Raman Microscopy with Two Counter-Propagating Beams

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Motivation

Fluorescence microscopy suffers from:

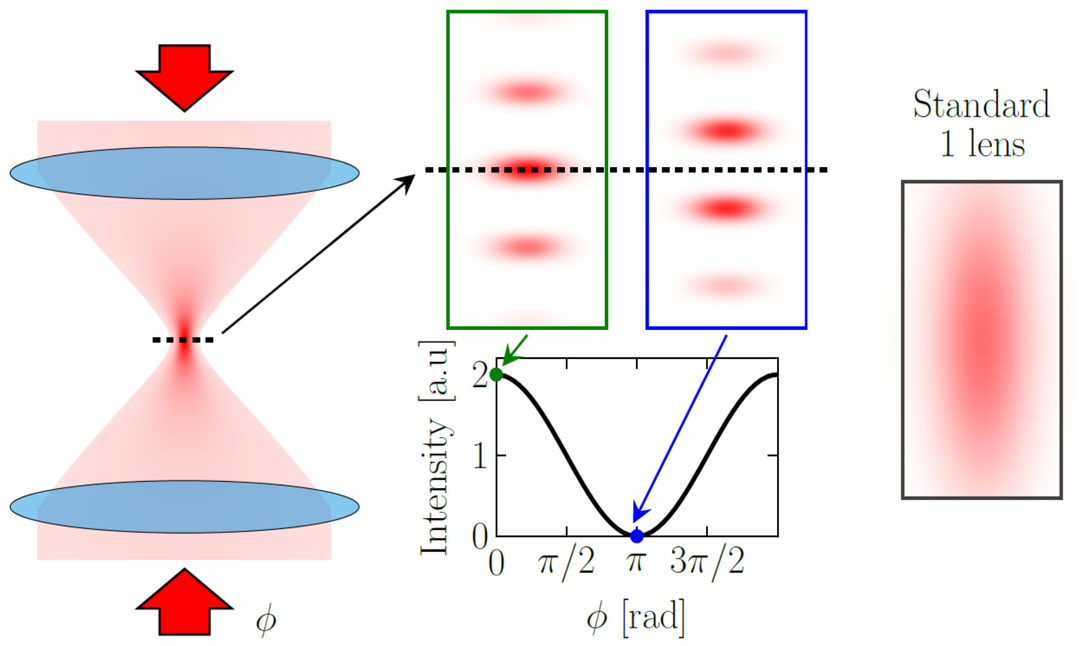
- Photobleaching
- Extrinsic fluorophores can affect the specimen

Using the intrinsic Raman signal solves these issues, but is weak and has low resolution.

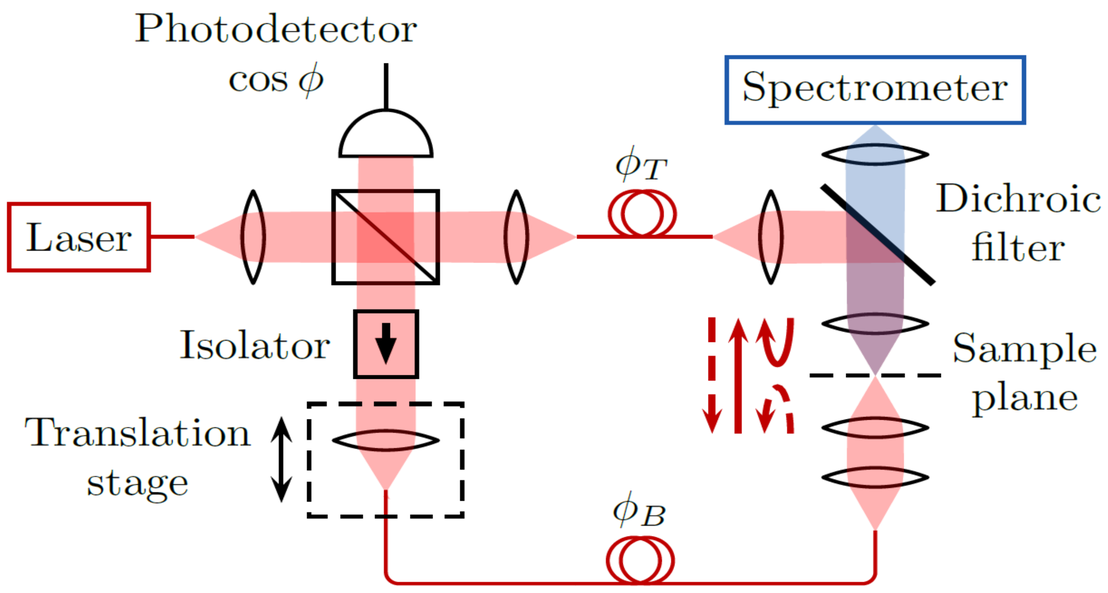
Novel Raman microscopy technique: Two counter-propagating pump beams generate an interference pattern that focuses the light into a smaller volume.

