

# Coherent Vibrational Micro-Spectroscopy Enables Nano-Biophotonics Studies

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Biophotonics is a vibrant interdisciplinary field exploring the interaction between electromagnetic radiation and biological materials such as sub-cellular structures and molecules in living organisms. Biophotonics research leads to applications in agriculture and life sciences, and produces tools for medical diagnostics and therapies. Within this broad field, we have recently made advances in ultrasensitive Raman-spectroscopic probing of viruses. Our approach is based on laser spectroscopy aided by plasmonic nanoantennas, as in tip-enhanced Raman spectroscopy (TERS). An additional enhancement in sensitivity and speed is obtained by employing the femtosecond adaptive spectroscopic technique (FAST) for coherent anti-Stokes Raman scattering (CARS). The combined approach allows nondestructive label-free biosensing with molecular-level sensitivity and with spatial resolution down to a fraction of a nanometer. This work will contribute to biomedical research and may well become a future approach for investigating and combatting diseases. Furthermore, the unique tool promises to find applications in, for example, materials research addressing the structure and function of novel systems, including topological and reduced-dimensionality materials.

\* A large number of people have contributed to this work; I will give proper acknowledgements during my presentation. In particular, I want to thank my co-authors on Refs. [1-5].

## References

- [1] V Deckert, Z Yi, A V Sokolov and M O Scully, *Biophotonics* **28**, 32 (2021)
- [2] V Deckert, T Deckert-Gaudig, D Cialla-May, J Popp, R Zell, S Deinhard-Emmer, A V Sokolov, Z Yi and M O Scully, *Proc. Natl. Acad. Sci. U.S.A.* **117**, 27820 (2020)
- [3] N Rajil, A Sokolov, Z Yi, *et al.*, *Nanophotonics* **10**, 235 (2021)
- [4] Z He, W Qiu, M E Kizer, J Wang, W Chen, A V Sokolov, X Wang, J Hu and M O Scully, *ACS Photonics* **8**, 424 (2021)
- [5] J Wang, K Wang, Y Shen, Z Han, F Li, Z He, D-W Wang, A V Sokolov and M O Scully, *ACS Photonics* **8**, 1137 (2021)