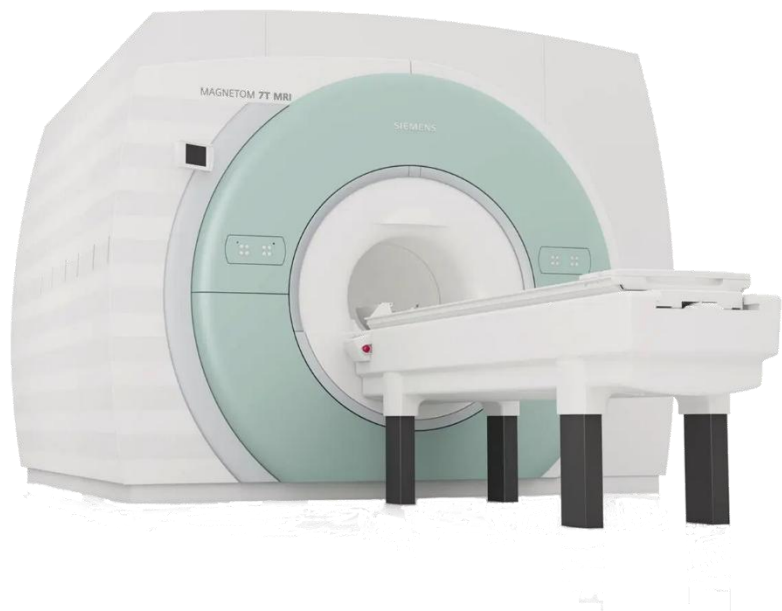


# 浙江大学7T磁共振成像平台



## 国内首家主动屏蔽的超高场7T磁共振

发展国际顶尖的跨物种、多模态、多尺度的成像技术

高精度脑功能结构定位和介观尺度功能单元成像调控为基础

发展多模态磁兼容整合技术开展交叉前沿研究

超高场磁共振场波普成像

**7T超高场磁共振成像系统**，相比传统高场磁共振设备，可以提供更高的成像信噪比、更精细的分辨率、更优异的组织对比度，更加适合观测组织精细结构和代谢生理变化，是脑科学研究的重要途径，将成为高水平脑科学研究和临床神经系统疾病研究的重要工具。

nature biomedical engineering

Science Advances

PNAS

NeuroImage

ADVANCED MATERIALS

npj | parkinson's disease

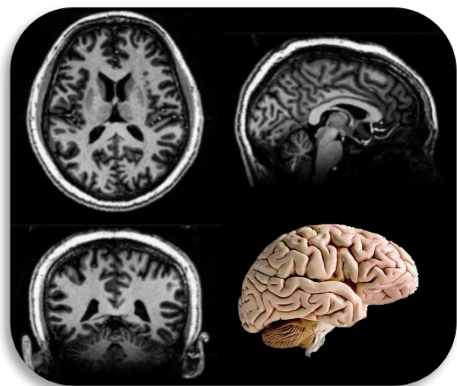
Molecular  
Psychiatry

IEEE Transactions on Medical Imaging

# 平台建设-7T磁共振成像

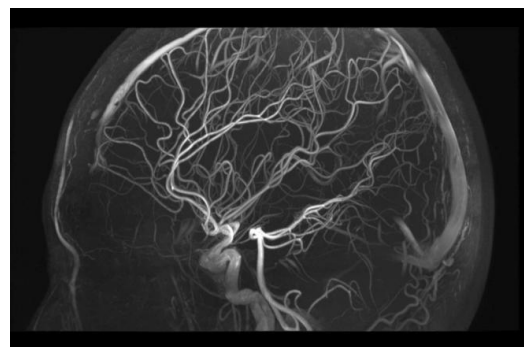
跨物种、多模态、多尺度

结构成像 (structural MRI)

