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LETTERS

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Observing the localization of light in space and time by ultrafast second-harmonic microscopy

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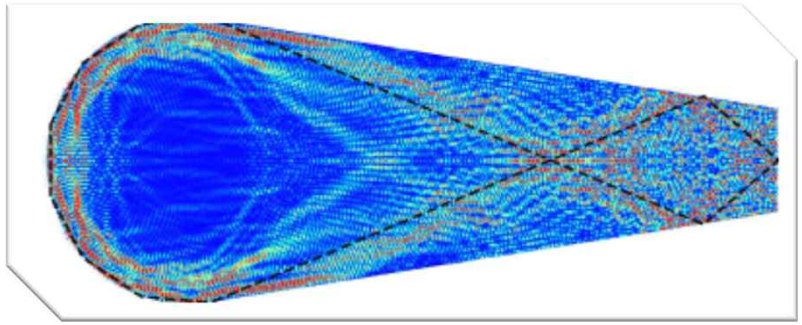
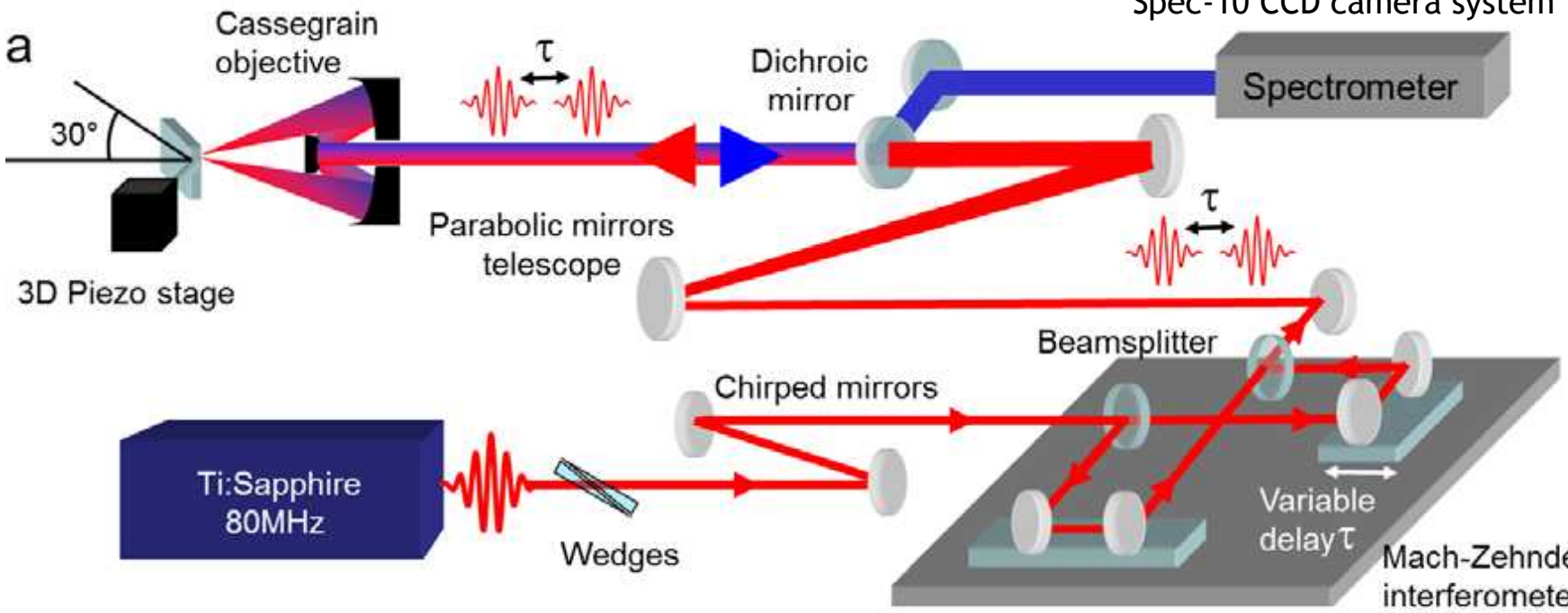


Optics Express, 20, 13651-13656 (2012).

