

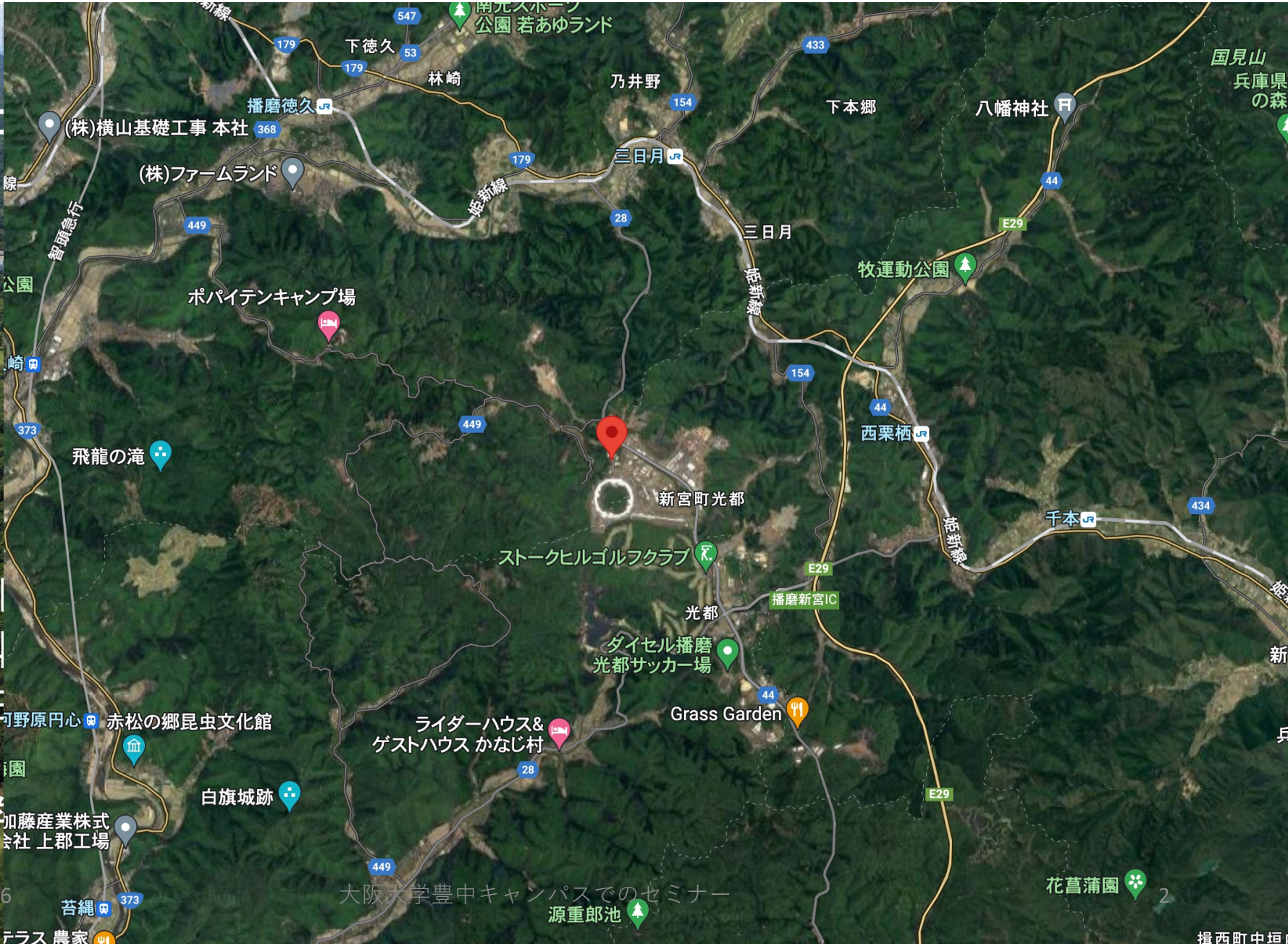
SPring-8/SACLAの加速器光科学基盤施設の 高度化長期ビジョンと最近の研究成果

理化学研究所
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田中 均
2023年10月16日
大阪大学豊中キャンパス