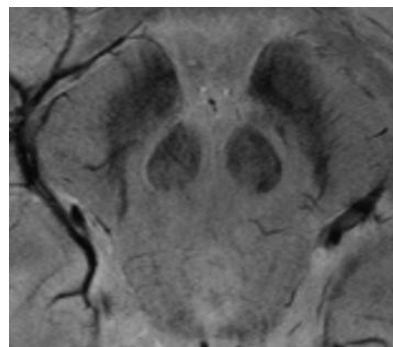


人脑

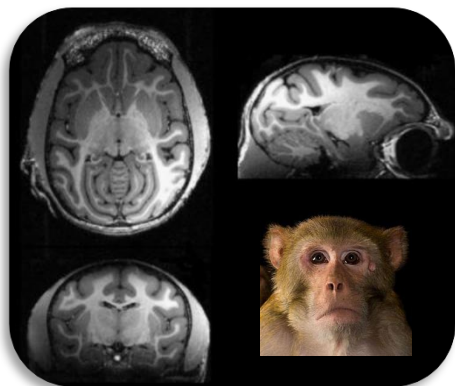
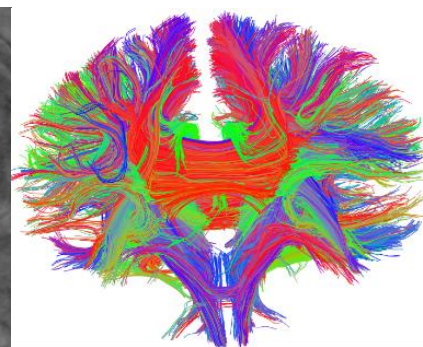
TOF 脑血管成像 (MRA)



磁敏感成像 (SWI) 铁沉积



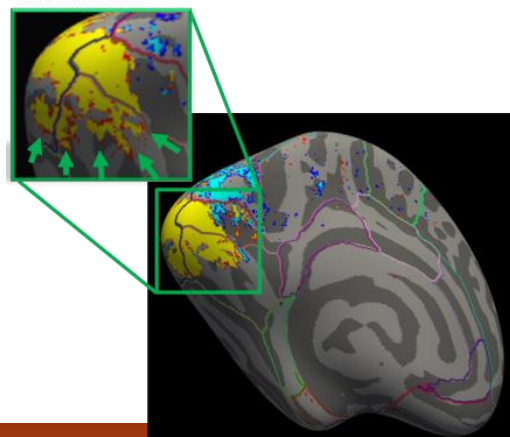
弥散张量成像(DTI) 神经纤维束跟踪



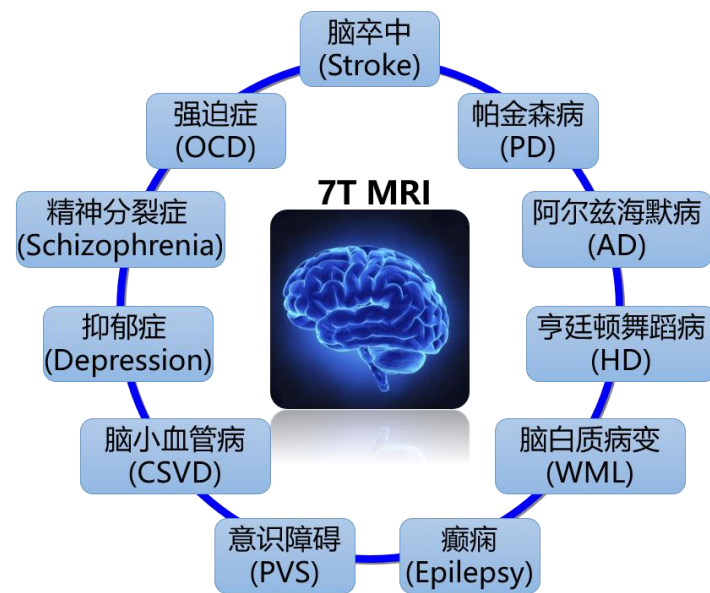
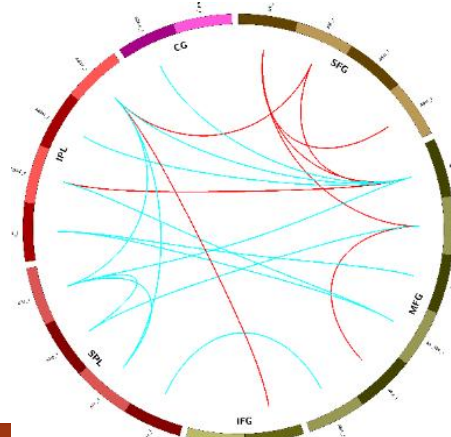
猕猴脑

