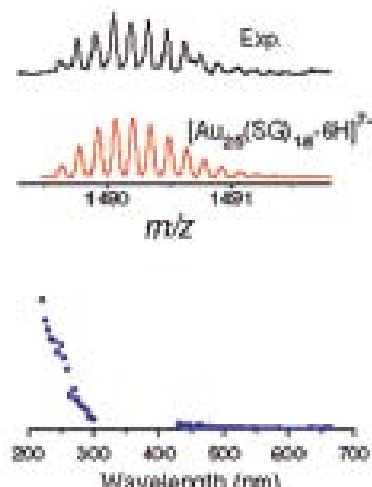
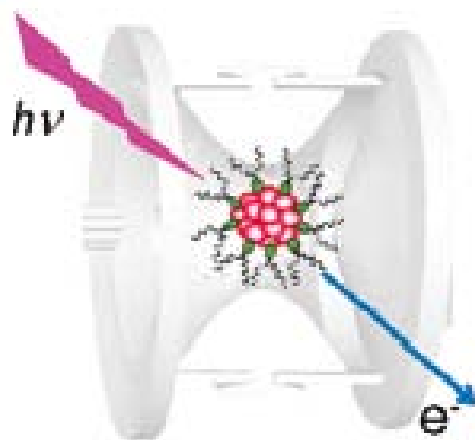


Electron Emission of Gas-Phase $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^{7-}$ -Gold Cluster and Its Action Spectroscopy

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Introduction :

- ❖ Tremendous efforts have been done for the development of new chemical routes and separation strategies to produce mono-disperse size selected ligand protected cluster .
- ❖ Knowing the intrinsic properties of protected nanoclusters is crucial for accurate forecast and understanding of the evolution of their properties in many environment and for comparison with theoretical predictions.
- ❖ In this paper they have recorded first time gas-phase action spectrum of $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^7^-$ gold QCs and compared with its solution absorption spectrum.

Instrumentation :

- ❖ The experimental setup consists of a LCQ Duo quadrupole ion trap mass spectrometer 39 (Thermon Finnigan, San Jose, CA, with a mass range of 50-2000) equipped with an ESI source and coupled to a Panther OPO laser pumped by a 355 nm Nd/YAG Power Lite 8000 (5 ns pulse width, 20 Hz repetitionrate).
- ❖ The vacuum chamber and the central ring electrode were adapted to allow the injection of the laser beam at the centre of the ion trap.
- ❖ The laser irradiation is synchronized with the presence of ions in the trap by using an electromechanical shutter triggered on the RF signal of the ion trap.
- ❖ The laser power was adjusted using a half-wave plate and a polarizer. The reflection on the chamber quartz window is used to monitor continuously the laser power.

