Interference Effects between Direct and 1s Resonant Photoemission to Ne^+ $2p^{-2}(^1D_2)3p$ ^2P, ^2D and ^2F

A De Fanis[1], N Saito[2], H Yoshida[3], Y Senba[3], H Tanaka[4], I Koyano[5] and K Ueda[1]

[1]IMRAM, Tohoku University, Sendai 980-8577, Japan
[2]AIST, Tsukuba 305-8568, Japan
[3]Department of Physical Science, Hiroshima University, Higashi-Hiroshima 739-8526, Japan
[4]Department of Physics, Sophia University, Yokyo 102-8544, Japan
[5]Department of Material Science, Himeji Institute of Technology, Kamigori, Hyogo 678-1297, Japan

Angular distributions and branching ratios for decay of inner-shell photo-excited states are often analyzed with the two step model in which excitation and decay are treated as independent processes. As a natural consequence, the interference between the resonant and the direct processes is neglected. It is well known that interference effects between resonant and direct photoemissions can play important roles in valence photoemission, for example, giving rise to asymmetric profiles for cross sections.

We observed photoemission to form the $2p^{-2}(^1D_2)3p$ states in the region of 1s excitation hν=866-870 eV. Experiments were carried out on the C branch of the beamline 27SU at SPring-8 in Japan. Both optical and electron energy bandwidths were less than 70 meV; such high resolution allowed to resolve the $(^1D_2)3p$ ^2P, ^2D and ^2F multiplet structure.

It is found that, although the photoemission cross section profiles for the $(^1D_2)3p$ ^2P, ^2D and ^2F components look symmetric, the relative branching ratios show strong oscillating behaviour typical of interference effects.

The cross sections and branching ratios are quantitatively analysed in terms of interferences between the direct and resonant photoemissions, as well as among resonant photoemissions through different excited states. Relative amplitudes of transition matrix elements for resonant and direct photoemission processes are extracted from the analysis.