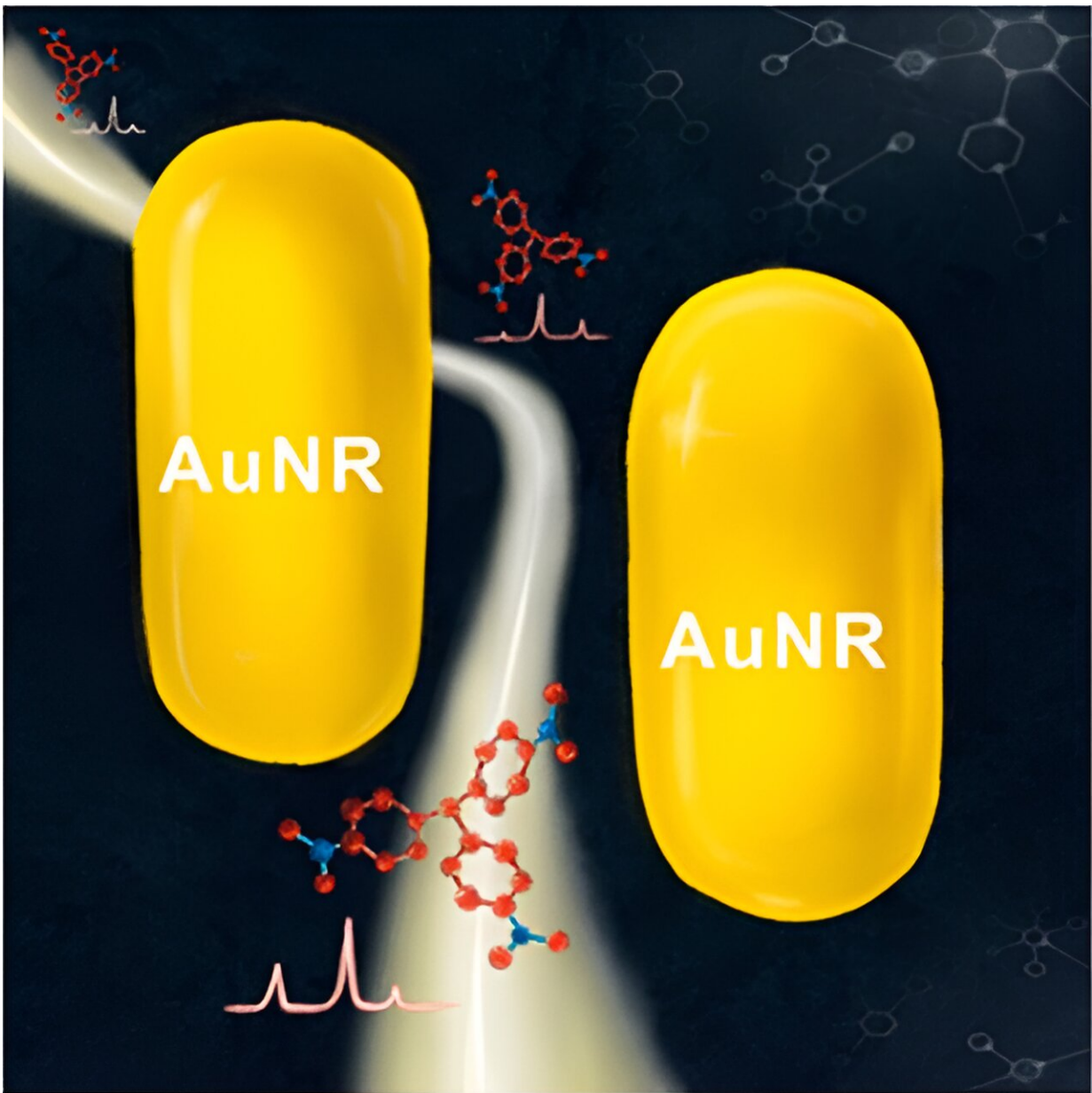


# Scientists use SERS technology to accurately monitor single-molecule diffusion behavior

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Graphical abstract. Credit: *The Journal of Physical Chemistry Letters* (2023).  
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A research team led by Prof. Yang Liangbao from the Hefei Institutes of Physical Science of the Chinese Academy of Sciences has used surface-enhanced Raman spectroscopy (SERS) to accurately monitor the diffusion behavior of a single molecule in the sub-nanometer space.

The [study](#) was published in *The Journal of Physical Chemistry Letters*.

SERS technology, a highly sensitive and selective analytical technique, enables single-molecule-level analysis by inducing a resonance phenomenon on a [metal surface](#) that significantly enhances the molecular Raman signal. However, long-term monitoring of unlabeled single molecules remains a challenge.

In this study, the researchers used the excellent photothermal effect of gold nanorods to construct [hotspot](#) structures with a gap size of ~ 1.0 nm using laser reconstruction.

The constructed hotspot not only provided excellent SERS enhancement but also actively trapped the target molecules, enabling real-time monitoring and analysis of the diffusion behavior of crystalline violet single molecules.

"This allowed us to observe the blinking behavior of single crystalline violet molecules for durations of up to four minutes using dynamic surface-enhanced Raman spectroscopy," said Yan Wuwen, a member of team.

Combining density functional theory (DFT) calculations and SERS

mapping results, they concluded that the single crystalline violet molecules can be confined in sub-nanometer space.

This study provides a unique way to understand molecular interactions, [chemical reactions](#), and the behavior of biomolecules.

**More information:** Wuwen Yan et al, Real-Time Monitoring of a Single Molecule in Sub-nanometer Space by Dynamic Surface-Enhanced Raman Spectroscopy, *The Journal of Physical Chemistry Letters* (2023). DOI: [10.1021/acs.jpcllett.3c02276](https://doi.org/10.1021/acs.jpcllett.3c02276)

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