

**Study and Development of Extremely Short Pulse Coherent Terahertz
Light Source Employing an Electron Isochronous Ring**

Hiroyuki Hama

(Tohoku University, Graduate School of Science, Professor)

【Outline of survey】

Terahertz radiation, located between the light and the microwave, is in wavelength region from several tens micro m to a few mm. Energy levels of interacting molecules and collective vibration of DNA and other biological molecules are in this frequency region, so that, in the photo-life science filed, Terahertz radiation has received much attention as a new non-ionizing probe light for investigation of global structure of protein. Though Terahertz radiation is a frontier area in other many scientific fields, sources of high quality radiation in this region have been scarce.

In this study, a light source accelerator system for multi users will be established. Electron bunches with bunch length less than 100 fs produced by an advanced linac are injected into an isochronous ring where the bunch form factor is preserved in whole ring, and then coherent synchrotron radiation of Terahertz region can be provided from every bending magnet. Two major key issues to be investigated are production of extremely short electron bunches and non-linear beam optics for complete isochronous system.

【Expected results】

Providing intense Terahertz radiation from the isochronous ring for multi users, Terahertz science will be progressed like a synchrotron radiation facilities. Employing light source based on conventional lasers and sharing common technologies among users, the facility will be evolved uniquely. In addition, since Terahertz radiation is able to be converted to soft X-ray via Compton backscattering, novel combination of probe photons is expected to open a door of new research fields.

【References by the principal investigator】

- “CONCEPTUAL DESIGN OF AN ISOCHRONOUS RING TO GENERATE COHERENT TERAHERZ SYNCHROTRON RADIAION”, H. Hama, H. Tanaka, N. Kumagai, M. Kawai, F. Hinode, T. Muto, K. Nanbu, T. Tanaka, K. Kasamsook, K. Akiyama, M. Yasuda, New J. of Phys. 8 (2006) 292 – 307.

【Term of project】 FY2008– 2012

【Budget allocation】

159,300,000 yen (direct cost)

【Homepage address】

<http://www.lns.tohoku.ac.jp/~acc/>