功能成像 (functional MRI)

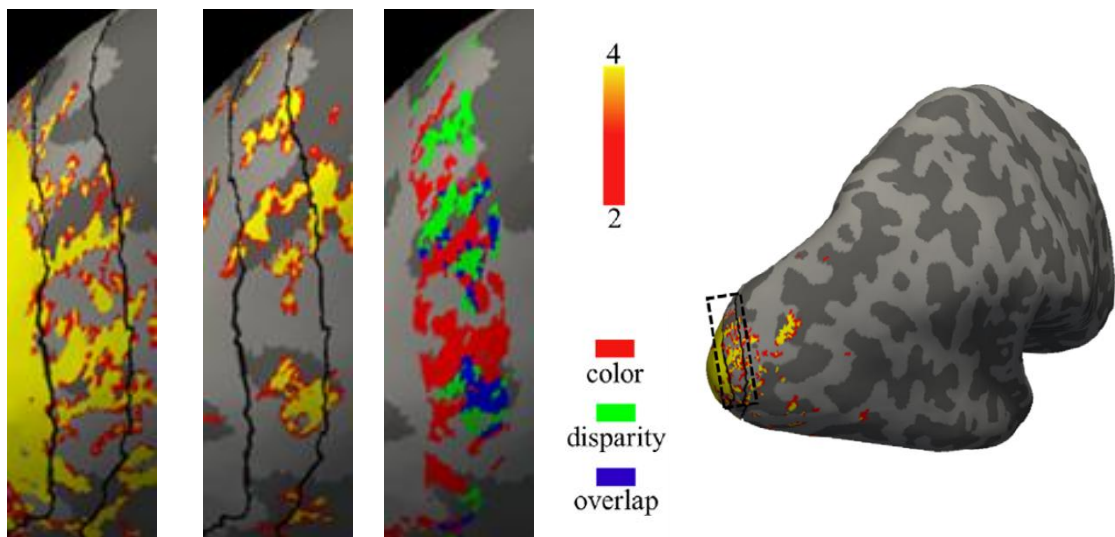
精准皮层功能成像



功能网络连结



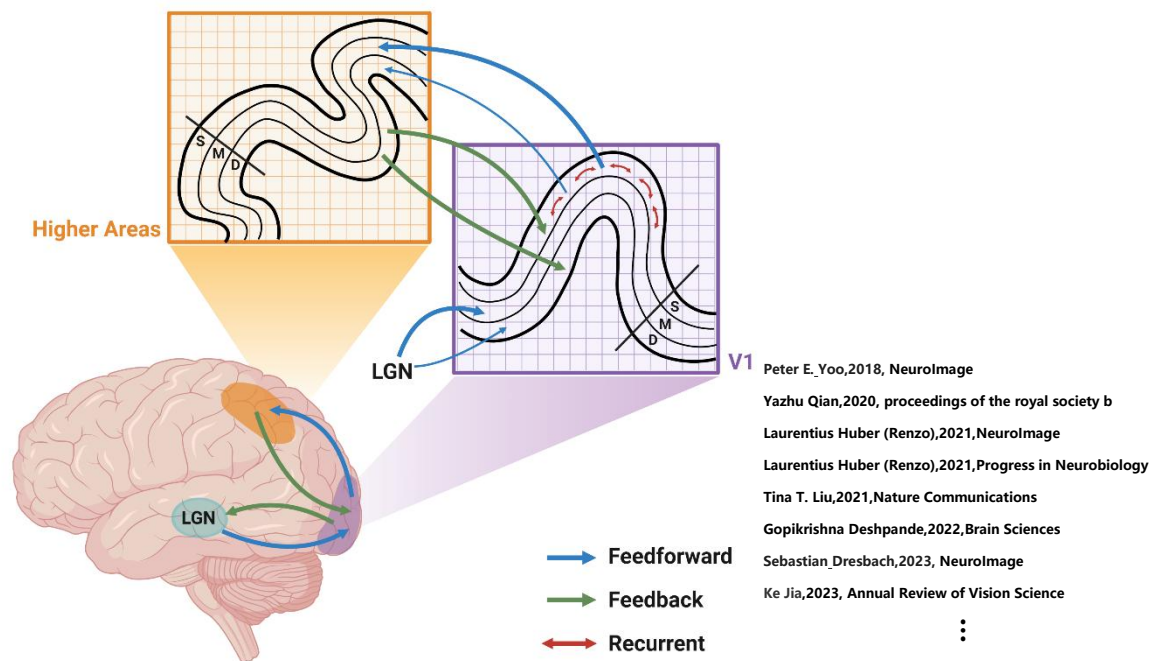
# 7T超高场分层和功能柱成像



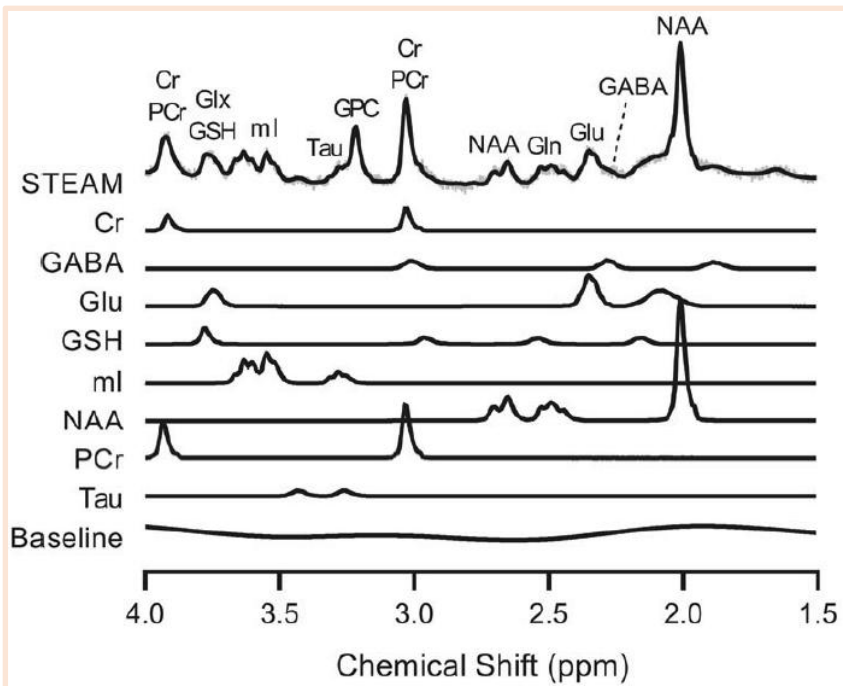
Jianbao Wang, 2022, Human brain mapping  
SIEMENS MAGNETOM 7T  
Zhejiang University 7T Brain Imaging Research Center

