

白眉 — The Hakubi Project

A Unique Opportunity for Outstanding Young Talent

The Hakubi Project was established by Kyoto University in 2009 to foster outstanding young researchers. The program recruits twenty international researchers per year as associate and assistant professors. It gives outstanding scholars a valuable opportunity to devote themselves entirely to their research.

Hakubi researchers are employed for up to five years with generous funding and a great deal of freedom to focus on their studies. They are not required to perform any administrative or teaching duties, and are free to pursue their research at institutions outside of Kyoto University. The assessment obligations are also minimal.

The project is open to any researcher holding a doctoral degree (or with equivalent research abilities) in any academic field. For further information please refer to the following website.

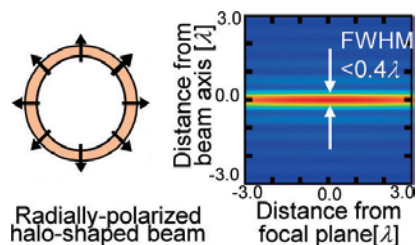
WEB www.hakubi.kyoto-u.ac.jp/eng

OPT-ELEC Next-Generation Laser Beam?!

Needle-like focus achieved by photonic-crystal lasers.

For many applications in optics, such as optical data storage, lithography, and laser microscopy, it is important to achieve a smaller focal spot size of laser beams than the beam's wavelength (λ), which is called Abbe's diffraction limit. Laser beams with a specific beam pattern and polarization show great promise in exhibiting peculiar focusing properties which can achieve this. Dr. Kitamura has designed a radially polarized halo-shaped beam which can generate a needle-

like focus with a smaller spot size than its wavelength ($\text{FWHM} < 0.4\lambda$). Moreover, by engineering photonic-crystal lasers, Dr. Kitamura has developed a simple optical device that emits the beam. Her accomplishments are expected to lead to further developments in various optics fields.



Dr. Kyoko Kitamura

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MED-CARE Creating a Health Care System in Bhutan

Caring for the elderly who are unable to visit healthcare facilities.



Dr. Sakamoto's project aims to formulate a health care system focused on providing health checkups for the elderly in the Kingdom of Bhutan. Such health checkups are important opportunities to identify health problems and prevent disease, disability, and death. The system aims to include elderly people with mobility problems who are unable to visit healthcare facilities. Dr. Sakamoto hopes that the program will help strengthen bonds among community members in Bhutan.



Dr. Ryota Sakamoto

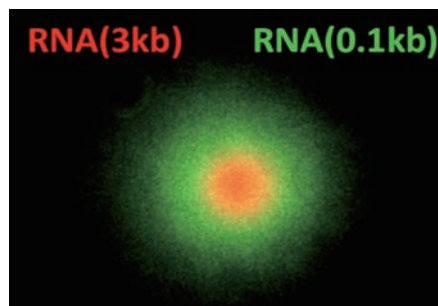
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BIOPHYS The Physics of How Life Started

RNA and temperature gradients.

In the 19th century, the French physicist Nicolas Léonard Sadi Carnot showed that the conversion of heat into work is possible using two thermal reservoirs: a hot source and cold sink. His study demonstrated the universality of the operation of any possible engine, and practically led to the industrial revolution. As Carnot demonstrated, heat can serve as a source of power, however, little is known about the process at the molecular scale.



At the scale of millimeters or microns, temperature differences induce the motion of molecules. This is called the Soret effect. Dr. Maeda has shown that, in a temperature gradient over tens of microns generated by laser heating, ribonucleic acid (RNA) is size separated. This separation is enhanced at the stem part of the double-stranded helix, suggesting the possibility of sequence selection. These findings have implications for the discovery of the origin of life.

The separation of ribozymes from the large library of RNA might occur in thermal vents in the deep ocean, where a temperature gradient is present.

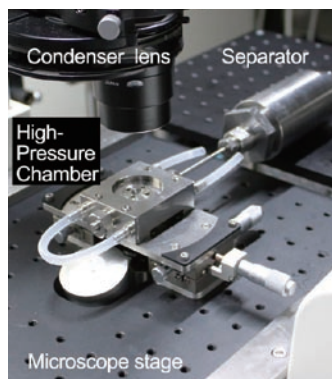


Dr. Yusuke T. Maeda

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BIANO-BIO Seeking a New Microscopic Analytical Method

Visualization of mechanical response of molecular machines working in vivo.



Biomolecules are nanometer-sized molecular machines which function well in conjunction with water molecules. Dr. Nishiyama is seeking to develop a new analytical method to modify molecular structures and functions by utilizing high-pressure techniques and extremely-high-resolution microscopic analyses. This system could enable scientists to control molecular machines without the use of any chemical materials other than the water molecules within cells. Dr. Nishiyama's goal is to elucidate the mechanism of how molecular machines perform biological functions in collaboration with water molecules.



Dr. Masayoshi Nishiyama

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What's in a Name?

The term hakubi (白眉), literally means 'white eyebrows' in Japanese (白 : white, 眉 : eyebrows). The word originates from a Three Kingdoms era (220-280 AD) Chinese legend: "Three kingdoms saga (三国志)". According to the legend, one of the kingdoms, called Shu (蜀), was home to five brothers with extraordinary talents. The fourth brother; 馬良季常 (Baryo Kijo), who was particularly outstanding, had white hairs in his eyebrows, and so the term hakubi has come to refer to particularly talented individuals.