2023/10/16

大阪大学豊中キャンパスでのセミナー





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大阪大学豊中キャンパスでのセミナー
源重郎池

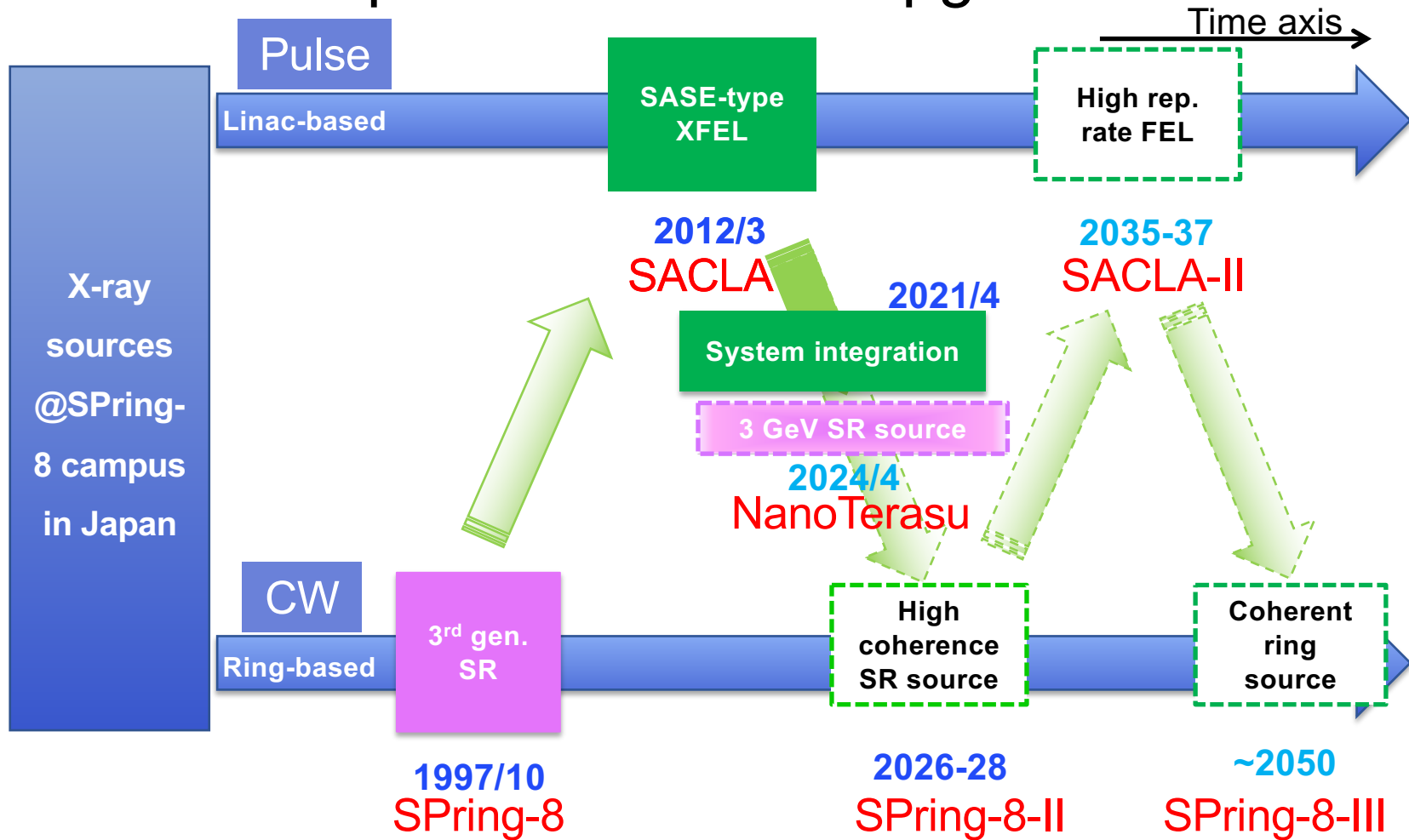
梶西町中塚

SPring-8/SACLAは、先端的高輝度X線により得られる情報で学問的研究に貢献することはもとより、企業の新たな製品開発等、日本の産業基盤の強靱化にも貢献する。その有益性が幅広く認知され、SPring-8を訪れる利用者は年間1万人を超える。

