Chains of nanogold – forged with atomic precision

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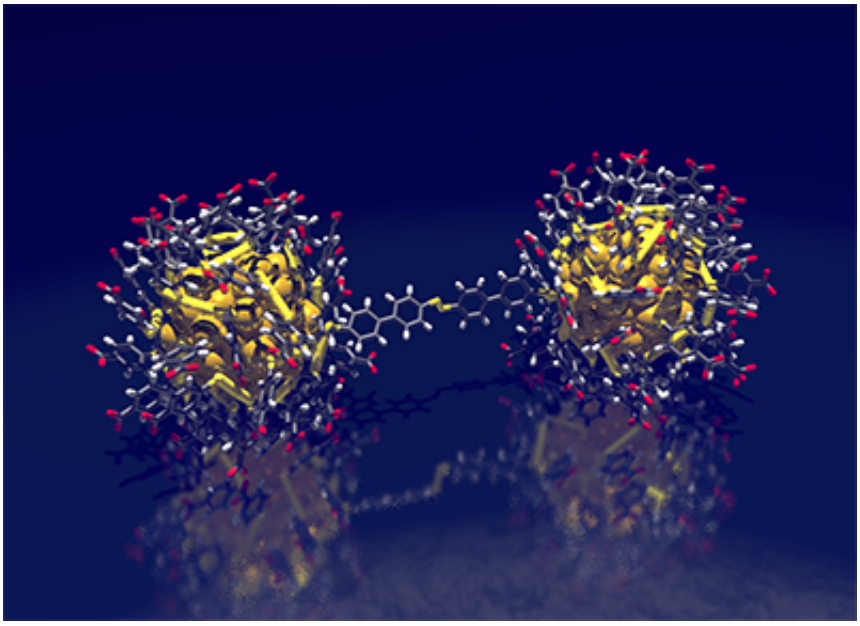

Credit: Suomen Akatemia (Academy of Finland)

Researchers at Nanoscience Center of University of Jyväskylä in Finland have succeeded in producing short chains and rings of gold nanoparticles with unprecedented precision. They used a special kind of nanoparticles with a well-defined structure and linked them together with molecular bridges. These structures – being practically huge molecules – allow extremely accurate studies of light–matter interaction in metallic nanostructures and plasmonics. This research was funded by the Academy of Finland.

Nanotechnology gives us tools to fabricate nanometer sized particles where only a few hundred metal atoms form their core. New interesting properties emerge in this scale, for example, the light–matter interaction is extremely strong and catalytic activity increased. These properties have led to several applications, such as, chemical sensors and catalysts.

"Synthesis of nanoparticles usually yields a variety of sizes and shapes," say lecturer Dr Tanja Lahtinen. The approach we use is exceptional in the sense that after purification we get only a single type of a nanoparticle. These nanoparticles have a specified number of each atom and the atoms are organized as a well-defined structure. It is essentially a single huge molecule with a core of gold.

These nanoparticles were linked with molecular bridges forming pairs, chains, and rings of nanoparticles.

"When these kind of nanostructures interact with light, electron clouds of the neighboring metal cores become coupled," explains researcher Dr Eero Hulkko. The coupling alters significantly the electric field what molecules in between the particles feel.

"Studying nanostructures that are well-defined at the atomic level allows us to combine experimental and computational methods in a seemless way," continues Dr Lauri Lehtovaara, Research Fellow of the Finnish Academy. We are aiming to understand light–matter interaction in linked metallic nanostructures at the quantum level. Deeper understanding is essential for development of novel plasmonic applications.

The research continues a long-term multidispilinary collaboration at Nanoscience Center of University of Jyväskylä.

"I am very happy that our dedicated efforts on studying monolayer

protected clusters and their applications have created an unique multidisiplinary center of excellence which is able to continuously publish high impact science," says Hannu Häkkinen, an Academy Professor and head of the Nanoscience Center.

More information: Tanja Lahtinen et al. Covalently linked multimers of gold nanoclusters Au(p-MBA)and Au(p-MBA), *Nanoscale* (2016). DOI: 10.1039/c6nr05267c

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