

TAKO TOSHIHARU "Pioneering Research of Lasers and Thier Frequency Stabilization"
田幸 敏治(1923-2011) 「レーザーとその周波数安定化に関する先駆的研究」

1. Bio and Honors

1923. 7.1 Born (~ 2011.12.24 Passed away)
 1947. 9 Graduated from the Department of Physics, Faculty of Science, Tokyo Imperial University
 1951.11.10 Dr. Science, Univ. Tokyo
 1948. 4. 1 Researcher, Institute of Science and Technology, University of Tokyo
 1949. 6. 1 Research Associate, Institute of Science and Technology, University of Tokyo
 1949.11.30 Transferred to Faculty of Liberal Arts, University of Tokyo
 1956. 1.16 Industrial Technical Officer, Ministry of International Trade and Industry, Central Measurement Institute, Chief Researcher
 1965. 1. 1 Measurement Research Institute Manager
 1967. 9.19 2nd Manager of Metrology Research Institute
 1970.12. 1 Tokyo Institute of Technology Adjunct Professor, Precision Engineering Laboratory
 1972. 4. 1 Transferred to Precision Engineering Laboratory, Tokyo Institute of Technology
 1983. 4. 1 Reorganized and rearranged to Laser Measurement Department
 1984. 3.31 retirement
 1991. 4. 5 Professor Emeritus, Tokyo Institute of Technology



TAKO Toshiharu
田幸敏治

Academic Activities

- 1964 Member of the JJAP Steering Committee
 1973 The Optical Society of Japan Secretary General
 1982 JJAP Editorial Committee Chairman
 1983 Japan Society of Applied Physics President
 1984 Applied Physics Society Auditor

Honors

- a) 1962.4.1 Applied Physics Society Optics Paper Award
 b) 1968.11.12 The 20th Anniversary of the Agency of Industrial Science and Technology Director's Commendation
 c) 1982.1.28 Shimadzu Prize
 d) 1983.10.1 Tokyo Metropolitan Science and Technology Award
 e) 2000.11.3 Order of the Sacred Treasure, Gold Rays

2. Performance

From April 1, 1972, Toshiharu Tako became a professor at the Institute of Precision Machinery and Electronics Engineering, mainly engaged in research on laser frequency control¹⁾. Of particular note is the measurement of fine ground vibrations using a 50m-long laser interferometer, which was designed and built underground since the construction of the Suzukakedai Campus in 1975 as shown in Fig. 1²⁾.

Figure 2 shows a photograph of the interferometer shown in Figs. 1. Figure 3 shows a 50m-long vacuum pipe installed in an underground tunnel through which laser light travels back and forth. A frequency-stabilized He-Ne laser is used. The control system is devised to filter out daily ground vibrations and detect only abnormal signals. Figure 4 shows the seismic waves that occurred on the island of Java captured by this interferometer. The Tokyo Institute of Technology Chronicle has a special feature on laser research at Tokyo Institute of Technology³⁾. Successor data have also been reported⁴⁾.

Around the time the department in charge changed its name to the Laser Measurement Division, Kenichi Iga was transferred to that department as an associate professor. Many of Tokyo Tech's departments and courses were run independently by professors and associate professors, so although their research themes were different, they always sat together on the same review committees for graduation. There is only one paper co-authored with Kenichi Iga. The spectral width of the semiconductor laser was measured using a Fabry-Perot spectrometer, and it was confirmed that it was 1 MHz or less with a single-mode Fabry-Perot laser (Fig. 5)⁵⁾.

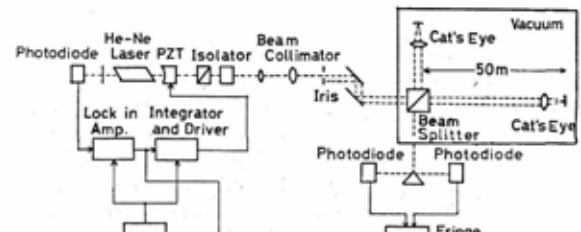


Figure 1: Configuration of 50m-long laser interferometer located underground²⁾



Figure 2: Laser interferometer²⁾



Figure 3: 50m-long interferometer vacuum pipe

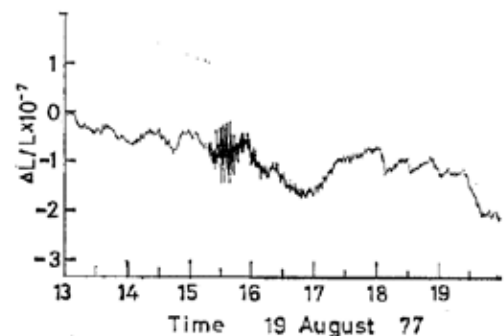


Figure 4: Detection of seismic waves in Java by 50m-long interferometer²⁾

Tako graduated from the Department of Physics, Faculty of Science, Tokyo Imperial University in September 1947, and was awarded a Doctor of Science degree from the University of Tokyo on November 10, 1961. From April 1, 1948, the year after graduation, he became a researcher at the Institute of Science and Engineering of the same university, and later worked as an assistant at the Faculty of Arts and Sciences of the University of Tokyo. On January 16, 1956, he joined the Central Metrology Institute (later the Metrology Research Institute, now the National Institute of Advanced Industrial Science and Technology) as an industrial technical officer of the Ministry of International Trade and Industry, where he engaged in spectroscopy and laser research.

