# APPLICATION OF SOFT X-RAY SPECTROMICROSCOPY METHODS AT EXPERIMENTS WITH SLOW $Ne^{9+}$ BEAMS INTERACTING WITH SURFACES

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The creation of hollow ions through the interaction of highly charged ions with surfaces is of great interest for studies of the atomic structure of multi-electron systems. Recently, also diagnostic applications for the study of instabilities in interpenetrating plasmas are condsidered[1].

The use of metallic micro-capillaries allowed the application of space resolved spectroscopy for the study of radiative decay processes[2] using a grating with a liquid nitrogen cooled CCD[3]. Interesting features were seen in the $K_\alpha$-satellite structure. However, a CCD seriously limits the spectral resolution.

In the present work we investigate the possibility for the application of extremely high resolution soft x-ray spectromicroscopic methods. Simultaneous high spectral ($\lambda/\delta\lambda$ = 7.000) and spatial ($\delta x$ = 7 μm) resolution is realized by means of a spherically bent mica Bragg crystal[4] (2d = 19.98 Å) and DEF x-ray film (grain size 1.6 μm) while maintaining high luminosity (no slit is required).

$Ne^{9+}$ was extracted from a 14.5 GHz Caprize type ECR source. The acceleration voltage was 10 keV. The neon beam was focused onto a metal plate under 45º. The x-ray crystal was mounted at a distance of 30 cm viewing perpendicular to the ion beam (space resolution along the projectile trajectory). The central Bragg angle was 44.7º. A large spectral interval from 13.4 to 14.7 Å with $\lambda/\delta\lambda$ = 500 (source size limited, d = 3 mm) and $\delta x$ = 15 μm was observed.

Fig. 1 (blue curve) shows the X-ray spectrum of neon. Identified are the He-like resonance line (1P1) = $1s^2 - 1s2p\ ^1P_1$, intercombination line (3P1) = $1s^2 - 1s2p\ ^3P_1$.

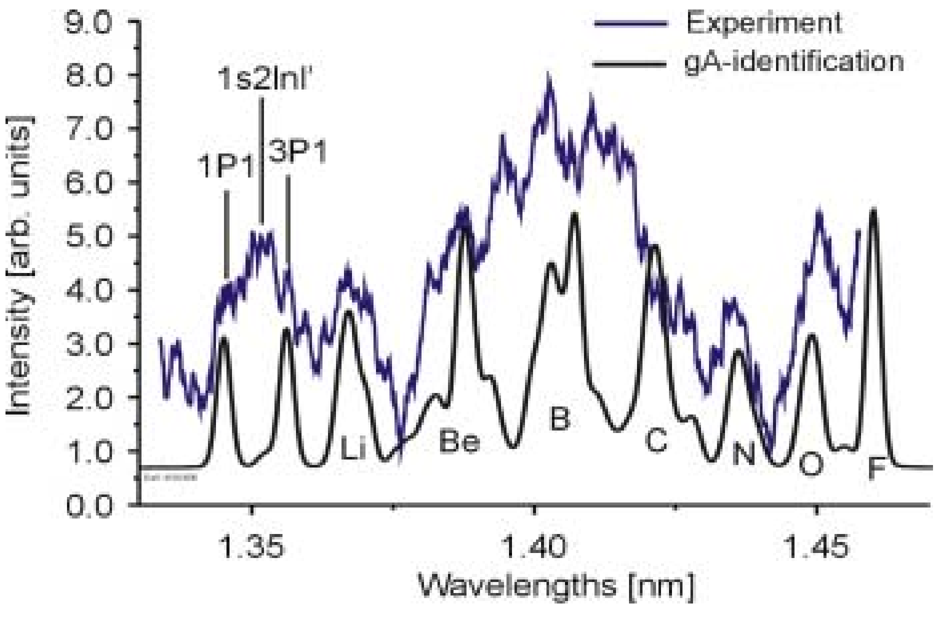


Figure 1:High resolution soft x-ray spectrum of neon projectiles

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Also well resolved are numerous $K_\alpha$-satellites: $1s^12s^n2p^m - 1s^22s^n2p^{m-1} + h\nu$. The black solid line in Fig. 1 shows a simulated spectrum (atomic data of all individual lines are calculated with a relativistic multi-confi-guration Hartree-Fock method[5]). Various features of the experimental spectrum are reflected by the simulation. Discrepancies may originate from satellite transitions with spectator electrons in higher shells. This can clearly be seen from the large intensity between the (1P1) and (3P1) lines: a huge intensity of the 1s2lnl'-satellites is observed. Similar contributions ($1s^12s^n2p^mnl$) may originate from various charge states.

## References

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