plasmas in which multi-step processes are dominant. Under most circumstance the excitation rates for metastable atoms and/or molecules are much larger than rates for single-step ionization. The relatively long effective lifetimes of metastables leads to high densities of these species. Electron impact and other collisionsal processes can easily ionize or excite the metastables. In the 1950s Art also recognized that radiation trapping could dramatically extend the effective lifetime of atoms in resonance levels and effectively make those levels metastable [3]. He applied radiation trapping theory first to the measurement of excitation coefficients, but the implications were clear. Resonance levels can play a major role in multi-step ionization and excitation.

[1] A. V. Phelps & J. P. Molnar, Phys. Rev. 89, 1202 (1953).
[2] A. V. Phelps, Phys. Rev. 99, 1307 (1955).
[3] A. V. Phelps, Phys. Rev. 110, 1362 (1958).

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