7T可以对介观尺度功能单元成像，用1mm isotropic分辨率对人类第二视觉区中分别对颜色和深度信息具有特异性的功能单元的成像。

使用7T的超高场fMRI（空间分辨率为0.8 mm），揭示了大脑内皮层下区域，以及柱状组织。这有助于深入理解大脑复杂计算，提高对大脑活动和信息处理的准确描述。



# 7T超高场波普成像

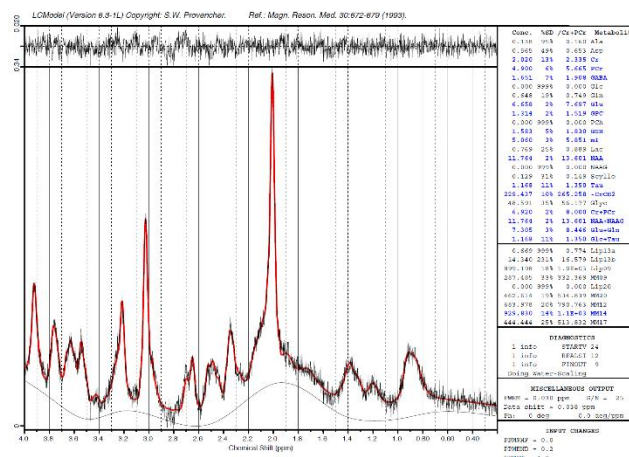


Middle temporal  
visual area



Xue Mei Song, 2021, Molecular Psychiatry  
SIEMENS MAGNETON 7T  
Zhejiang University 7T Brain Imaging Research Center