Experimental configuration

Acton SpectraPro-2500i
Spec-10 CCD camera system

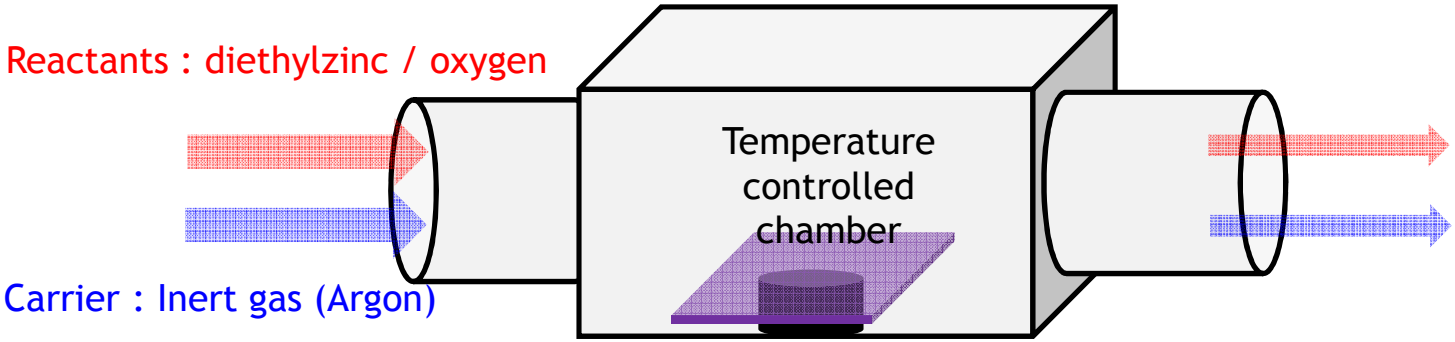


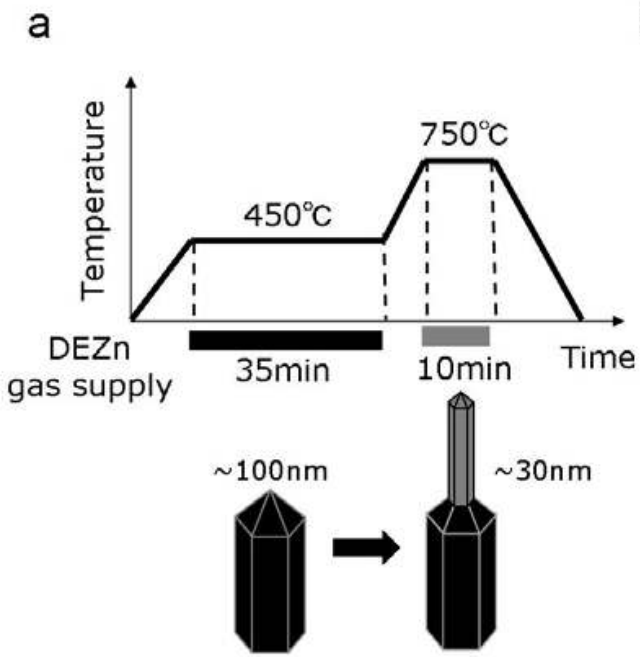
FEMTOLASERS, Rainbow™ (2.5nJ / 6fs)

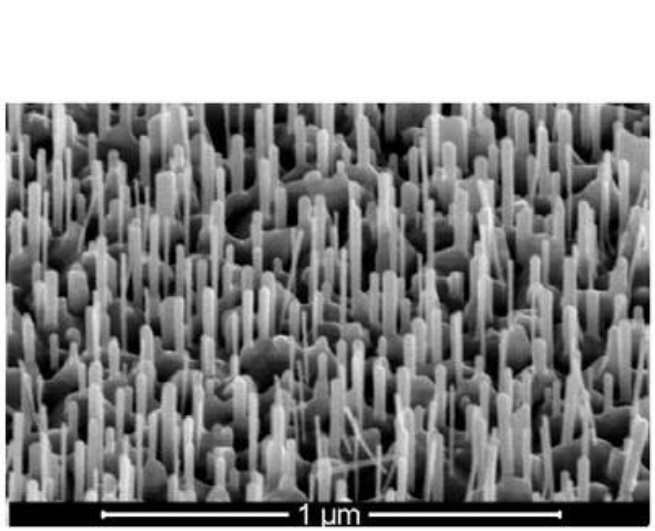
P-621.1CD PIHera® XY Piezo Stage
(accuracy ~ 0.1nm, 30as)

