理工学部講演会

Molecular Superconductivity: a personal voyage into the unexpected

講師：Prof. **Kosmas Prassides**

(*WPI-AIMR*, Tohoku University)

日時：9月2日（金）14：00～15：30

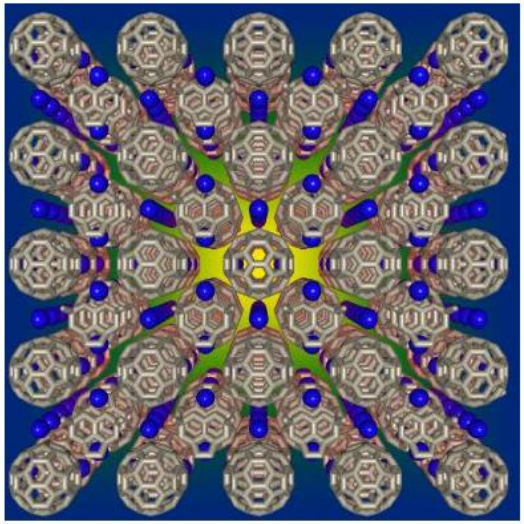
場所：VII号館112号室

分子性結晶の超伝導体をはじめ、新規超伝導研究の最前線を
訪れてみよう！（超伝導になじみのない学生さんにも解りやすく講演していただきます）
（言語：English）

担当：水木純一郎（先進エネルギーナノ工学科）

Molecular superconductivity: a personal voyage into the unexpected

Kosmas Prassides
WPI-AIMR, Tohoku University, Sendai, Japan



Three-dimensional depiction of the crystal structure of the molecular A_3C_{60} fulleride superconductors. The fulleren molecules pack in an isotropic cubic-close-packed array in three dimensions. Alkali metal ions (blue spheres) occupy vacant interstitial holes of octahedral and tetrahedral symmetry.

Molecular solids whose cooperative electronic properties are based purely on π-electrons from carbon atoms offer a fertile ground in the search for exotic states of matter, including unconventional superconductivity and quantum magnetism. Following the discovery of C_{60} (a quasi-spherical molecule with dimensions of ~1 nm) in 1985, the subsequent isolation and preparation of bulk crystalline samples of fullerenes—a set of hollow, closed-cage molecules consisting purely of carbon—from arc-processed carbon in 1990 sparked off a remarkable interdisciplinary research activity, encompassing diverse fields of chemistry, physics and materials science. The early research activity quickly culminated in 1991 in the synthesis of superconductors with stoichiometry A_3C_{60} (A = alkali metal) and considerably enhanced superconducting transition temperatures, T_c, when compared with any other molecular system. This was followed by a long period during which the established fulleride chemistry failed to deliver new materials. Therefore the physical picture of fullerene superconductivity remained unaltered until 2008 when the discovery of Cs_3C_{60} led to their rebirth and demonstrated their commonality with other classes of unconventional superconductors such as the cuprates, the iron chalcogenide/pnictide and the heavy fermion systems. Here I will attempt to trace the development of this field of science to date with emphasis on its current status and future prospects. In concluding, I will also address the topical issue of the potential of extended molecular architectures built by other π-electron open-shell molecular units such as the polyaromatic hydrocarbons to afford electronically conducting or exchange-coupled quantum spin networks.