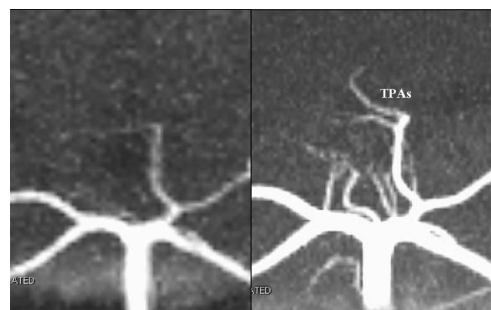
使用STEAM脉冲程序采集的前脑部单元活体核磁共振波谱，来自不同化学物质的谱线很容易就可以识别，特别是位于 $\delta$  2.0~3.0之间的GABA、Glu谱线，而在3.0 T下这些谱线是重叠在一起



Subechhya Pradhan, 2015, Magnetic Resonance Imaging  
Meredith A. Reid, 2018, Schizophrenia Bulletin  
Anna M. Wang, 2019, JAMA Psychiatry  
Jyothika Kumar, 2020, Molecular Psychiatry  
S. Andrea Wijtenburg, 2021, Frontiers in Psychiatry  
L. McCarthy, G. Verma, 2022, AJNR

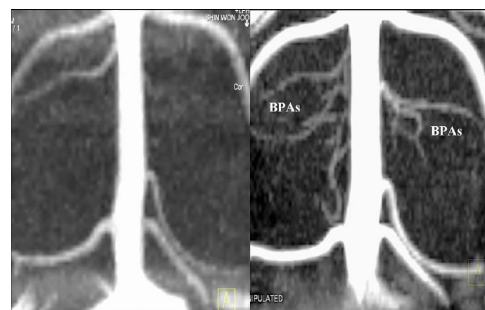
# 7T超高场血管成像

TOF成像，各向同性分辨率为0.3mm，头足方向覆盖范围为50mm。大脑中央部分的冠状最大强度投影和分割（顶部）、矢状最大强度投影与分割（中间）和血管分割的3D视图（底部）。



3T

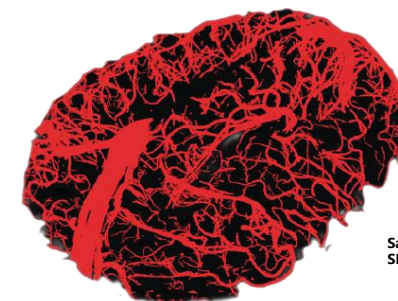
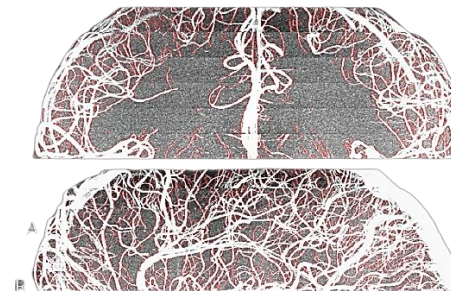
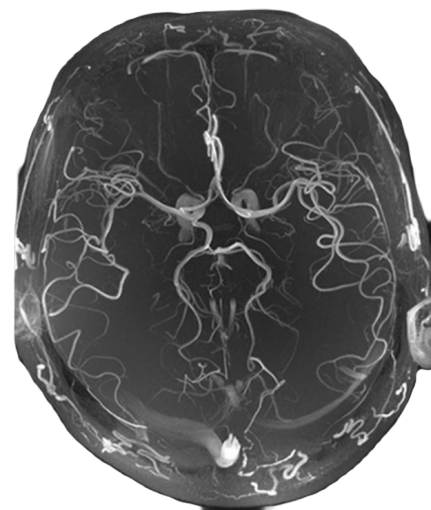
7T



