***A critical overview of Optical Emission Spectroscopy for plasma diagnostics***

G. Dilecce1

*1 Institute for Plasma Science and Technology – CNR via Amendola 122/D 70125 Bari - Italy*

Optical Emission Spectroscopy (OES) is perhaps the most flexible plasma diagnostic technique, from the hardware point of view. Non-invasive collection of light and its spectral analysis can be done on virtually any plasma device at any plasma condition. Utilization of the spectral information for the measurement of plasma parameters is much less straightforward. Light emission at optical or VUV wavelengths originates from unstable atomic/molecular electronic states. These are someway excited in the plasma and then undergo a collision/radiative kinetics during their short lifetime. In non-equilibrium plasmas, then, a correct interpretation of the OES outcomes is possible only if the excitation and loss kinetics is well known, together with the relaxation properties of the vibrational and rotational manifolds of molecules. Furthermore, inferring plasma parameters is possible only if particular conditions are fulfilled. It is therefore of paramount importance to address the issue of how to recognize and assess the dominant, if any, process producing the molecular excitation to a radiative state. Starting from a survey of the most common excitation mechanisms, not always the mere electron impact with the ground state, and of the collision kinetics of excited states, we shall address the measurements by OES analysis of the translational and vibrational temperatures, of the electric field in a gas discharge, of the concentration of species, in a variety of non-equilibrium plasma conditions, from low to high pressure, including plasma processing devices, negative ions sources and cold edge plasmas. With a focus on common mistakes arising from the misuse of bad assumptions in the analysis of spectra.