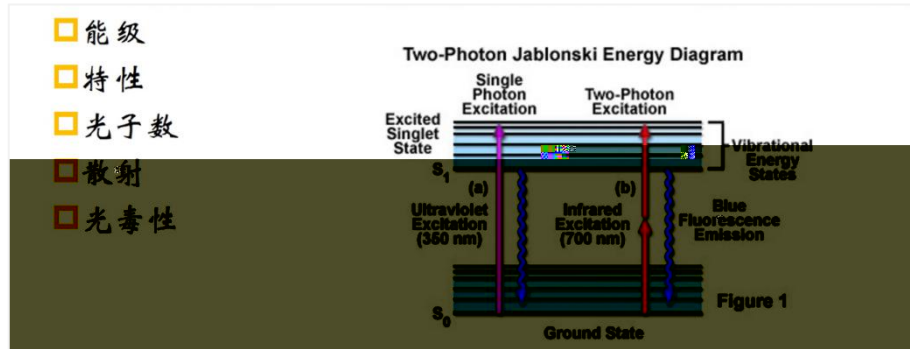
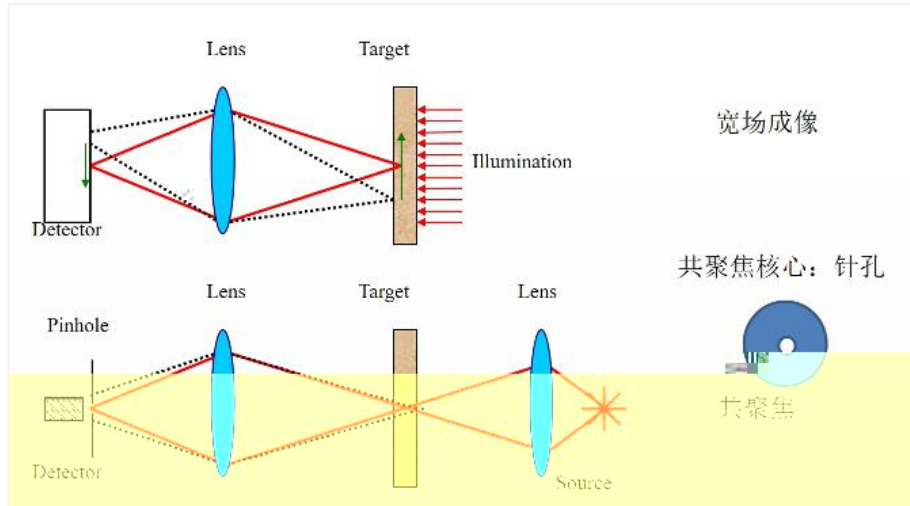


Cell

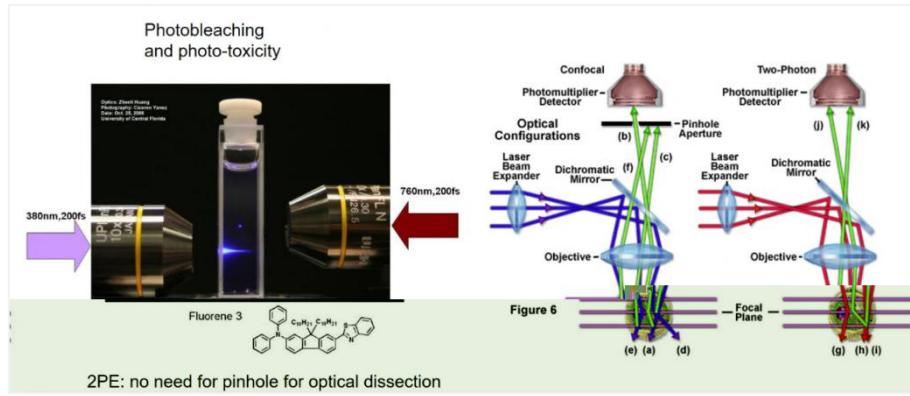


1.

SPE

$10^{-18}$

TPE




2.

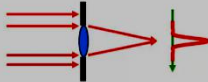
+

700-1500nm

4mm


 **认识分辨率**

- 什么是点?
- 点→点扩展函数
- PSF 决定了分辨率



$$d = \frac{\lambda}{2NA}$$

- 分辨:
  - 如果点扩展函数比较宽,
  - 当两个点靠得太近且同时发光时,
  - 它们就不能被分辨。



1.