3T

7T

Chan-A Park,2018,Neuroimage  
SIEMENS MAGNETOM 7T



Saskia Bollmann,2022,eLife  
SIEMENS MAGNETOM 7T

丘脑和基底动脉附近的血管结构如示意图所示，7T超高长场MRA可获得所有3T MRA不可见的精细穿通动脉成像

Chengcheng Zhu,2016, Magnetic Resonance Materials in Physics, Biology and Medicine

Chan-A Park,2018,Neuroimage

De Cocker L.J,2018, Neuroimage

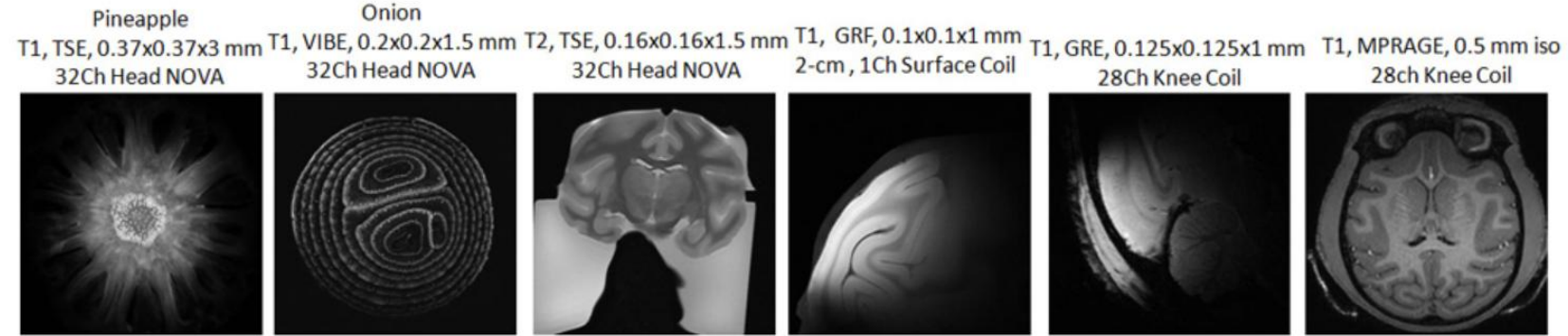
Samantha J. Ma,2019, ,Neuroimage

Rutland J,2020, AJNR Am J Neuroradiol

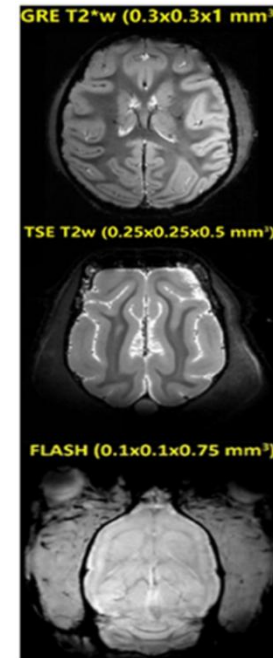
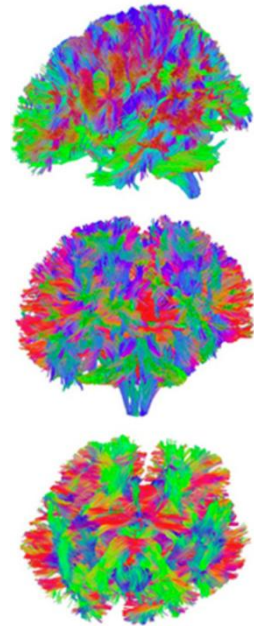
J.W. Rutland,2020,AJNR

