March 30, 2004

Report to the CCL/CCTF joint group meeting from Japan

--- NMIJ/AIST ---

The research group of Prof. Katori in Tokyo University has demonstrated the spectroscopy of the $5s^2\ ^1S_0$ (F = 9/2) → $5s5p\ ^3P_0$ (F = 9/2) clock transition of ^{87}Sr atoms (natural linewidth of 1 mHz) trapped in a one-dimensional optical lattice. Recoilless transitions with a linewidth of 0.7 kHz as well as the vibrational structure of the lattice potential were observed (as shown in Fig.1). By investigating the wavelength dependence of the carrier linewidth, they have determined the magic wavelength, where the light shift in the clock transition vanishes, to be 813.5±0.9 nm.

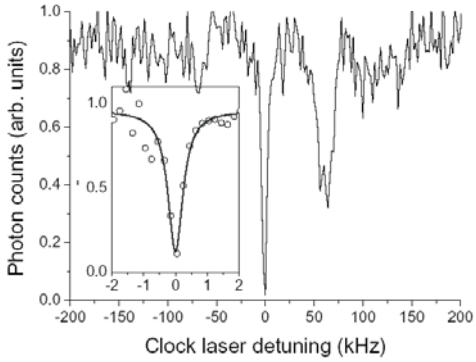

Fig. 1

References:

1) M. Takamoto and H. Katori, Phys. Rev. Lett. 91, 223001 (2003)
2) H. Katori and M. Takamoto, V.G. Pal'chikov, and V.D. Ovsiannikov, Phys. Rev. Lett. 91, 173005 (2003)
3) T. Ido and H. Katori, Phys. Rev. Lett. 91, 053001 (2003)
4) T. Mukaiyama, H. Katori, T. Ido, Y. Li, and M. Kuwata-Gonogami, Phys. Rev. Lett. 90, 113002 (2003)

To measure the absolute frequency of the clock transition of the Strontium Optical Lattice Clock, NMIJ has started a joint research project with Katori's group. As shown in Fig. 2, the atomic clocks in both sites (distance ~ 100 km) are linked by the GPS signals. We have transported a Cs atomic clock, an iodine-stabilized Nd:YAG laser and a fs comb system to the Tokyo University for this purpose. The iodine-stabilized Nd:YAG laser is used to improve the short-term stability in the frequency measurement. The measurement is now in progress.

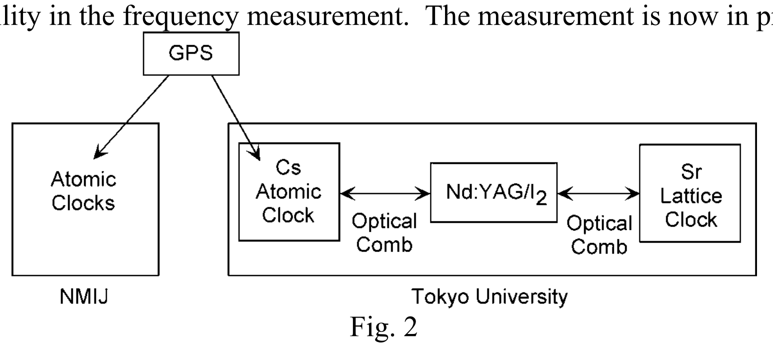

Fig. 2