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A Physics-Based Procedure for Analyzing Langmuir Probe Data
RON BRAVENEC, Fourth State Research and Tokyo Electron America, JIAN-PING ZHAO, LEE CHEN, MERRITT FUNK, Tokyo Electron America — The usual method of obtaining the electron energy distribution function (EEDF) from Langmuir probes is through the Druyvesteyn relation [M. J. Druyvesteyn, Z. Phys. **64** (1930) 781], which relates the EEDF in an isotropic plasma to the second derivative of the electron current versus voltage. Not only is the resulting EEDF very sensitive to the type and degree of smoothing of the current, but it is also difficult to interpret physically. Our technique fits the current to an analytical expression derived from a physics-based model of the EEDF. A good fit lends support to the model whereas a bad fit motivates a reevaluation of the physics thought to govern the EEDF in the specific plasma. The model can depend on the plasma source, location in the plasma, input power, pressure, etc. For an RLSA (radial-line slot antenna) plasma source, we find the EEDF is well represented by the sum of two Maxwellians, one which may have a drift velocity. We present a fit to the electron current very near the top source region. We also compute the EEDF projected onto the cylindrical probe surface, which is valid for an arbitrarily anisotropic plasma [R. C. Woods and I. D. Sudit, Phys. Rev. E **50** (1994) 2222].

Ron Bravenec
Fourth State Research and Tokyo Electron America

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