⋮

# 7T超高场成像

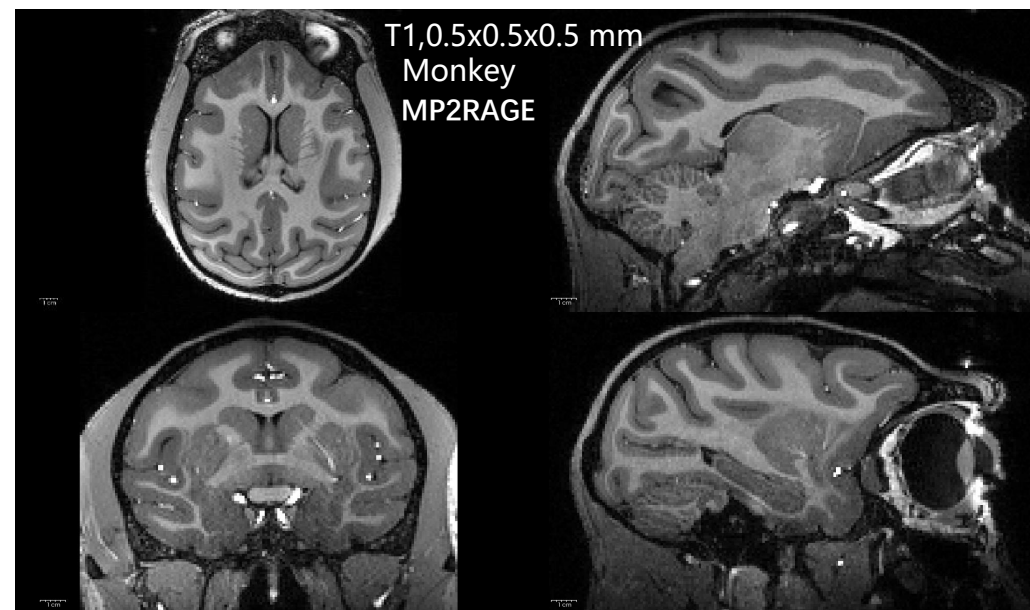
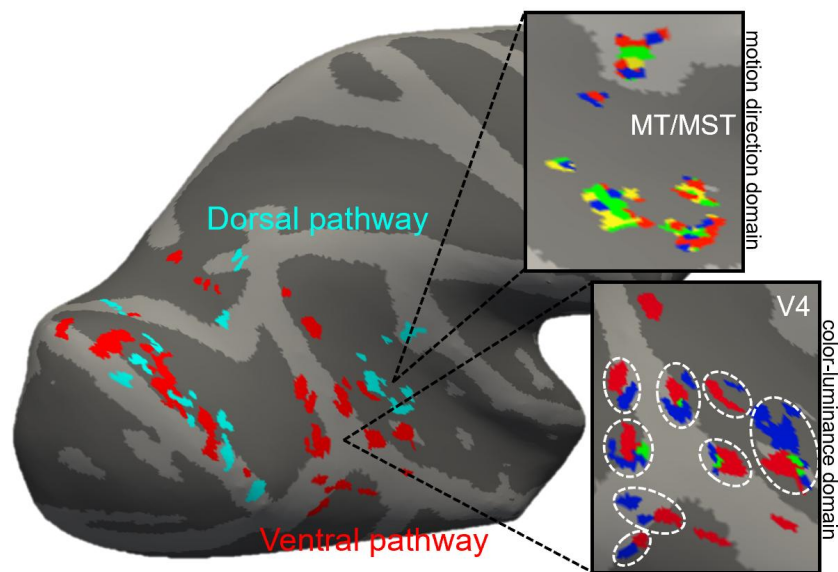
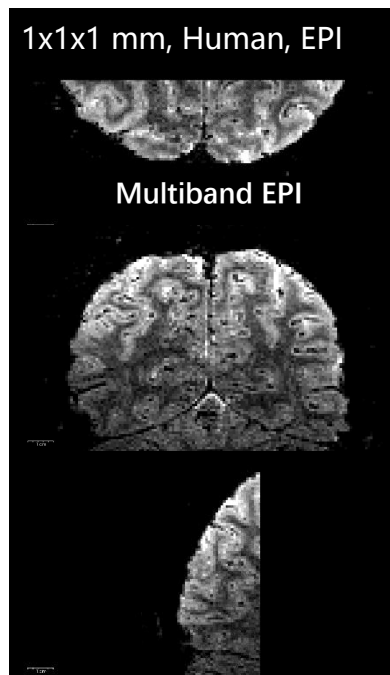