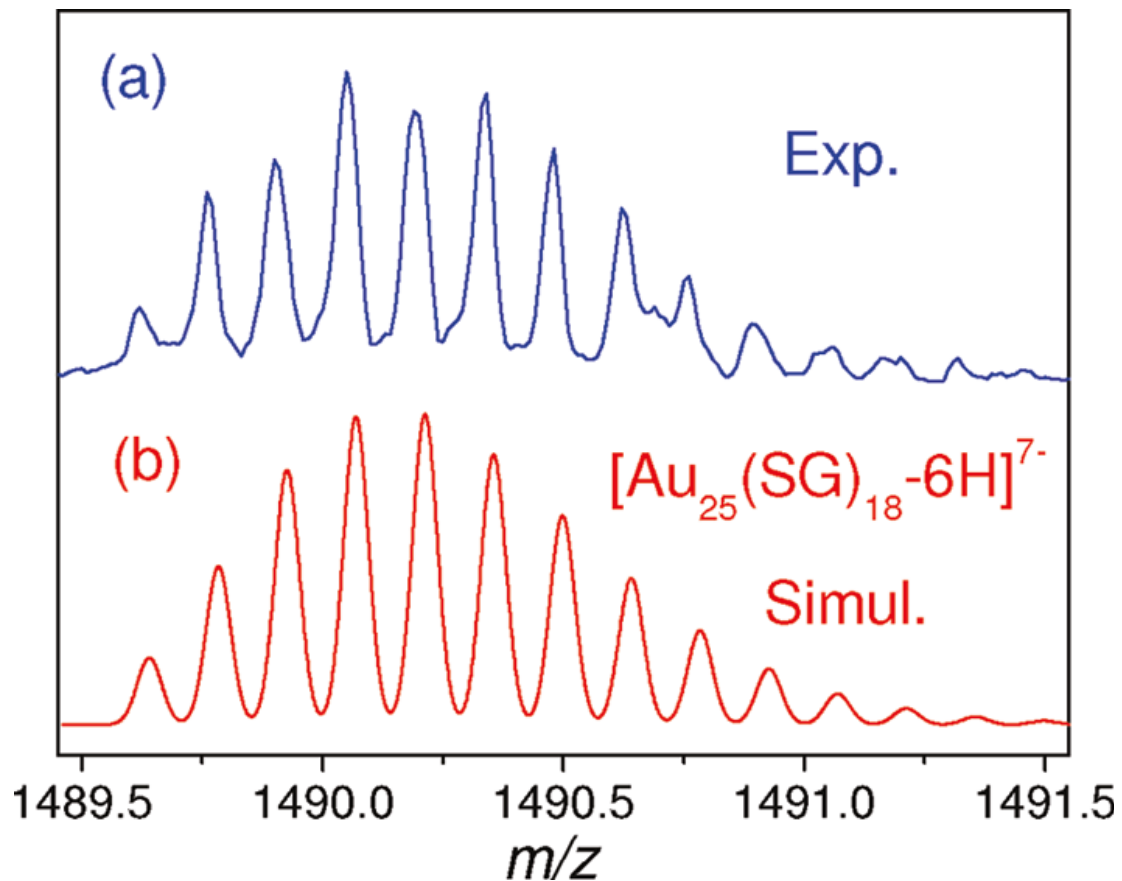
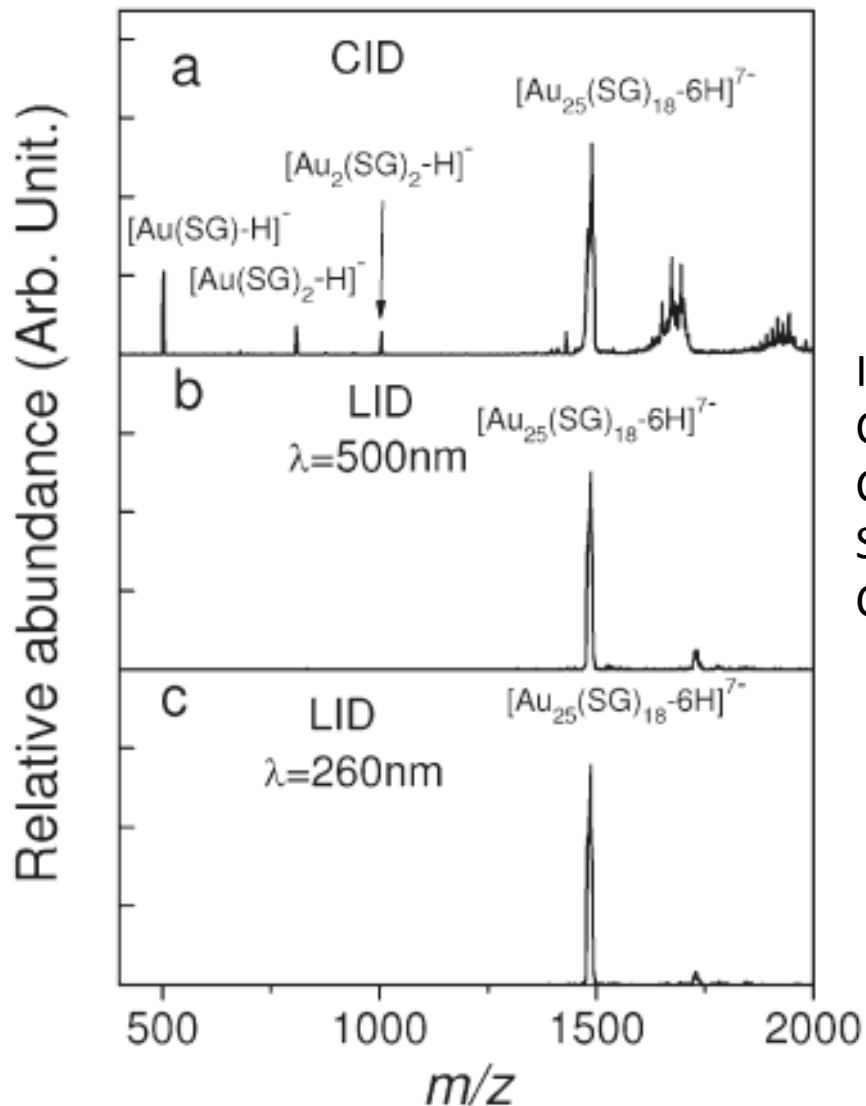


Figure 1. (a) Experimental isotopic distribution of the seven negatively charged-protected metal gold clusters. (b) Calculated isotopic distribution for $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^{7-}$.



