Visiting Professors

Visiting Professor
MASE, Kazuhiko *(from High Energy Accelerator Research Organization)*

Development of New Nonevaporable Getter (NEG) with a Low Activation Temperature

Nonevaporable getter (NEG) is a functional material that evacuates residual gases at room temperature by forming an active surface when heated in ultra-high vacuum (UHV). Recently we have developed a new NEG thin film that was prepared by the following simple procedure, sublimation of high-purity Ti under UHV in the range of 10^{-7} to 10^{-8} Pa, followed by N_2 introduction (partially nitrided high-purity Ti). We confirmed that partially nitrided high-purity Ti deposited on inner surfaces of a vacuum vessel pumps H_2, H_2O, O_2, and CO gases even after 30 cycles of pumping, baking at 185 °C for 6 hours, cooling down to room temperature, introduction of high-purity N_2, and exposure to air. We applied surface-partially nitrided high-purity Ti deposition to the inner surface of the vacuum ducts in the upstream section of BL-12C in the Photon Factory 2.5 GeV ring and baked them at 250 °C. Pressure in the section reached 2.2 × 10^{-8} Pa without ion pumps after isolation from a turbomolecular pump with a gate valve. Partially nitrided high-purity Ti deposition is also applicable to UVSOR beamlines.

Visiting Professor
FUKUHARA, Takeshi *(from RIKEN)*

Quantum Gas Microscopy of a Frustrated XY Model in Triangular Optical Lattices

Ultracold quantum gases in optical lattices provide a clean and controllable platform for studying quantum many-body systems; especially they enable us to emulate a variety of fundamental models in solid-state physics. We have prepared Bose-Einstein condensates (BECs) in triangular optical lattices for the study of frustration physics, and implemented quantum gas microscope, which makes it possible to observe such quantum gases at the single atom level. By regarding the phase of BECs as a spin and by implementing antiferromagnetic spin–spin couplings via a lattice shaking technique, we have realized frustrated XY spin model. The frustration leads to two-fold ground states corresponding to two chiral modes. We have investigated the relaxation dynamics from the ferromagnetic phase to the spiral phases with the chiral modes by dynamically changing the spin–spin coupling. The domain formation of the chiral modes has been observed though high-spatial-resolution time-of-flight measurements.

Visiting Associate Professor
NAKAYAMA, Yasuo *(from Tokyo University of Science)*

Epitaxially-Grown Single-Crystalline Organic Molecular Semiconductors

Single-crystalline organic semiconductor materials exhibiting “band transport” realize considerably high charge carrier mobility of over 10 $cm^2V^{-1}s^{-1}$ and have potential applications as flexible and efficient electronic devices. However, current organic semiconductor electronics are mostly built on heterojunctions composed of polycrystalline or amorphous molecular solids, in contrast to the inorganic semiconductor cases where epitaxial growth of single-crystalline is one of the most essential technologies for modern electronic applications. Our group has been working on single-crystalline heterojunctions of organic molecular semiconductors by “molecular beam epitaxy” techniques. Recently, we have published that on the single-crystal surface on phthalocyanine-copper (CuPc), which is one of the most well-studied organic semiconductors, perfluorinated CuPc exhibits epitaxial growth. As this is an analogical finding to our previous collaborative achievement with IMS for epitaxial perfluorinated pentacene on the single-crystal pentacene, further studies on its electronic properties will be of our next targets.