

## A 25: Poster II - Photoionization

Zeit: Donnerstag 16:30–18:30

Raum: Poster B

A 25.1 Do 16:30 Poster B

**Entanglement in atomic photoionization and decay processes** — •THOMAS RADTKE<sup>1</sup>, STEPHAN FRITZSCHE<sup>1</sup>, and ANDREY SURZHYKOV<sup>2</sup> — <sup>1</sup>Institut für Physik, Universität Kassel, D-34132 Kassel, Germany — <sup>2</sup>Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany

Atomic photoionization and decay processes have been studied intensively during the last decades. Recently, however, the interest in these processes was renewed in the context of quantum information processing as they may enable one to observe and manipulate entanglement. Therefore, in order to explore the role of entanglement in the photoionization of alkaline-earth metals, we have studied the photoion-electron entanglement as function of the photon angle and energy. It was found that the photoion-electron entanglement decreases significantly near the ionization threshold and that, in general, it depends on both the photon energy and angle [1].

Another atomic process of interest is the two-photon decay of the metastable 2S state of hydrogen or hydrogenlike systems. For this decay, it was verified by Perrie and coworkers that the outcome of polarization measurements on the emitted photons violate Bell's inequality so that the photons are polarization entangled [2]. Using the density-matrix theory, we have analyzed the photon-photon entanglement in dependence on the emission angles of the two photons and the polarization of the initial 2S states.

[1] T. Radtke, S. Fritzsche, A. Surzhykov, PRA 74, 032709 (2006).

[2] W. Perrie et al., PRL 54, 1790 (1985).

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**Observation of the interaction between Rydberg series of doubly excited states in Kr and Xe after excitation with narrow bandwidth synchrotron radiation by photon induced fluorescence spectroscopy (PIFS)** — •STEPHAN KLUMPP<sup>1</sup>, WITOWSLAW KIELICH<sup>1</sup>, LUTZ WERNER<sup>1</sup>, ARNO EHRESMANN<sup>1</sup>, VIKTOR SUKHORUKOV<sup>2</sup>, IVAN PETROV<sup>2</sup>, and PHILIP DEMEKHIN<sup>2</sup> — <sup>1</sup>Institut für Physik und CINSaT, Universität Kassel — <sup>2</sup>Rostov State University of Transport Communications

Xe gas was excited with synchrotron radiation of narrow bandwidth produced by the undulator U125/2 of BESSY II, Berlin, and dispersed by a 10m NIM. The emitted and dispersed Xe fluorescence lines were observed simultaneously within a fluorescence wavelength range between 90nm and 100nm using the method of PIFS. In the exciting-photon energy range between 25.25eV and 25.50eV Codling and Madden 1972 and Wills et. al. 1990 published a number of resonances but weren't able to assign quantum numbers. With the narrow bandwidth excitation radiation it was possible to resolve a more detailed spectrum of the named excitation-photon energy range. According to Codling and Madden the visible resonance features measured in this exciting-photon energy region are due to correlative doubly excited states in XeI. Calculations for doubly excited states in KrI will be presented

taking into account core relaxation and interaction between many resonances and many continua explaining Rydberg series  $5snp^4P_{1/2}$  and  $5snp^2P_{3/2}$  of doubly excited states in KrI in the fluorescence emission spectra of KrII.

A 25.3 Do 16:30 Poster B

**Readout of Delayline Detectors using Transient Recorder Technique** — •LUTZ FOUCAR<sup>1</sup>, ACHIM CZASCH<sup>1,2</sup>, OTTMAR JAGUTZKI<sup>1,2</sup>, SVEN SCHÖSSLER<sup>1</sup>, TILL JAHNKE<sup>1</sup>, HORST SCHMIDT-BÖCKING<sup>1,2</sup>, and REINHARD DÖRNER<sup>1</sup> — <sup>1</sup>Johann Wolfgang Goethe-Universität Frankfurt am Main, Institut für Kernphysik — <sup>2</sup>RoentDek GmbH, Im Vogels Haag 8, Kelkheim

In order to study high correlated systems, it is necessary to detect and measure the position of all participating fragments with high precision. To detect the position of the impact a Delayline Anode is used. Usually the readout of the Delayline Anode is done via a Constant Fraction Discriminator. We are studying the advanced of using a Transient Recorder Readout of Delayline Anode Detektors over Constant Fraction Discriminators. Using the Transient Recorder Readout Technique, one is able to detect many particles with a very small deadtime. In this Presentation we compare the two techniques on exemplary experiments.

A 25.4 Do 16:30 Poster B

**Symmetrie und deren Brechung im  $H_2^+$  Molekül** — •TILO HAVERMEIER<sup>1</sup>, LUTZ FOUCAR<sup>1</sup>, THORSTEN WEBER<sup>1</sup>, KATHARINA KREIDI<sup>1</sup>, MARKUS SCHÖFFLER<sup>1</sup>, LOTHAR SCHMIDT<sup>1</sup>, TILL JAHNKE<sup>1</sup>, FERNANDO MARTÍN<sup>3</sup>, JORGE FERNÁNDEZ<sup>3</sup>, ALLEN LANDERS<sup>4</sup>, OTTMAR JAGUTZKI<sup>1</sup>, ACHIM CZASCH<sup>1</sup>, EMANUEL BENIS<sup>5</sup>, TIMUR OSIPOV<sup>2</sup>, ALI BELKACEM<sup>2</sup>, MIKE PRIOR<sup>2</sup>, HORST SCHMIDT-BÖCKING<sup>1</sup>, CHARLES LEWIS COCKE<sup>5</sup> und REINHARD DÖRNER<sup>1</sup> — <sup>1</sup>Institut für Kernphysik, University Frankfurt, Max von Laue Str 1, D-60438 Frankfurt, Germany — <sup>2</sup>Lawrence Berkeley National Lab., Berkeley CA 94720 — <sup>3</sup>Departamento de Química, C-9, Universidad Autónoma de Madrid, 28049-Madrid, Spain — <sup>4</sup>Department of Physics, Auburn University Auburn AL-36849 — <sup>5</sup>Department of Physics, Kansas State University, Cardwell Hall, Manhattan KS 66506

Die Ununterscheidbarkeit der zwei Protonen im dissoziierenden  $H_2^+$  Molekül lässt es nicht zu, dass das Elektron bei der Bildung des neutralen Wasserstoff-Atoms einen beiden Kerne bevorzugt. Hier wird jedoch ein Weg aufgezeigt, wie über die Besetzung doppelt angeregter Zustände diese Symmetrie gebrochen werden kann. Es wurde im März 2005 ein Experiment an der Advanced-Light-Source in Berkeley durchgeführt, bei dem durch Photoionisation die dissoziierenden Zerfallskanäle von Wasserstoff- und Deuterium-Molekülen untersucht wurden. Mit Hilfe der COLTRIMS-Methode wurden die Impulse der entstehenden Photo-Fragmente vermessen, wodurch eine Übersicht aller auftretenden Zustände erstellt werden konnte.