PSF

200nm

1)

d---STED

STED ---

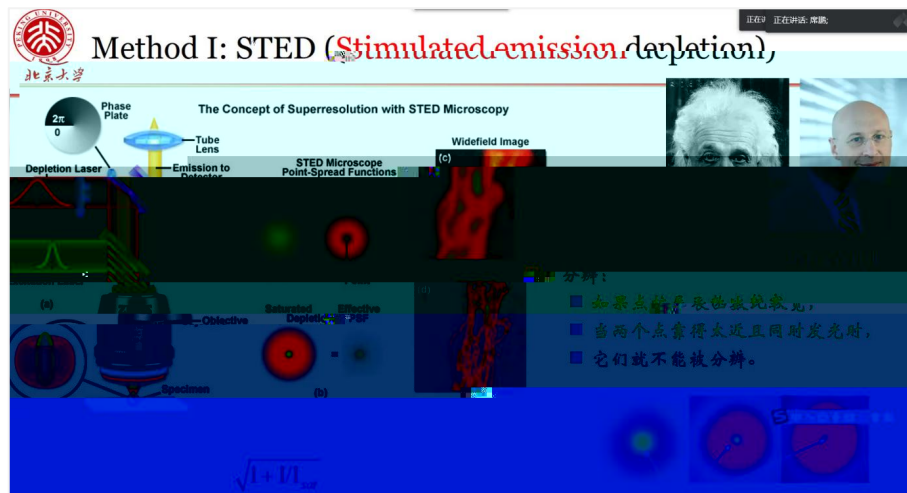
d

TIRF

evanescent

field Z

MEANS-STED




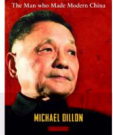
2)

PALM/STORM


PALM/STORM ---


PALM/STORM


**Photo-Activation Localization Microscopy**
正在直播: 课程



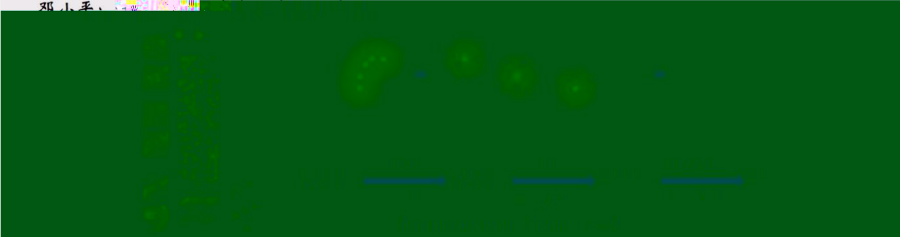
Michael Hellmann





分辨:

- 如果点扩展函数比较宽,
- 当两个点靠得太近且同时发光时,
- 它们就不能被分辨。



3)

---


SIM

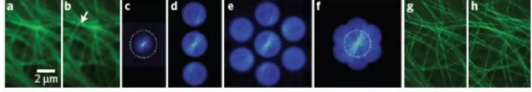
SIM


---

2

SIM


**SIM**
Mats Gustafsson (1960-2011)







4)

February 1, 1995 / Vol. 20, No. 3 / OPTICS LETTERS 237

北京大学

### Proposed method for molecular optical imaging

E. Betzig  
NSOM Enterprises, 17 Webster Drive, Berkeley Heights, New Jersey 07922

- Separate at one optical dimension;
- Localize each molecule;
- Sum up all the molecules to get super-resolution.

- Physical dimensions of fluorescence
  - Spectrum
  - Lifetime
  - Orientation

Fig. 1. (a) Field of discrete features as conventionally imaged in  $m$  spatial dimensions with a broad PSF. (b) Same features after isolation in  $m + n$  dimensions on the basis of  $n$  distinguishing optical characteristics. (c) Final image reconstructed at resolution  $\delta x$  given by the uncertainty in the measured position of each isolated feature. In general,  $|\delta x| \ll \text{PSF}$ .

Eric Betzig

PALM/STORM

SDOM

SIM

SIM

北京大学

### Similarities between structure illumination and dipole excitation

(a) Structured illumination setup: Objective, Lens, Grating, Tube Lens, Dichroic, Detector, PM. (c) Spatial Dimension sinusoidal modulation.

(b) Dipole modulation setup: Objective, Lens, Mirror, Tube Lens, Dichroic, Detector, PM. (d) Dipole Orientation sinusoidal modulation.

Structured illumination:  
Sinusoidal in spatial domain

Dipole modulation:  
Sinusoidal in orientation domain

2.

一项新技术通常采取如下两种途径来造福科研界：

- 将相关技术开放获取，其他学者通过搭建类似系统来得到应用；
- 将相关技术商业化，其他学者通过采购仪器来得到应用。

该工作开辟了推动科研的第三条途径：通过深入挖掘SIM技术及商用仪器的潜在特性，为现有的SIM系统“赋能”，挖掘出了包括其发明人都没有注意到的现有SIM系统内在的偏振探测特性，使现有系统不经任何改动，就可以实现偏振SIM的功能。

成像技术的发展目标：轻快生活

1.

2.

CCD sCMOS

3.

4.

5. RUSH and MOST

6. Lensfree

7. Deep learning and AI with microscopy AI pathology

- 新兴成像技术的核心是：通过多学科交叉，引入新的“奇思妙想”，将一个领域的知识和技术引入另一个领域，从而突破旧的技术壁垒，解决过去难以解决的问题
- 对于生物成像的几个共性问题：清、快、深、活
- 新兴成像技术需要我们走出自己原本的领域，带着原领域的技术来拓展出一片新的领地



Cross-platform

correlative microscopy

AI

random

AI

AI