In case of CID spectrum singly charged fragment corresponding to single complexes and GSH cleavage took place. Whereas in case of LID spectrum electron detachment from the initial cluster happened.

Figure 2. MS/MS spectrum of the $[\text{Au}_{25}(\text{SG})_{18}-6\text{H}]^{7-}$ ion under different activation Condition. (a) CID spectrum (b) LID spectrum at $\lambda=500\text{ nm}$ (c) LID spectrum at $\lambda=260\text{ nm}$

They measured the the electron photo detachment yield as a function of laser wavelength (220-300 and 430-650 nm ranges) using the following equation

$$Y = \ln \left[\frac{I_{[\text{Au}_{25}\text{SG}_{18}]^{7-}} + I_{[\text{Au}_{25}\text{SG}_{18}]^{6-}}}{I_{[\text{Au}_{25}\text{SG}_{18}]^{7-}}} \right] \frac{1}{P\lambda}$$

where $I_{[\text{Au}_{25}\text{SG}_{18}]^{7-}}$ is the intensity of $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^{7-}$ after irradiation, $I_{[\text{Au}_{25}\text{SG}_{18}]^{6-}}$ is the intensity of $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^{6-}$, and P and λ are the laser power and laser wavelength, respectively.

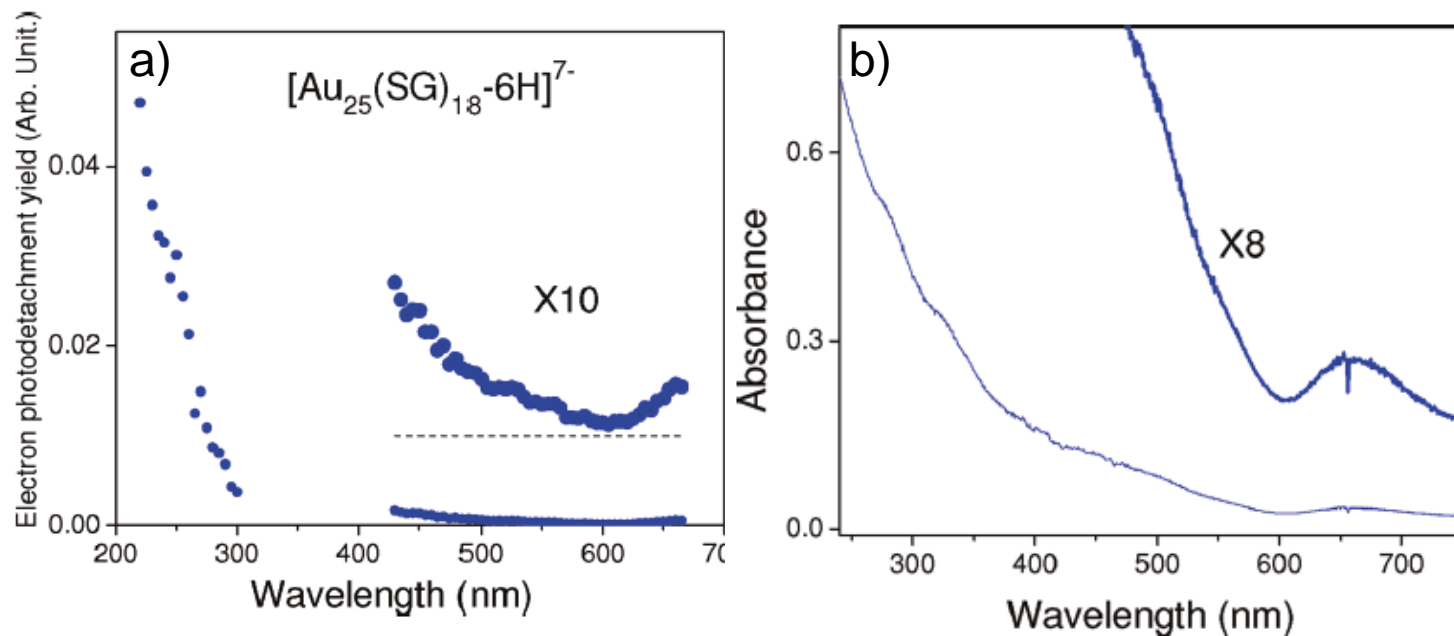


Figure 3. a) Electron photo detachment yield measured as a function of the laser wavelength for $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^{7-}$. b) UV-vis absorption spectrum of $\text{Au}_{25}(\text{SG})_{18}$ in water (concentration $\sim 4 \mu\text{mol L}^{-1}$).

