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NANOMETER-SCALE GOLD AND SILVER DISPERSED BY LIGANDS: ELECTRONIC, OPTICAL AND BIO-CONJUGATE PROPERTIES

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Nanometer-scale, ligand-stabilized noble metal clusters have emerged in recent years as a novel form of nano-matter with potential applications in molecular electronic, optics, sensing, drug delivery and biolabeling. Tremendous advances have been achieved in understanding their stability and structure due to contributions from synthetic work, X-ray crystallography and density functional theory computations. Their electronic structure can be understood surprisingly well from the simple concepts that have been used in the related field of bare gas-phase metal clusters since 1980's, particularly from the so-called "superatom model" that accounts for the delocalized sp-electrons in the metal core. Forming in most cases the frontier orbitals of the nanoparticle, these electrons are responsible for low-energy optical transitions and much of the chemistry. Recent progress in understanding the structure as well as physical and chemical properties of this class of "superatoms" is reviewed, and a novel application of using atomically precise, functionalized thiol-stabilized gold nanoclusters for site-specific conjugation to enteroviruses is discussed.