私達が目指すのは、多くのそして根源的な**Why**に答えること。そのためには、終状態だけを観測するのではなく、Dynamicsを高精度で可視化する必要がある。

それが可能な基盤を開発・整備していくことで、持続的発展可能な社会への転換の加速に貢献すると共に、基盤施設自体も省エネ、省資源化を進める。

1. Roadmap for accelerator upgrade



IN FOCUS ACCELERATING SCIENCE IN ASIA

2022 cerncourier.com

2022年12月CERN CourierのIn Focusに取り上げられ、カバーページを飾る。

SUSTAINABLE SUCCESS FOR SACLA, SPRING-8

AEPSHEP: it's all about connection
IHEP capitalises on R&D strategy

ACCELERATORS | FEATURE

SACLA and SPring-8: a roadmap towards sustainable science

21 December 2022

In a world-first implementation, the linear accelerator of the SACLA X-ray free-electron laser is now being used as the beam injector for the storage ring of the SPring-8 synchrotron light source. Project leader Toru Hara explains the technical motivations for the upgrade and the long-term operational benefits.



Progressions of power The new beam-injection scheme for the SPring-8 storage ring has yielded an impressive 20% reduction in the synchrotron facility's power bill. Further operational efficiencies are in the works given the global surge in energy prices. Credit: SPring-8

Sometimes, it seems, mere proximity is the engine-room of opportunity. That's certainly the case for two of Japan's flagship large-scale research centres – the SPring-8 (Super Photon Ring 8 GeV) synchrotron facility and SACLA (the SPring-8 Angstrom Compact free-electron LASer) – which are co-located adjacent to each other on the main campus of Harima Science Park City in Hyogo Prefecture.

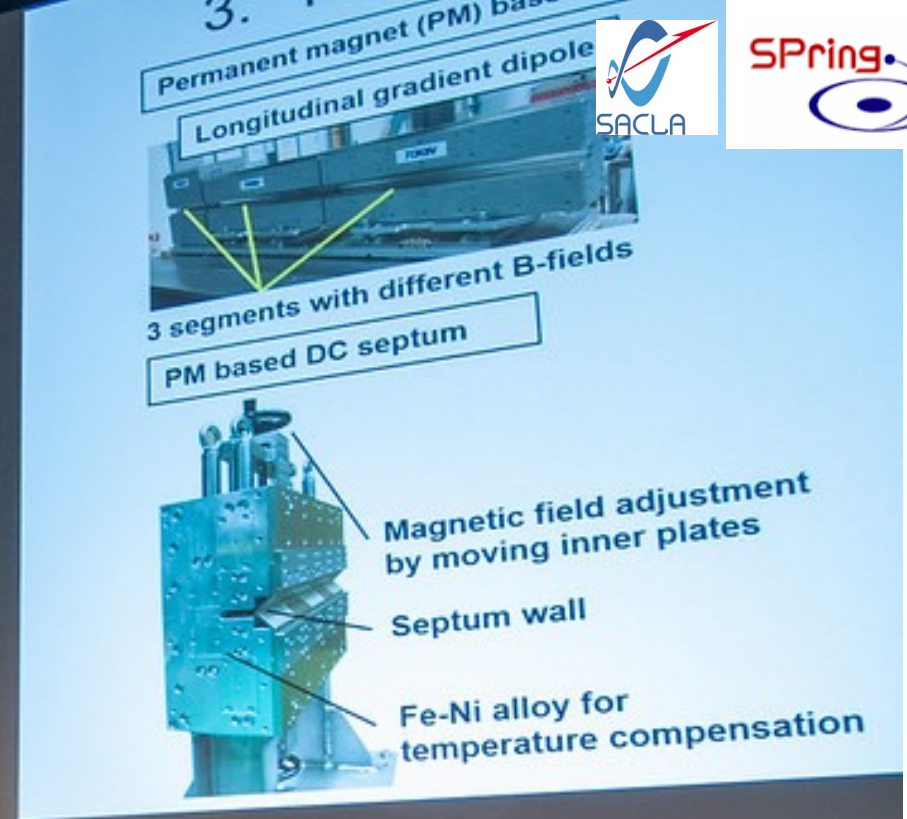
It's now two years since a joint research group from SPring-8 Center, which is managed by Japan's premier research agency RIKEN, and the Japan Synchrotron Radiation Research

