DITANET

DITANET Complementary Skills School, Liverpool 15-19th March, 2010

Diagnostics for DESIREE

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Overview of Double ElectroStatic Ion Ring ExpEriment (DESIREE)

- Two Rings – same circumference (~ 9 m) & common straight section (~ 1m) for merged beam experiments with ions of opposite charges:

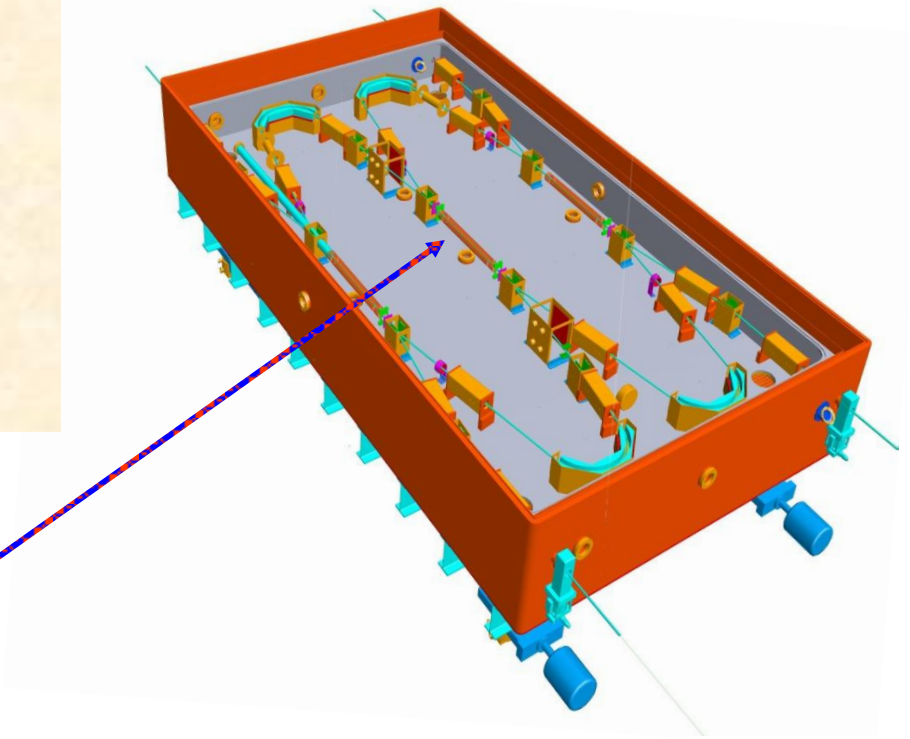
  Ring 1: Lighter ions, Ring 2: Heavier ions, Vacuum ~ 10-11 mbar

- Operated at both ¤ room temperature & ¤ cryogenic temperature (~ 20 K)

Diagnostics, basic

- Electrostatic pickups
- Zero degree detectors
- Faraday cups
- Scrapers in the overlap section
- Detectors for neutral particles and charged reaction products.....

Optimizing and measuring the overlap between the two beams is particularily challenging



under Construction

Publishing Research Results

- Related conferecne

- Porceedings published in *Journal of Physics: Conference Series* (IOP Publication) (http://www.iop.org/EJ/journal/conf)

- ✓ Peer Reviewed
- ✓ Fully Citable
- ✓ Fast
- ✓ Open Access

Forthcoming conferences

1. HCI Conference, Aug.30-Sept.3, 2010, China
http://hci2010.fudan.edu.cn/index.asp

2. MPS, 4-7 Sept., 2010, Japan
http://hci2010.fudan.edu.cn/page.asp?id=103

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Interferences in electron emission spectra from 1, 3 and 5 MeV $H^+ + N_2$ collisions

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Abstract. Electron interferences associated with coherent two-centre emission in 1-5 MeV $H^+ + N_2$ collisions are investigated. Spectra were measured for ejected electrons with energies from 5-410 eV and observation angles in the range 30° to 150°. Experimental molecular N_2 cross sections were normalized to theoretical atomic N cross sections, revealing oscillatory structures that do not change significantly with observation angle or collision velocity. It is suggested that the oscillations are due to previously observed secondary interferences arising from intramolecular scattering following ejection of a K-shell electron.

1. Introduction

Previously, we investigated electron interferences for fast H^+ (v/c ~ 0.1) and Kr^{34+} (v/c ~ 0.3) ions interacting with H_2, revealing both primary Young-type interferences due to coherent electron emission from the identical atomic centers as well as secondary interferences caused by intramolecular scattering [1,2,3,4]. The primary oscillations were found to depend strongly on the electron observation angle [2,4] and to a lesser extent on the collision velocity [4], in general agreement with theoretical calculations [5,6,7]. In contrast, the secondary oscillations which have two to three times higher oscillation frequencies showed little variation with either the emission angle or the collision velocity [3,4]. These results have prompted new studies for H_2 by other investigators [8,9,10,11].

Electron interferences for diatomic molecules other than H_2 have been studied for ejection of valence electrons from N_2 and O_2 [12] and core (K-shell) electrons from N_2 by photons [13]. In the latter case, the interference structures were attributed to intramolecular scattering following K-shell ejection. In the present work, our previous studies for $H^+ + H_2$ [4] are extended to N_2 for which electron ejection is expected to occur primarily from the L-shell with a binding energy nearly identical to that of H_2, but ionization can also occur from the K-shell. Since the internuclear separation of N_2 is larger than that of H_2 (2.1 a.u. compared to 1.4 a.u.), equivalent to increasing the slit separation in Young's experiment, higher oscillation frequencies for the primary interference structures are expected for N_2. Notably, for photons [12,13] the incident energy can be chosen to selectively ionize the K or L shell, whereas fast ions can ionize either shell for a given collision energy.

Here, electron emission spectra for 1, 3 and 5 MeV $H^+ + N_2$ collisions were measured for ejected electron energies ranging from 5-410 eV and observation angles 30° to 150°. The measured N_2 cross sections divided by the corresponding theoretical atomic N cross sections show oscillatory structures that exhibit little dependence on the observation angle or collision velocity, a result that suggests the structures are due to secondary oscillations arising from intramolecular scattering.


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