Equilibrium statistical mechanics of self-consistent wave-particle system

YVES ELSKENS\textsuperscript{1}, umr6633 CNRS-univ. Provence, Marseilles (FR)

— The equilibrium distribution of \( N \) particles and \( M \) waves (e.g. Langmuir) is analysed in the weak-coupling limit for the self-consistent hamiltonian model

\[
H = \sum_r p_r^2/(2m) + \sum_j \omega_j I_j + \epsilon \sum_{r,j} (\beta_j/k_j) \cos(k_j x_r - \theta_j) \ [1].
\]

In the canonical ensemble, with temperature \( T \) and reservoir velocity \( v < \text{inf}_j \omega_j/k_j \), the wave intensities are almost independent and exponentially distributed, with expectation \( \langle I_j \rangle = k_B T/\omega_j \). These equilibrium predictions are in agreement with Monte Carlo samplings \( [2] \) and with direct simulations of the dynamics, indicating equivalence between canonical and microcanonical ensembles.


\textsuperscript{1}elskens@up.univ-mrs.fr