Thursday

May 18th

At 3:45 PM

Nobelium Laser Spectroscopy

Abstract:

Precision measurements of atomic properties by laser spectroscopy allow probing an element's electronic structure. This is of particular interest for the heaviest elements whose electronic structure is strongly affected by relativistic effects, quantum electrodynamics, and electron correlations[1,2]. In recent experiments performed at the GSI Darmstadt, a very sensitive method based on two-step laser-ionization has been employed for optical spectroscopy of nobelium[3,4]. In pioneering experiments several atomic transitions in nobelium atoms were identified for the first time[5]. To this end, nobelium ions produced online were separated from the primary beam by the velocity filter SHIP, slowed down in high-purity argon gas and accumulated on a filament. Following thermal evaporation from the filament, they were laser ionized and detected by their characteristic alpha decay. The lowest yield available at the experimental setup was on the order of one particle every ten seconds in the case of ^{252}No.

Besides the strong $^1S_0$-$^1P_1$ transition from the atomic ground state of nobelium several high-lying Rydberg-states were identified in ^{254}No. Based on the observed Rydberg series an accurate value of the first ionization potential of nobelium was obtained. In addition, the frequency shift of the $^1S_0$-$^1P_1$ transition in the isotopes ^{252,253}No was measured providing nuclear properties such as the ground state spin in ^{253}No and the change in the mean square charge between ^{252,254}No.

I will present the experimental results from the 2015 and 2016 campaigns and compare them to predictions by state-of-the-art theoretical models. Perspectives for future measurements in heavier elements will also be discussed.

References

1. E. Eliav, S. Fritzsche, U. Kaldor, Nucl. Phys. A 944, 518 (2015)

2. P. Schwerdtfeger, L. F. Pasteka, A. Punnett, P.O. Bowman, Nucl. Phys. A 944, 551 (2015)

3. H. Backe, W. Lauth, M. Block, M. Laatiaoui, Nucl. Phys. A 944, 492 (2015)

4. M. Laatiaoui, H. Backe, M. Block et al., Eur. Phys. J. D 68, 71 (2014)

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Refreshments will be served at 3:30 pm