The He-Ne gas laser oscillation in 1963 was the first in Japan (Fig. 6). The first paper was published in 1963 in Applied Physics^{6,7)}. This was shortly after A. Javan of Bell Labs at the time succeeded in 1962 as the first gas laser to oscillate a He-Ne gas laser with a wavelength of 1.15 microns. Tako's laser research has consistently aimed at a length standard using light. Later, the wavelength of the laser became the wavelength standard as well as the frequency standard. After working as chief researcher and section manager at the same research institute, he became the department head in September 1967. During this time, he was active mainly in the Japan Society of Applied Physics, giving lectures and commentary on lasers. In 1962, Kenichi Iga began researching lasers in the laboratory of Yasuharu Suematsu, an assistant professor at Tokyo Institute of Technology, for graduation research.

At the Institute of Metrology, he engaged in laser research with Misaho Oi (later professor at Tokyo Gakugei University), Shigeo Asami, Yoshiaki Akimoto, and Eiichi Sakuma^{6,7)}. In particular, he worked on research to lock the He-Ne gas laser wavelength in the 3.39-micron wavelength band to the absorption line of methane, and contributed greatly to the standardization of frequencies⁸⁾. This idea is due to Koichi Shimoda, and should be highly evaluated together with the experiments by Tako and his collaborators at the Institute of Metrology.

After that, in December 1970, he joined the Precision Engineering Laboratory of the Tokyo Institute of Technology as a concurrent professor. Since April 1968, Iga has been working as an assistant to Professor Fukuyo Hitohiro at the same research institute, which dates back to the time when he started research on frequencies using rubidium atoms. Professor Fukuyo was chairman of the frequency standard committee of the Institute of Electrical Engineers of Japan, and Iga was ordered to prepare the minutes as an assistant secretary. Iga was with Tako on this committee. Two years later, on April 1, 1972, he was formally transferred to the Institute for Precision Engineering as a Professor. Since then, he served until his retirement on April 1, 1984, and on April 5, 1992, was awarded the title of Professor Emeritus from the same university.

3. Remarks

At the Precision Engineering Laboratory, he was in charge of the electrical measurement department and the reorganized laser measurement department. Professor Motoichi Otsu who transferred to the University of Tokyo, Professor Nobuaki Takahashi of the National Defense Academy, and Professor Kenichi Asakawa who moved to the University of Tokyo from KDD are active in various fields such as universities and research institutes. In addition, Masashi Akahane, Sadao Aoki, and Katsumi Kishino were appointed as assistants in the research department to promote research in different fields. Masashi Akahane used liquid crystals, Sadao Aoki used X-ray optics, and Katsumi Kishino worked on semiconductor lasers. They were employed as professors in other universities later. After retiring from Tokyo Tech, Tako became a professor at Tokyo University of Science on April 2, 1984, and worked for many years in research and education.

References

- 1) M. Nakazawa, T. Tako, T. Musha: "Unmodulated Frequency Stabilization of 3.39 μm He-Ne Laser Using CH_4 Externally Saturated Absorption Cell", Transactions of the Institute of Electronics and Communication Engineers C, Vol. 62, No. 1, pp. 9-16, Jan. (1979)
- 2) K. Asakawa, T. Tako, T. Hirata: "Measurement of Ground Vibration by Laser Interferometer", Applied Physics, Vol. 48, No. 6, pp.519-525, June (1979)
- 3) https://dl.ndl.go.jp/view/download/digidepo_8208079_po_225-.pdf?contentNo=1&alternativeNo=
- 4) K. Iga, T. Sakaguchi, M. Kuroiwa, T. Tako, M. Ohtsu, and E. Hatakoshi, "Long-term measurement of earth strains and vibrations by a 50-m laser interferometer," in Conference on Lasers and Electro-Optics, D. Pinnow and P. Moulton, eds., Vol. 7 of OSA Technical Digest (Optica Publishing Group, 1988), paper TUQ5.<https://opg.optica.org/abstract.cfm?URI=CLEO-1988-TUQ5>
- 5) T. Takakura, K. Iga, and T. Tako, "Linewidth measurement of a single longitudinal mode AlGaAs laser with a Fabry-Perot interferometer," Jpn. J. Appl. Phys., Vol. 19, No. 12, pp. L725-L727, Dec. 1980.
- 6) T. Tako, M. Oi, and S. Asano: "He-Ne レーザー (I)", 応用物理(Oyo Buturi), Vol. 32, pp. 492-496, July (1963)
- 7) M. Oi and T. Tako; "He-Ne レーザー (II)", 応用物理(Oyo Buturi), Vol. 32, pp. 497-505, July (1963)
- 8) T. Tako: "Stable Frequency Laser", 応用物理(Oyo Buturi), Vol. 51, No. 4, pp. 465-467, Apr. (1982)

(Presented by Kenichi Iga on October 03, 2022)

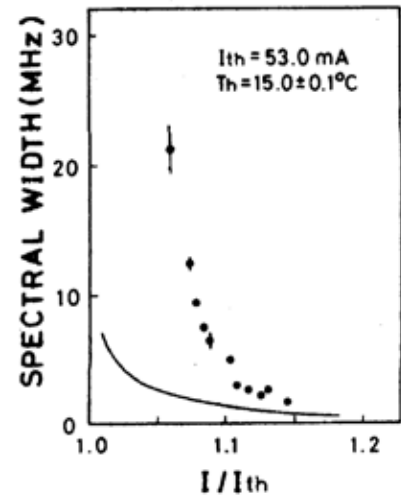


Figure 5: Semiconductor laser spectral width measurement result⁵⁾.

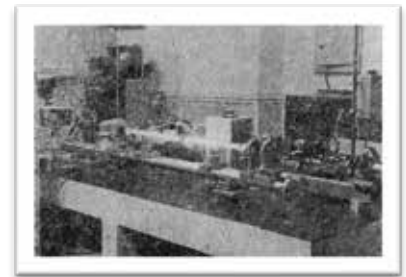


Figure 6: Equipment developed by T. Tako et al. that succeeded in oscillating He-Ne laser for the first time in Japan^{6,7)}