Green-oriented upgrade of accelerator complex at the SPring-8 campus

Hitoshi Tanaka, Takahiro Inagaki, Toru Hara,
Takahiro Watanabe, and Tetsuya Ishikawa

7 – 12 May 2023 | Venice Italyで開催されたIPAC2023
でのOral Presentation

発表前からNature Physicsの取材申し込みもあり、発表後にも多数の方々から多くの肯定的なコメント、反響や相乗効果があった。



August 1, 2023

Dr. Hitoshi Tanaka
Development and Upgrade of Light Sources
RIKEN SPring-8 Center
Saitama, Japan

Dear Dr. Tanaka,

I am writing to invite you to give one of the distinguished lectures in the National Synchrotron Light Source II (NSLS-II) Colloquium series at Brookhaven National Laboratory (BNL). As you may know, NSLS-II is the Department of Energy's newest user facility and the world's brightest synchrotron. The monthly NSLS-II Colloquium series is designed to benefit the NSLS-II and BNL communities by bringing renowned scientists from all disciplines to lecture on topics of general interest. The objectives include the identification of new areas of science or technology in which NSLS-II could have impact, the exploration of new synchrotron methods and the generation of new research initiatives between NSLS-II staff and researchers at various institutions.

The NSLS-II Colloquium Committee reviewed speaker suggestions from a diverse range of research areas and found your pioneering work on light source developments can show exciting directions in improving the NSLS-II performance as well as in designing NSLS-II upgraded lattice. A lecture on your recent advances in this field would be of considerable interest to the NSLS-II and BNL communities. It would be wonderful to have you visit and give us your perspective on the light source developments.

If your schedule permits you to visit us, we will cover travel to BNL and local expenses for up to two nights to provide adequate time to tour facilities and interact with research staff with similar interests. Jinhyuk Choi, who is a member of the Colloquium Committee, will serve as your local host. Jinhyuk will work with you to ensure that your visit is interesting and productive.

I would be honored if you would accept our invitation. Please confirm you are able to come and speak on March 21, 2024.

Yours Sincerely,

J.P. Hill
Director, NSLS-II
Deputy ACD for Energy & Photon Sciences Directorate

The NSLS-II Colloquium Committee reviewed speaker suggestions from a diverse range of research areas and found your pioneering work on light source developments can show exciting directions in improving the NSLS-II performance as well as in designing NSLS-II upgraded lattice. A lecture on your recent advances in this field would be of considerable interest to the NSLS-II and BNL communities. It would be wonderful to have you visit and give us your perspective on the light source developments.

せっかくなのでワシントンにも足を延ばすことを考慮



U.S. DEPARTMENT OF
ENERGY



Dr. Harriet Kung
Deputy Director for Science Programs
Office of Science
U.S. Department of Energy

加速器Gの出版論文(2023-2022)

直近の2年間で11 報の論文を投稿

Phys. Rev. Lett. 1

Physical Review Accelerators and Beams 2

Review of Science Instruments 2

Journal of Synchrotron Rad. 1+1 (accepted)

Japanese Journal of Applied Physics 1

Journal of Applied Physics 1

Synchrotron Radiation News 1

Opt. Lett. 1

Three papers under preparation

(11) Hiroshi Yamaguchi, Tsumoru Taniuchi, Kenji Fukami, Yasuhiro Takemura, Tsuyoshi Aoki, Shiro Takano, and Takahiro Watanabe., “Design and demonstration of low current density dc septum magnet”, *Physical Review Accelerators and Beams* **26**, 092401 (2023).

