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 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 such as dehydroannulenes and non-alternant hydrocarbons by annulation of weakly aromatic (hetero)arenes. 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 robustness toward multi-electron reduction.

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

Development of Neutral Radical Molecular Conductors with Intramolecular Charge Degrees of Freedom

Design and synthesis of novel molecular materials have been a central issue for the development of molecular science. In this work, we have successfully developed a new type of neutral radical molecular conductor crystals with intramolecular charge degrees of freedom. Measurements of X-ray diffraction, electrical resistivity, and magnetic susceptibility have revealed that this new type of charge degrees of freedom is coupled to the intermolecular charge degrees of freedom, leading to unique strongly correlated electron phenomena and properties in molecular materials. In particular, we emphasize that the successful formation of a 3/4-filled electron band in this system is an unprecedented event in neutral molecular solids, which allows not only the realization of an ambient-pressure metallic state but also the emergence of exotic Mott insulating states relevant to the charge degrees of freedom. These results offer new possibilities of neutral radical solids as a molecular strongly correlated electron system.

Visiting Associate Professor
KAMIYA, Yukiko *(from Nagoya University)*

Expand the Artificial Nucleic Acid World Based on the Studies of Molecular Science

Nucleic acids (DNA and RNA) are essential biopolymers that carry genetic information in all living organisms. On the other hand, various artificial nucleic acids (XNAs) having ribose-modified or non-ribose type backbone and nucleic acid recognition ability have been developed. One of the motivation of XNA study is development of nucleic acid drugs. Another big motivation is addressing the fundamental question why nature selected ribose as backbone of genetic materials. Our group has focused on amino acid-type artificial nucleic acids and we are studying on characterization of their molecular recognition properties, design of unique structures, and development of molecular tools and drugs that target RNA as applications. The unique feature of the XNAs is that they form highly stable homo-duplex than XNA/RNA hetero duplex. In the recent study we have developed the methodology that can control the hybridization of XNA/XNA and XNA/RNA by designing the nucleobase structures.