20A/2000G240

Stark quantum beat of He

Osamu IWAI, Tomohiro AOTO, Hiroshi YOSHII[1] , Hazime TOKUNAGA, Hidemasa YOSHIDA, Yumio MORIOKA , Institute of Phys. Univ. of Tsukuba,Tsukuba City, Ibaraki 305-8571 Japan
[1]Institute of Appl. Phys. Univ. of Tsukuba, Tsukuba City, Ibaraki 305-8573 Japan

Since the energy splitting between M=0 and M=±1 is very small, it is not possible to measure it in the usual strength electric field and a conventional monochromator. However, if the interference between two levels occurs, the energy splitting between M=0 and M=±1 can be measured. In this research, the Stark energy splitting between magnetic quantum number M=±1 and 0 of He($1s^{2\,1}S_0$-$1snp\,^1P_1$ Series) was measured through the quantum beat. The experimental values of the energy splitting were compared with calculated values.

The experiment was performed using synchrotron radiation as a light source on beam line 20A of KEK. The fluorescence excitation spectrum and the decay curve of He ($1s^{2\,1}S_0$-$1snp\,^1P_1$ Series) were measured. The synchrotron radiation was monochromitized by the 3m normal incidence monochromator, and focused in the interaction region using three mirrors. He gas supplied through the supersonic jet nozzle in the interaction region was excited by the monochromitized light, and fluorescence from the He Rydberg state was detected using MCP (Micro Channel Plate). A supplied the static electric field of 0-5kV/cm was to the interaction region. When a static electric field vertical or parallel to an electric vector of light is supplied, the atom was excited to M=±1 or M=0, respectively, because the ground state of He is M=0. To excite both levels simultaneously, the static electric field was supplied at 45° for an electric vector of light.

Fig.1 shows the quantum beat spectrum in He 7^1P_1 obtained by the experiment. The energy splitting in the electric field can be deduced from the quantum beat spectrum. Fig.2 show the experimental and calculated values of the beat frequencies (corresponding to energy splitting) versus the square of the electric field strength. The experimental values were indicated by the dots and the calculated values were indicated by the line. The calculated values were obtained by using the perturbation theory[1]. It can be confirmed at the experimental and calculated value almost agree. Experimental error was assumed to be ±4%, mainly caused by the distortion of the electric field.

Now calculation is being performed to higher principal quantum numbers.

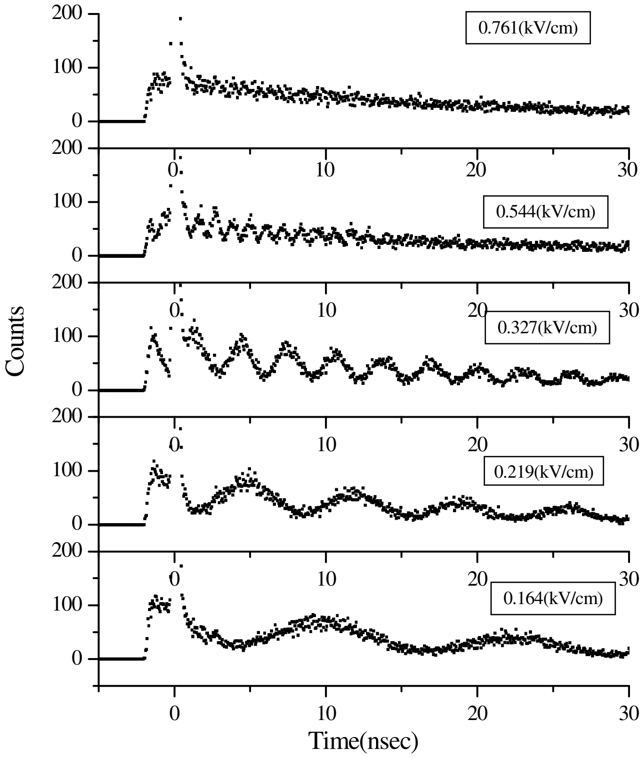

Fig.1. The quantum beat spectrum in He7^1P_1 state

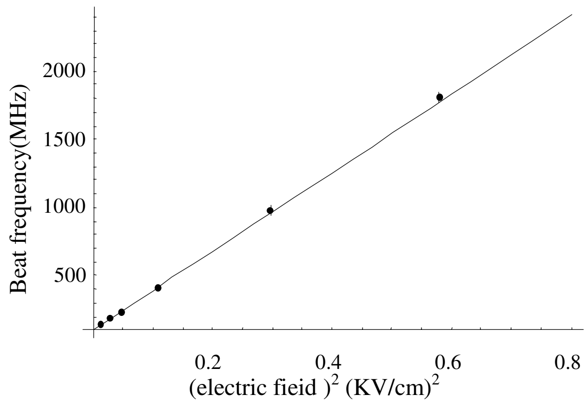

Fig.2. The beat frequency versus the square of the electric field strength (7^1P_1). The experimental values were indicated by the dots and the calculated values were indicated by the line.

References

[1] J.S. Foster, Proc.R.Soc. London, Ser. **A117**, 137 (1928)

*i08808@kyouiku.tsukuba.ac.jp