The scattering is accompanied by hopping of the electron between N and S planes. The threshold is therefore Δ, as in
tunneling between a normal and superconducting metal. After a logarithmic singularity at $\omega - \omega' = \Delta + 2t^2/\Delta$, which is the maximum of the sum of the gaps in both bands (in the sence of the dependence on k_z; the bands are assumed to be isotropic in the plain), the cross section decreases as $[\Delta/(\omega-\omega')]^2$. The average scale for reasonable values of parameters is

$$d\sigma \sim 10^{-12} \frac{d\omega}{\Delta} d\Omega.$$

In the case of parallel polarisation Z(XX)$\bar{Z}$ the interaction of electrons with light appears in the kinetic energy terms of the Hamiltonian and is given by

$$\int \psi_\sigma^+ \left(-\frac{e}{c} v_{1x} A_x + \frac{e^2}{2m_1c^2} A_x^2 - \frac{e}{c} v_{2x} A_x + \frac{e^2}{2m_2c^2} A_x^2 \right) \psi_\sigma dV \quad (8)$$

As was shown in [2], the terms linear in A_x contribute only minor corrections to $d\sigma$, and so we consider only the quadratic terms. They contain the band mass in the denominator. In order to obtain a finite threshold value of $\omega - \omega'$ we have to assume that $m_2 \gg m_1$. Then the main contribution is due to the superconducting layers. The result can be illustrated by Fig. 3.

fig. 3. Electronic Raman scattering cross-section for the geometry Z(XX)$\bar{Z}$

The threshold is at 2Δ. A discontinuous jump (it can be smoothed out, if the anisotropy in the plane is taken into account) is followed by a logarithmic singularity at the maximum of the double gap $2(\Delta+t^2/\Delta)$ and then falls off as $[\Delta/(\omega-\omega')]^2$. The scale is again of the order $d\sigma \sim 10^{-12} \frac{d\omega'}{\Delta} d\Omega$. At smaller $\omega-\omega' < 2\Delta$ there can be a small contribution from the normal band but other sources of additional scattering cannot be excluded.