セプタム磁場(隔壁の外側の漏れ磁場をほぼゼロにする特殊な磁石の新たな設計提案とその性能の実験的検証
従来のコイルに必要な電力を数%まで削減可能とした

Editor's Suggestion

(10) Takashi Tanaka et. al., “Experimental demonstration to control the pulse length of coherent undulator radiation by chirped microbunching”, *Phys. Rev. Lett.* **131**, 145001 (2023).

アト秒のパルス幅のXFELを生成するスキームの実験的検証

Editor's Suggestion

プレス発表

(9) Takahiro Watanabe and Hitoshi Tanaka, "SPring-8 Upgrade Project: Accelerator Redesigned and Restarted", *Synchrotron Radiation News* **36**, No.1, 3-6 (2023).

SPring-8 upgrade project のStatus

(8) Eito Iwai, Ichiro Inoue, Hirokazu Maesaka, Takahiro Inagaki, Makina Yabashi, Toru Hara, and Hitoshi Tanaka, “Spectral-brightness optimization of an X-ray free-electron laser by machine-learning-based tuning”, *accepted by J. Synchrotron Rad.*

MLを実際のXFELのチューニングに適用し、実用化

プレス発表
予定

(7) Tamotsu Magome, Kazuaki Togawa, and Hitoshi Tanaka, "Precise measurement of the work function of a hot CeB6 thermionic cathode through photoelectron yield spectroscopy using a tunable pulsed laser", *Journal of Applied Physics* **133**, 165107 (2023).

1700 Kに加熱された熱電子銃カソードの仕事関数の精密計測手法

(6) Takashi Tanaka et. al., "Development of an insertion device selectively operational as a helical/figure-8 undulator", *J. Synchrotron Rad.* **30**, 301-307 (2023).

円偏光/8の字アンジュレータ放射が切り替え可能な新しい
アンジュレータの磁気回路

(5) K. Fukami, T. Inagaki, T. Iwashita, H. Nakanishi, N. Nishimori, S. Takano, Y. Takemura, T. Taniuchi, T. Watanabe, H. Yamaguchi, and H. Tanaka, "Iron lamination and interlaminar insulation for high-frequency pulsed magnets", *Review of Science Instruments* **93**, 023301 (2022).

IPAC'23 Oral

MHzの周波数領域までインピーダンスを制御できるキッカー電磁石の提案とその
性能実証(複数磁石のパルス磁場波形制御に有効)

(4) T. Tanaka and P. R. Ribic, "Proposal to generate a pair of intense independently tunable attosecond pulses from undulator radiation", *Opt. Lett.* **47**, 1411-1414 (2022).

独立に遅れ時間と光子エネルギーを制御可能な2パルスのアト秒
シングルサイクル高ピーク強度EUV放射; (10)で用いられた理論
の応用

(3) Toshihiko Hiraiwa, Kouichi Soutome, and Hitoshi Tanaka, "Suppression of emittance variation in extremely low emittance light source storage rings", *Physical Review Accelerators and Beams* **25**, 040703 (2022).

極低エミッタンス電子ビームのユーザー実験中の輝度変動を
パッシブに抑制する方法

IPAC'23 Oral

(2) Yuji Hosaka, Nobuyuki Nishimori, Toshiro Itoga, Shingo Nakazawa, Shinichiro Tanaka, Toshio Seno, Chikara Kondo, Takahiro Inagaki, Toru Fukui, Takahiro Watanabe, and Hitoshi Tanaka, "Visualization of light-emitting diode lighting damage process in radiation environment by an in-situ measurement", *Japanese Journal of Applied Physics* **61**, 076504 (2022).

X線照射が引き起こすLED照明の故障メカニズムの解明と対策

プレス発表

(1) Kazuaki Togawa, Hirokazu Maesaka, Reichiro Kohana, and Hitoshi Tanaka, "Frequency-segmented power amplification using multi-band radiofrequency amplifiers to produce a high-voltage pulse with an arbitrary structure", *Review of Science Instruments* **93**, 073304 (2022).

RF増幅器を用いたスケーラブルな新方式の高速パルサー

プレス発表

みなさん、是非、光源加速器システムの開発にトライしてみませんか

Blue Oceanが残されています！