A 9: Collisions, scattering and correlation phenomena

Time: Tuesday 16:30–18:30 Location: P

A 9.1 Tue 16:30 P

photoionization time delay in 2D model systems — •sajjad azizi, ulf saalmann, and jan-michael rost — Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

Time delay is a hot topic, which is discussed and measured mostly for atoms, i.e. spherical single-center objects. In molecules, the interpretation is considerably more challenging since there is a dependence on the direction, and the molecule has a finite extension. We study this problem for 2D short- and long-range model systems.

A 9.2 Tue 16:30 P

Charge-exchange three-body reaction with participation of stau $\tilde{\tau}$ — •Renat A. Sultanov — Odessa College, Department of Mathematics, 201 W. University Blvd., Odessa, Texas 79764, USA

We report computational results for a few-body charge-exchange reaction with participation of heavy, long-lived, SUSY supersymmetric particle stau $\tilde{\tau}$ (or tau slepton) [1]. Specifically, the cross sections and rates are computed for the following three-body reaction:

$$(pX^-) + {}^4\mathrm{He}^{++} \to ({}^4\mathrm{He}^{++}X^-) + p, \qquad (1)$$

where p is a proton, ${}^4\mathrm{He}^{++}$ is a helium nucleus and X^- is stau. The mass of X^- is $\sim$125 GeV [1]. Stau is a supersymmetric partner of τ-lepton. The quasi-stable negatively charged NLSP (next-to-lightest supersymmetric particle) X^- can make Coulomb bound states with nuclei and severely affect the early Big Bang Nucleosynthesis (BBN) era nuclear reactions [2,3]. A detailed few-body approach based on a modified Faddeev-Hahn-type equation formalism [4] is applied to the charge-transfer reaction (1) in this work.

1. CMS Collaboration, *Eur. Phys. J. C* 80:189 (2020).
2. M. Pospelov, *Phys. Rev. Lett.* **98**, 231301 (2007).
3. K. Hamaguchi, T. Hatsuda, M. Kamimura, Y. Kino, T. T. Yanagida, *Phys. Lett. B* **650** 268 (2007).
4. R. A. Sultanov and S. K. Adhikari, *J. Phys. B* **32**, 5751 (1999).

A 9.3 Tue 16:30 P

Multi-electron transfers and -excitations in near-adiabatic collisions of Xe52+,54+ +Xe at the ESR Storage ring — •Siegbert Hagmann[1], Pierre-Michel Hillenbrand[1,2], Jan Glorius[1], Uwe Spillmann[1], Yuri Litvinov[1], Yuri Kozhedub[6], Ilya Tupitsyn[6], Michael Lestinsky[1], Alexander Gumberidze[1,3], Sergij Trotsenko[1,4], Hermann Rothard[7], Enrico DeFilippo[8], Emmanouel Benis[9], Stefan Nanos[9], Robert Grisenti[1,2], Nikos Petridis[1,2], Shahab Sanjari[1], Carsten Brandau[1], Esther Menz[1], Timo Morgenroth[1], and Thomas Stöhlker[1,4,5] — [1]GSI Helmholtz-Zentrum Darmstadt — [2]Inst. f. Kernphysik, Univ. Frankfurt — [3]Extreme Matter Institut EMMI, GSI Darmstadt — [4]Helmholtz Inst. Jena — [5]Inst. f. Optik u. Quantenelektronik, U. Jena — [6]Dep. of Physics, St Petersburg State Univ. — [7]CIMAP, Ganil, Caen France — [8]INFN Catania ,Italy — [9]Univ. of Ioannina, Greece

In near adiabatic collisions of bare to He-like Xe ions with Xe atoms multi-electron transfer processes are studied by measuring the emitted target- and projectile K- and L- x rays in coincidence with projectiles which have captured 3 to 6 electrons, and with time of flight of recoiling Xe target ions. We find that in the projectiles a wide range of electron levels even with main quantum numbers n>5 are excited- extending to a very significant population of Rydberg levels, all dependent on capture multiplicity; a strong contribution of K x rays from high n shells indicates that outer shell transfer avoids Yrast states l=n-1 but dominantly prefers low l states of the projectile with l=1.

A 9.4 Tue 16:30 P

Compton Polarimetry on the polarization transfer in hard x-ray Rayleigh scattering — •Wilko Middents[1,2], Günter Weber[2,3], Uwe Spillmann[3], Marco Vockert[1,2], Philip Pfäfflein[1,2,3], Alexandre Gumberidze[3], Sophia Strnat[4,5], Andrey Surzhykov[4,5], Andrey Volotka[1,6], and Thomas Stöhlker[1,2,3] — [1]IOQ, FSU Jena — [2]Helmholtz Institut Jena — [3]GSI Darmstadt — [4]PTB, Braunschweig — [5]TU Braunschweig — [6]ITMO University

For photon energies up to the MeV range, the fundamental photon-matter interaction process of elastic scattering, where both the energy of the incident and the scattered photon are the same is dominated by Rayleigh scattering. This process, referring to the 2nd order QED process of a photon being scattered on a bound electron exhibits a high degree of sensitivity to the polarization characteristics of the incoming photons. Thus precisely determining the poliarization of the incident and scattered photon beam allow a stringent tests of the underlying theory. For this purpose, we performed an experiment at the 3rd generation synchrotron facility PETRA III of DESY, Hamburg, scattering a highly linearly polarized hard x-ray beam with a photon energy of 175 keV on a gold target. The polarization characteristics of the scattered beam were analyzed within and out of the polarization plane of the incident synchrotron beam using a prototype 2D-sensitive silicon strip detector, developed within the SPARC collaboration, that can be utilized as a highly sensitive Compton polarimeter. We will present both experimental details as well as first results of this beamtime.

A 9.5 Tue 16:30 P

orientation recovery for scattering images from molecules using deep learning — •siddhartha poddar, ulf saalmann, and jan michael rost — Max Planck Institute for the Physics of Complex Systems, Noethnitzer Strasse 38, Dresden, Germany

The recovery of a molecule's orientation in coherent-diffractive imaging with intense Xray-pulses is tackled with a deep neural network. This network provides the a priori unknown orientation for each image within the set of single-molecule scattering images. By means of this information it is possible to reconstruct the 3D structure of the molecule from a dedicated subset of 2D projections.