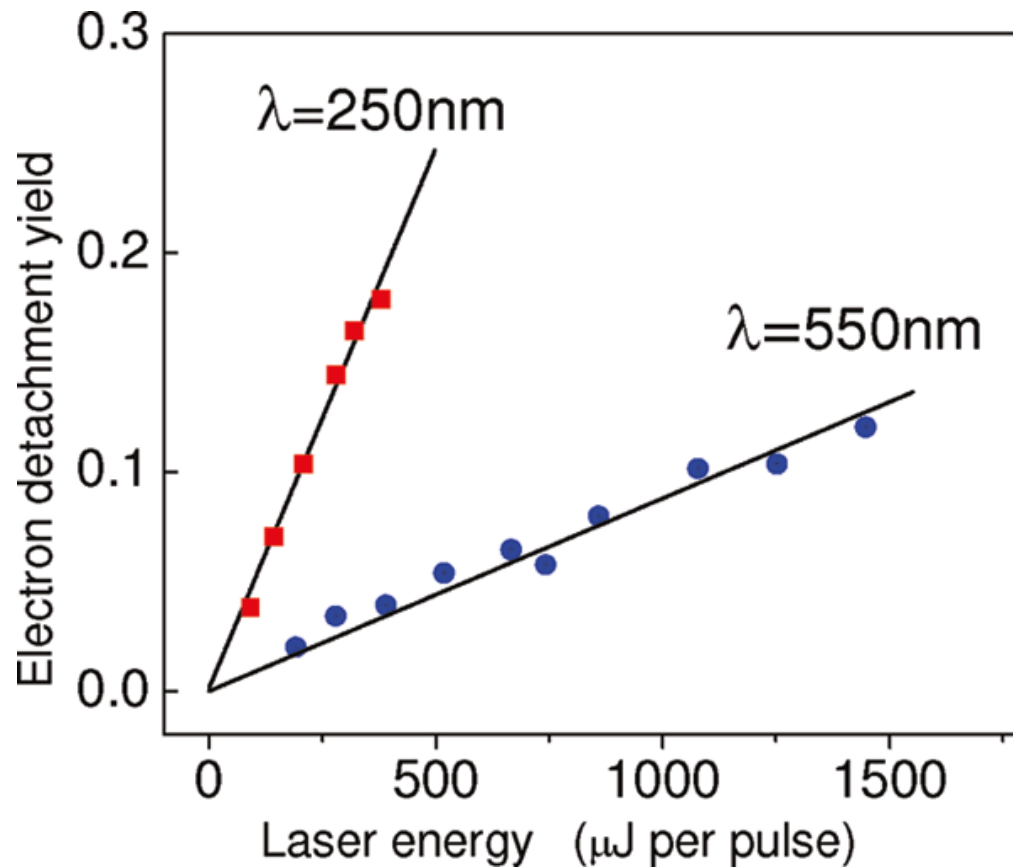


Figure 4. Electron photodetachment yield measured as a function of the laser power at $\lambda = 250\text{ nm}$, irradiation time 100 ms and $\lambda = 550\text{ nm}$, irradiation time: 500 ms.

Conclusion:

- ❑ Photo excitation of $[\text{Au}_{25}(\text{SG})_{18}\text{-6H}]^{7-}$ results electron detachment.
- ❑ The electron detachment is one photon process.
- ❑ They obtained first gas-phase optical action spectrum on such species .
- ❑ The recorded gas-phase spectrum is similar to the one obtained in solution with sp-sp intraband and sp-d interband transitions.

Future scope :

- To do an experiment (CID) with a mixture of He and O₂ for Au₁₈SG₁₄.
- To do an experiment (LID) to confirm from where electron detachment of [Au₂₅SG₁₄-6H]⁷⁻ take place.

Thank you!
Jim