Compared to standard Raman microscopy we get:

- Better spatial resolution
- Larger Raman signal

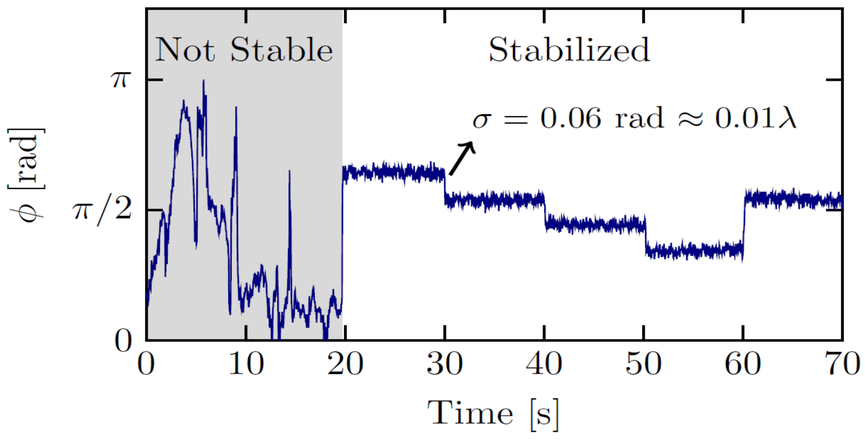


Experimental Setup



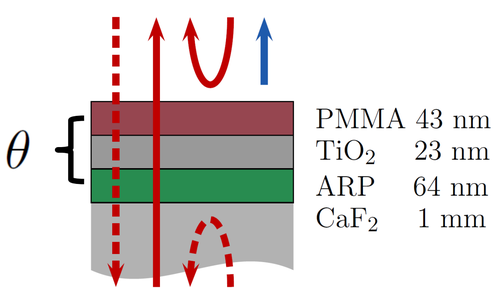
The interferometer allows us to:

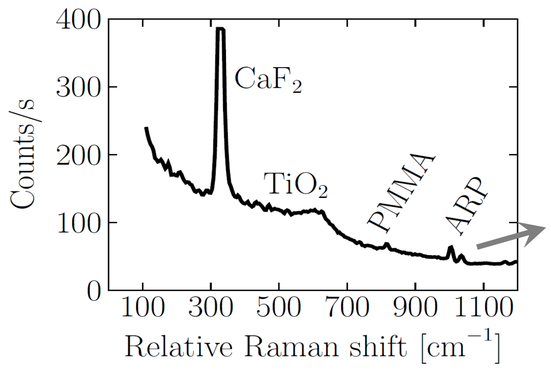
- Control the phase at the sample plane
- Get rid of the phase noise.

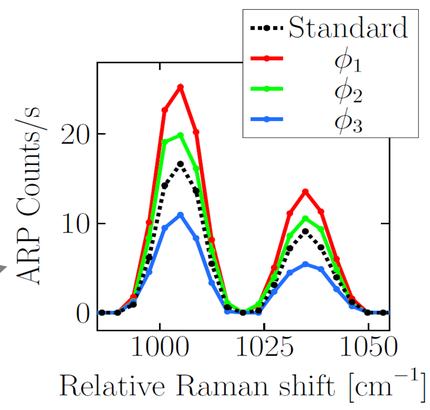


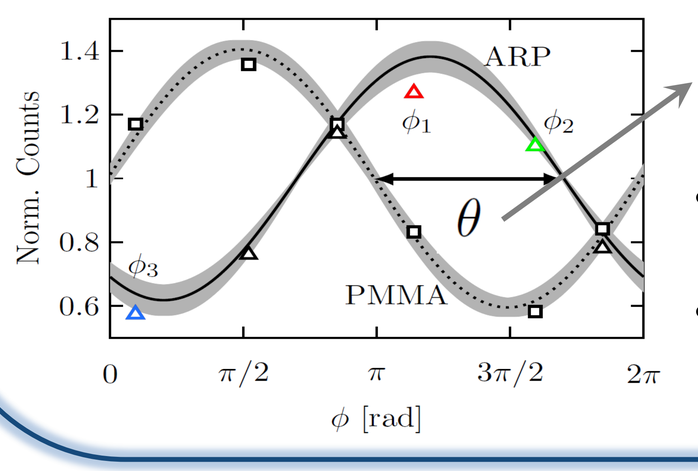
Results

Identify materials and their separation in a nanolayer stack





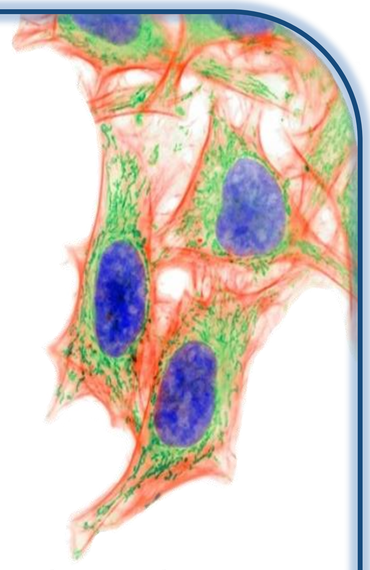




~ Optical path length between nanolayers

- 6 nm precision
- x1.4 Raman signal

Upcoming



- 3D Biological tomography
- Collect Raman from both sides
- Measure refractive index and physical length from nanolayers

Conclusion

Besides increasing the signal and resolution, the proposed Raman microscopy technique provides additional advantages. It detects the chemical fingerprint and structure of the sample, something not feasible with fluorescence.

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