$\Delta\Omega(1\rightarrow 2)$ is very simple and is given by

$$\Delta\Omega(1\rightarrow 2) = \frac{\Omega(1\rightarrow 3)\cdot\Omega(3\rightarrow 2)}{\Omega(1\rightarrow 3)+\Omega(3\rightarrow 2)} \, . \qquad (3)$$

This expression is valid for each total angular momentum L^t of the system (ion + e^-). The expression (3) has been pointed out rigorously by Gailitis, but it is possible to obtain (3) through the same physical arguments that A. Burgess used in his paper on recombination [5].

Let us look at the specific problem of the Ca II excitation by electron impact. This problem is a six-channel problem if one reduces Ca II to its first three levels: 4s, 3d and 4p. For a given total angular momentum L^t, the six associated channels are:

$1 \equiv k_1^2;\ 4s;\ l_1 = L^t \qquad 4 \equiv k_2^2;\ 3d;\ l_4 = L^t+2$

$2 \equiv k_2^2;\ 3d;\ l_2 = L^t-2 \qquad 5 \equiv k_5^2;\ 4p;\ l_5 = L^t-1$

$3 \equiv k_2^2;\ 3d;\ l_3 = L^t \qquad 6 \equiv k_5^2;\ 4p;\ l_6 = L^t+1$,

k_i^2 and l_i being the energy and the angular momentum of the additional electron associated with the channel i. One sees that introduction of the level 4p corresponds to two new channels in the scattering problem. It follows that (3) is no longer valid. Since the interaction potential between the channels 5 and 6 is quadrupolar, and by no means weak, it is possible to show that the following is a good approximation (i = 2, 3, 4):

$$\Delta\Omega(1\rightarrow i) = \frac{\Omega(1\rightarrow 5)\cdot\Omega(5\rightarrow i)}{\sum\limits_{j<5}\Omega(5\rightarrow j)} + \frac{\Omega(1\rightarrow 6)\cdot\Omega(6\rightarrow i)}{\sum\limits_{j<5}\Omega(6\rightarrow j)} \, . \qquad (4)$$

Taking the R matrixes computed by D. Petrini, who used the Coulomb-Born approximation [6], we have computed $\Delta\Omega(4s\rightarrow 3d)$.

Table 1 shows the results for each total angular momentum L^t. These results show that the effects of the non-direct excitation are not negligible at all. Roughly speaking, one can assure that $Q(4s\rightarrow 3d)$ is multiplied by 2 between the levels 3d and 4p.

In conclusion we can say that each time one has to deal with a weak transition cross section one has to worry about the effects that the strong coupled transitions could introduce to the weak transition cross section through the process mentioned above. The particularly interesting case of Fe XIV is under investigation now.

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NOTES ON THE SUBMILLIMETER LASER EMISSION FROM CYANIC COMPOUNDS

W. PRETTL and L. GENZEL
Physikalisches Institut der Universität Freiburg i.Br., Germany

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From CH_3CN and from a mixture of CH_3CN and $(CH_3)_2SO_4$ laser emission additional to that already reported in the literature has been found at 119 μ, 310.4 μ, 310.5 μ, 311.5 μ, 334.4 μ and 334.8 μ.

Several authors have reported far-infrared laser emission from cyanic compounds [1-6]. We observed with a pulsed electric discharge through CH_3CN the well-known strong lines at 337 μ and 310 μ. Furthermore we found under appropriate conditions, strongly dependent on vapor pressure, a splitting of the 310 μ line into three lines at 310.4 μ, 310.5 μ, 311.5 μ and a new line group at 334.4 μ and 334.8 μ. The splitting of 337 μ emission first reported by Kneubühl et al. [4] could be proved.

Table 1

Vapour	Wavelength (μ)	Optimum pressure (Torr)	Output peak energy per pulse (J)
CH_3CN	310.4	0.3	10^{-6}
	310.5		10^{-6}
	311.5		10^{-7}
	334.4	0.5	10^{-6}
	334.8		10^{-6}
CH_3CN + $(CH_3)_2SO_4$	119.0	CH_3CN : 0.01 $(CH_3)_2SO_4$: 0.8	10^{-5}
	± 0.1%		

In a mixture of CH_3CN and $(CH_3)_2SO_4$ with partial pressures of 10^{-2} Torr and 0.8 Torr resp., a strong line at 119 μ was obtained. This oscillation occurred only if the electric discharge was first applied for a few minutes to CH_3CN only and then $(CH_3)_2SO_4$ was added. With pure CH_3CN or pure $(CH_3)_2SO_4$ an emission of this wavelength could not be observed. All lines are listed in table 1.

The laser cavity was a glass tube 5.85 m long having an internal diameter of 7.2 cm closed at one end by a plane aluminized mirror and at the other end by a plane copper mesh. The properties of this mesh were [7, 8]: grating constant = 35 μ, grating constant to strip half breadth ratio = 8 and reflection = 0.97, transmission = 0.02 all at 330 μ wavelength. The radiation was coupled through the mesh to the outer detector system consisting of a Fabry-Perot-interferometer [9] to separate the different line groups and a bolometer. The bolometer was calibrated to measure the energy per radiation pulse. The wavelength of the lines were determined by the interferometric properties of the laser cavity. The interferograms are shown in figs. 1 and 2.

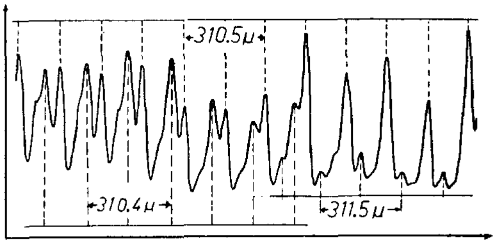

Fig. 1. Interferogram of CH_3CN. Three lines at 310.4 μ, 310.5 μ, 311.5 μ. The dashed lines mark the $\frac{1}{2}\lambda$-resonances.

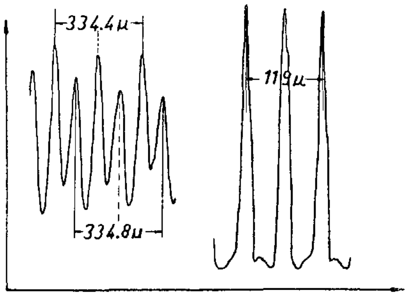

Fig. 2. *Left*: Interferogram of CH_3CN. Two lines at 334.4 μ and 334.8 μ. With an external FPI these resonances were proved to be produced by two lines and not by one line at 167 μ. *Right*: Interferogram of CH_3CN and $(CH_3)_2SO_4$. One line at 119 μ.

The electric pulses were produced by a 17 kV d.c.-source and a 0.1 μF condenser periodically discharged through the vapour in the cavity. The repetition frequency was 1 cps.

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