Sample – ZnO nanorods

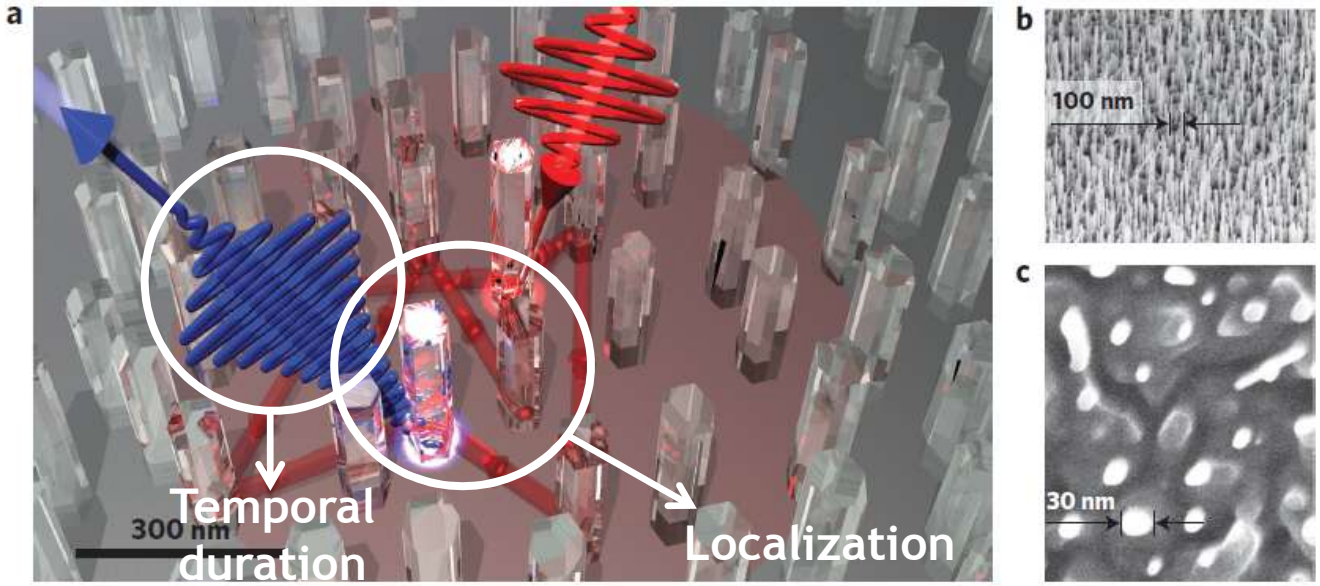
MOVPE on a sapphire (0001) substrate







What they wanted to see?



