Visiting Professors

Visiting Professor
FUKAZAWA, Aiko *(from Kyoto University)*

Renaissance of Nonbenzenoid π-Conjugated Systems toward Functional Materials

The work of our group has focused on exploring functional organic compounds with unusual with superb optical and/or electronic properties, based on the molecular designs of novel π-conjugated scaffolds as well as unusual functional groups. In particular, we have recently proposed a rational design of stable yet unusual π-conjugated systems based on the characteristics of nonbenzenoid hydrocarbons, *i.e.*, dehydroannulenes, non-alternant hydrocarbons, and fulvalenes, by annulation of weakly aromatic (hetero)arenes. In this year, we have succeeded in synthesizing several thiophene-fused antiaromatic π-systems that exhibit high thermal stability even without bearing bulky substituents while retaining pronounced antiaromatic character. Moreover, we have recently succeeded in synthesizing the fulvalene-based π-conjugated oligomers that exhibit exceptional electron-accepting character as well as the robustness toward multi-electron reduction.

Visiting Professor
WATANABE, Rikiya *(from RIKEN)*

Single Molecule Physiology

Our study aims to understand cellular functions using a bottom-up approach from the single molecule level. To achieve this, we are attempting to elucidate the mechanism by which individual biomolecules or their networks function in a precise manner, by developing novel single-molecule techniques using multidisciplinary approaches, including biophysics, bioMEMS, and chemical biology. In addition, we are developing a methodology to investigate correlations between genetic mutations, dysfunctions, and diseases with single molecule sensitivity, which would provide new insights for biological as well as pharmaceutical studies. Notably, last year, we developed a novel technology that can identify new coronavirus, SARS-CoV-2, at the single molecule level, enabling the world's fastest quantitative detection for early diagnosis.

Visiting Associate Professor
UEDA, Akira *(from Kumamoto University)*

Development of Purely Organic Molecular Materials with Three-Dimensional Electronic Structure

Design and synthesis of novel molecular materials have been a central issue for the development of molecular science. Our group has recently succeeded in the development of a new type of molecular conductor crystal composed of a zwitterionic neutral radical with a partially charge-transferred structure. Single crystal X-ray analysis reveals that this material has a peculiar electronic structure where two-dimensional conducting layers are electronically coupled to each other through the intramolecular interaction of the partially charge-transferred zwitterionic neutral radical. Therefore, one can say that this material has a three-dimensional-like electronic structure different from one- or two-dimensional ones in the conventional molecular conductors. Interestingly, the low-temperature structural analysis and physical property measurements suggest that this material undergoes a phase transition from the charge-uniform state to a three-dimensionally charge-ordered state.