TILA-LIC 2025 Satellite : 3rd TILA Seminar

“Promise of Tiny Integrated Lasers: from Basic Sciences include Laser Acceleration to Industrial Applications”

Time: 13:30-18:00
Date: April 28th, 2025

Place: Rm. 201, Institute for Molecular Science, Japan

Access <https://www.ims.ac.jp/en/about/campus/access.html>
Map <https://www.ims.ac.jp/en/about/campus/shonai.html>

Sponsor: Micro Solid-State Photonics Association, Japan
Laser-Driven Electron-Acceleration Technology Group, RIKEN SPring-8 Center (RSC), Japan
Division of Research Innovation and Collaboration, Institute for Molecular Science (IMS)

Contact: Y. Ono ono@ims.ac.jp, N. Okuhara norie-okuhara@ims.ac.jp (Secretary of Taira Group)

Contents

13:30-13:40
1. Opening Remarks
Takunori Taira (RIKEN / IMS, Japan)

13:40-14:40
2. "Quasi-Phase Matched for Frequency Conversion and Optical Signal Processing (tentative)"
Prof. Martin M. Fejer (Stanford University, USA)

14:40-14:50 Coffee Break

14:50-15:50
3. "New Nonlinear Crystals for UV Generation"
Prof. Gerard Aka (PSL Université - Chimie ParisTech, France)

15:50-16:10
4. "Tiny Integrated Lasers: Laboratory Introduction"
Takunori Taira (RIKEN / IMS, Japan)

16:10-18:00 Laboratory Tour

18:30-20:30 (tentative)
Reception at the restaurant (Okazaki)

TILA consortium

<https://tila.ims.ac.jp/en/> < https://tila.ims.ac.jp/en/membercompanies/>

TILA-LIC 2025 Satellite : 3rd TILA Seminar
"Promise of Tiny Integrated Lasers:
from Basic Sciences include Laser Acceleration to Industrial Applications"
Institute for Molecular Science, Okazaki, Japan
April. 28th, 2025

4: 15:50-16:10

Tiny Integrated Lasers: Laboratory Introduction

Takunori Taira

Laser-Driven Electron-Acceleration Technology Group, RIKEN SPring-8 Center, 1-1-1 Kouto, Sayocho, 679-5148, Japan
Division of Research Innovation and Collaboration, Institute for Molecular Science, 38 Nishigonaka, Okazaki, 444-8585, Japan
taira@spring8.or.jp, taira@ims.ac.jp

Abstract

In RIKEN SPring-8 center (RSC), we are developing the tiny integrated laser (TILA) for compact X-ray free electron lasers (XFEL) [1],[2] based on micro solid-state photonics for the ubiquitous power lasers: ceramics based artistic lasers[3],[4], quasi phase matching (QPM) nonlinear optics[5] and inter-layer assisted surface activated bonding (il-SAB) for power scaling[6]. On the other hand, those cutting edges high-performance laser could open the new industrial applications in Institute for Molecular Science (IMS): laser ignition, laser peening of metallic bridge, fine laser material processing with handy palm top and robot arm [7], long-distance laser induced breakdown spectroscopy (LIBS)[8]. Up to >80MW peak power and >20mJ pulse energy with a single chip MCL [9], and >2GW and 2J have been obtained at the room temperature with the distributed face cooling (DFC) amplifiers by using il-SAB [10]. Also, it is possible to improve the damage threshold of laser ceramics surface by single crystal il-SAB [11] for the high power attosecond level ultrashort pulse. These tiny integrated lasers (TILA) promise the extremely high-brightness lasers for both of science and industrial application. This work was partially supported by Innovative Science and Technology Initiative for Security Grant Number JPJ004596, ATLA: JST-Mirai Program Grant Number JPMJMI17A1.

[1] N.H. Matlis, et al., Nuclear Inst. and Methods in Physics Research A, **909**, 27-32 (2018).
[2] S. W. Jolly, et al. Nature Communications. **10**, 2591 (2019).
[3] T. Taira, IEEE J. Sel. Top. Quantum Electron., **13**(3), 798 (2007).
[4] T. Taira, Opt. Mater. Express, **1**(5), 1040 (2011).
[5] H. Ishizuki and T. Taira, Opt. Express, **20**(18), 20002 (2012).
[6] L. Zheng, A. Kausas, and T. Taira, Opt. Mater. Express **7**(9), 3214 (2017).
[7] Y. Sano, et al., Forces in Mechanics **7**(100080), 1 (2022).
[8] K. Tamura, R. Nakanishi, H. Ohba, T. Taira, and I. Wakaida, J. Nucl. Sci. Technol., **59**(7), 10 pages (2022).
[9] H. H. Lim and T. Taira, Opt. Express, **30**(4), 5151 (2022).
[10] V. Yahia, T. Taira, Opt. Express **32**(8), 14377 (2024).
[11] A. Kausas, and T. Taira, Opt. Lett. **47**(12), 3067 (2022).