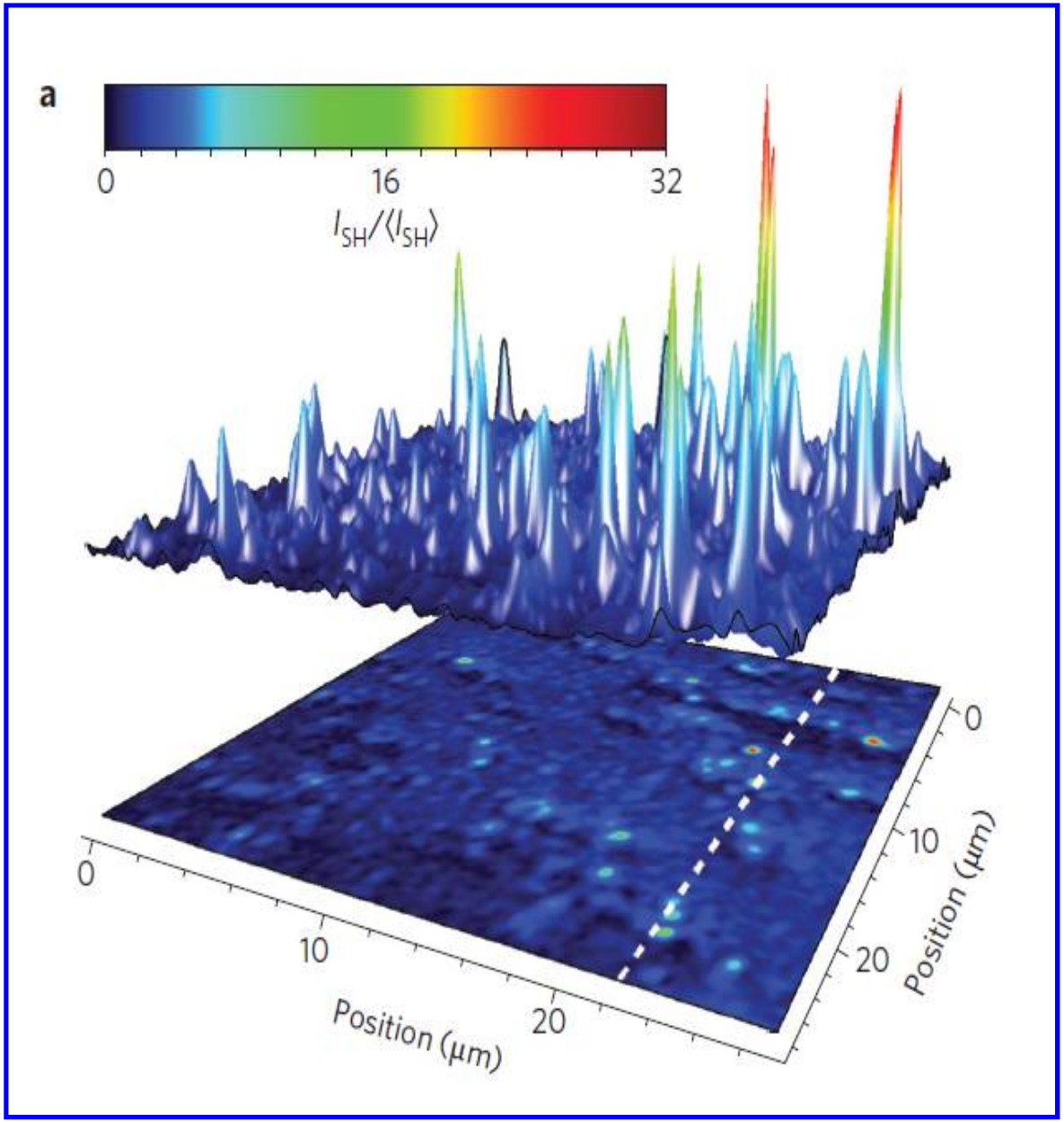
ZnO provide ➡ **Large $\chi^{(2)}$ (near 400nm due to 3.3eV bandgap)**

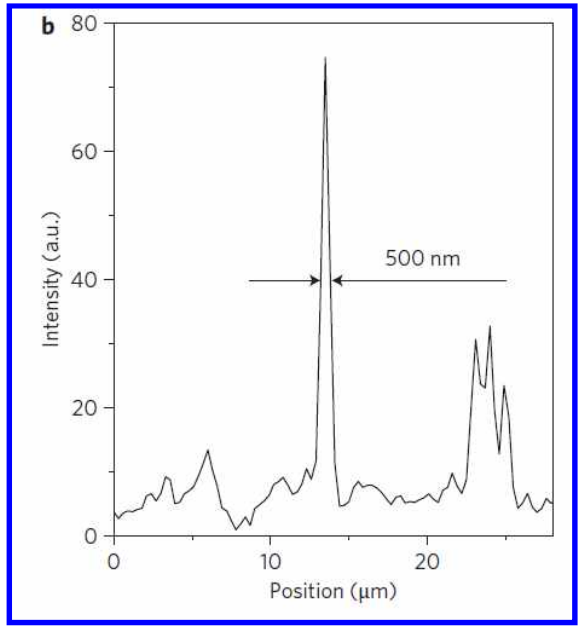
➡ **High refractive index (~1.9 at 800nm) / work as good scatterer**

