

1. M. Garçon *et al.* in *Spin Observables of Nuclear Probes, 1988* edited by C.J. Horowitz, C.D. Goodman, and G.E. Walker (Plenum Press, 1988) p.357.
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DIELECTRONIC RECOMBINATION IN He^+ IONS*

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Dielectronic recombination (DR) is an atomic collision process which involves electron capture accompanied by simultaneous ionic excitation, i.e., an inverse Auger transition. We have investigated DR for $1s \rightarrow nln'l'$ transitions in $\text{He}^+ + e^-$ collisions¹ at IUCF using the ion storage ring and the electron Cooler in a "single pass" mode, i.e., the ions circled the magnet, and then are collected in a Faraday cup. A beam of 44 MeV $^3\text{He}^+$ ions (current ~ 300 nA) was merged with the electron cooling beam (current ~ 0.2 A) over an interaction length of ~ 2.8 m. Events resulting in DR were detected by observing neutral He atoms produced in the electron Cooler. These atoms, which exited through a 0° port following the cooler region, were observed with solid-state detectors in a dE/dx arrangement thereby allowing particle identification to separate the He atoms from background events.

For He^+ ($1s$) ions DR is expected to occur for relative energies of 33–39 eV between the ion and electron. By ramping the relative electron energy from $-50 \text{ eV} \leq E_{rel} \leq +50 \text{ eV}$, DR maxima were observed for electron velocities less and greater than the ion beam velocity, respectively. Between these DR maxima, a peak due to radiative recombination (inverse phototelectric effect) was observed for $E_{rel} = 0$. A typical spectrum is shown in Fig. 1. Maximum counting rates at the DR maxima were about 10 Hz and the signal to noise ratio was about 18:1. Due to a hardware problem, the electron beam energy resolution (about 20 eV in the projectile frame) was insufficient to resolve individual transitions due to DR. New measurements are planned with this problem corrected, and it is anticipated that the resolution will be sufficient to observe these individual transitions.

Because the measurements were conducted in a single pass mode, the ion beam current was accurately measured thereby giving a reliable value for the absolute DR cross section. Preliminary estimates indicate the total DR cross section to be on the order of 10^{-18} cm².

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1. See J. A. Tanis *et al.*, Nucl. Instrum. Meth. Phys. Res. B43, 290 (1989).

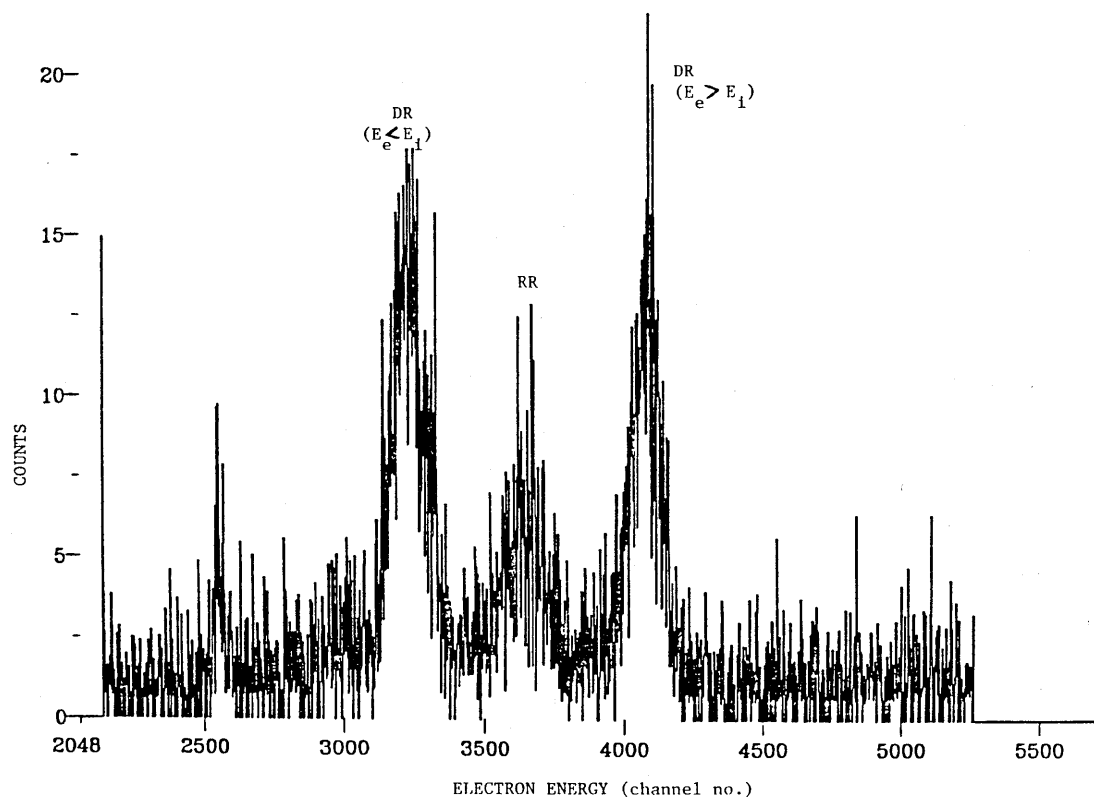


Figure 1. Yield of neutral He atoms formed in the Cooler region as a function of electron energy.