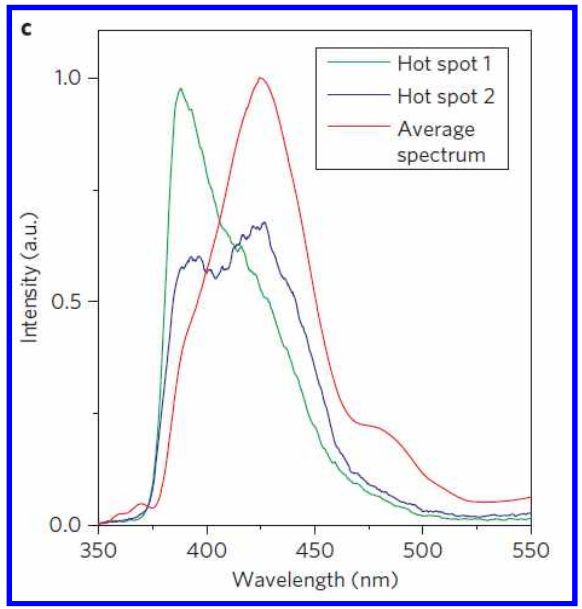
➡ **Can be fabricated as fine nanostructures**

$$E_{SHG} \propto \left| E(t) + E(t+\tau) \right|^2$$

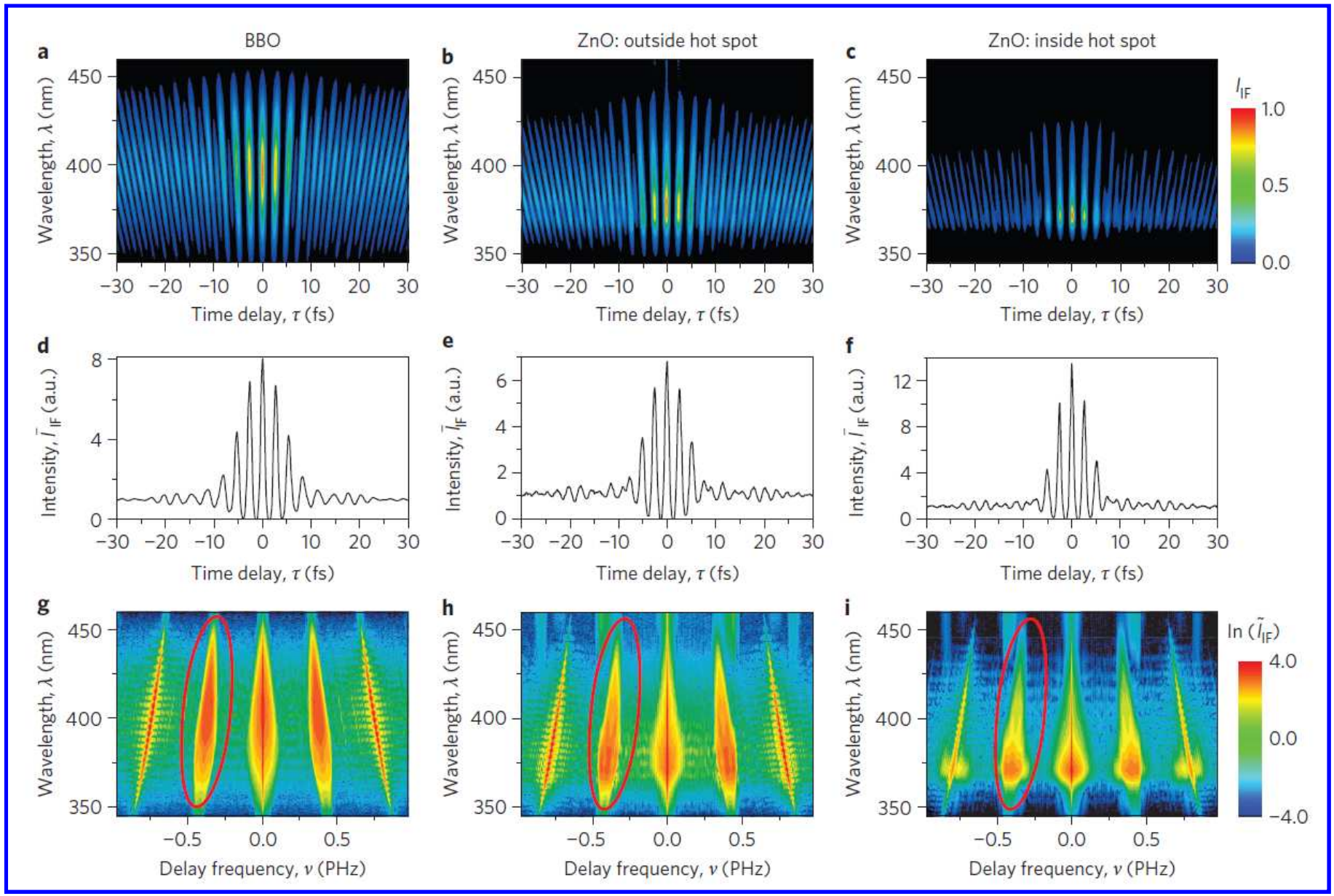
Spatial profile of SHG signal



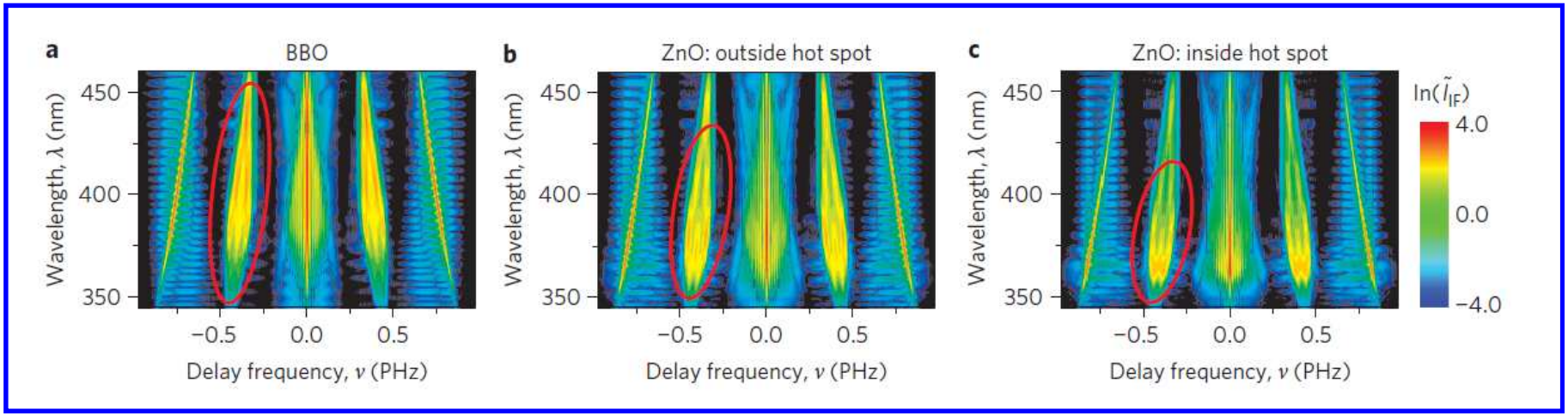




Spectral interferogram of SHG

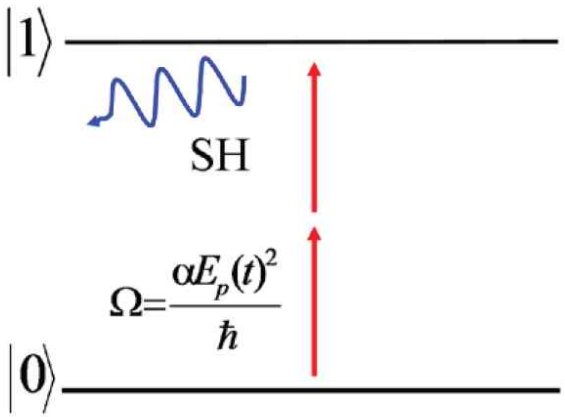


Simulated interferogram with two level system



*** Optical Bloch equation for two level system**

$$H_0 = \hbar\omega_0 |0\rangle\langle 0| + \hbar\omega_1 |1\rangle\langle 1| + \hbar\Omega(t)\left(|1\rangle\langle 0| + |0\rangle\langle 1|\right) \qquad \Omega(t) = \alpha \frac{E_p(t)^2}{\hbar}$$



T_1 = decay lifetime of $|1\rangle \propto$ decay lifetime of the local field

$$\frac{\partial}{\partial t}\rho = -\frac{i}{\hbar}[H,\rho] + \frac{\partial}{\partial t}\rho\Big|_{rel} \qquad \rho = \begin{bmatrix} \rho_{11} & \rho_{12} \\ \rho_{21} & \rho_{22} \end{bmatrix}$$