Resolve DTI B=2K 1.253 MM3



# 7T超高场成像

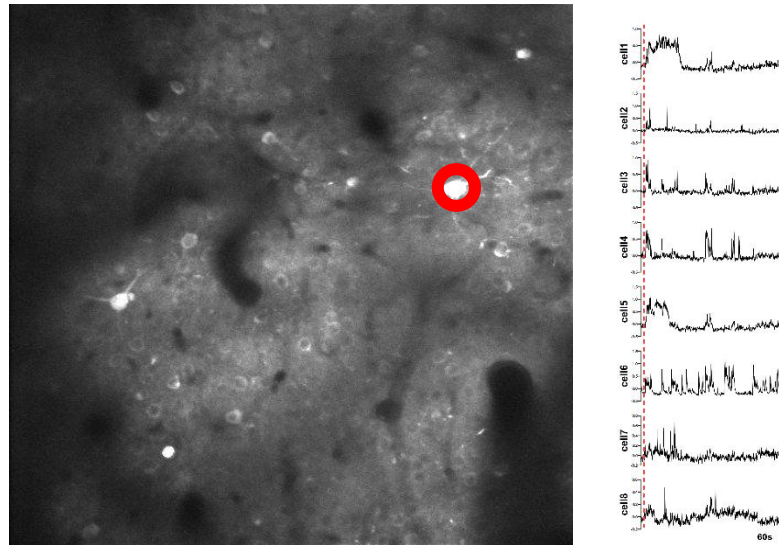
0.6 mm 分辨率——大视野介观尺度功能单元成像



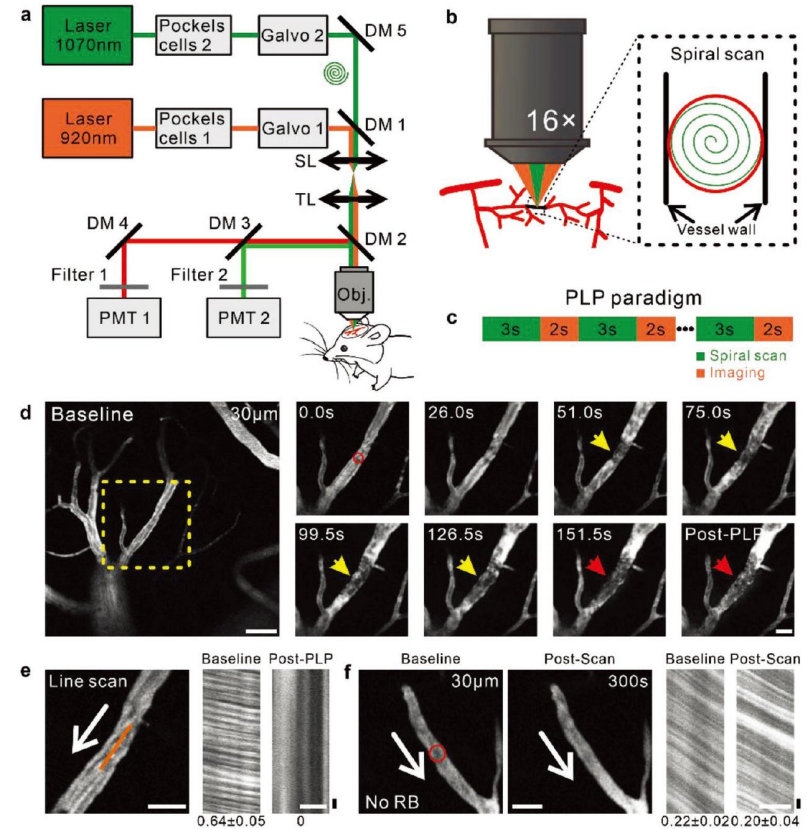
Wang et al., 2024, Prog. Neurobiol.

# 双光子/三光子显微成像

双光子显微成像系统包含双路成像及刺激光路；可在光成像的同时对神经元进行光刺激；还可进行精准快速光血栓技术以及微血管缺血模型研究等



光刺激神经元

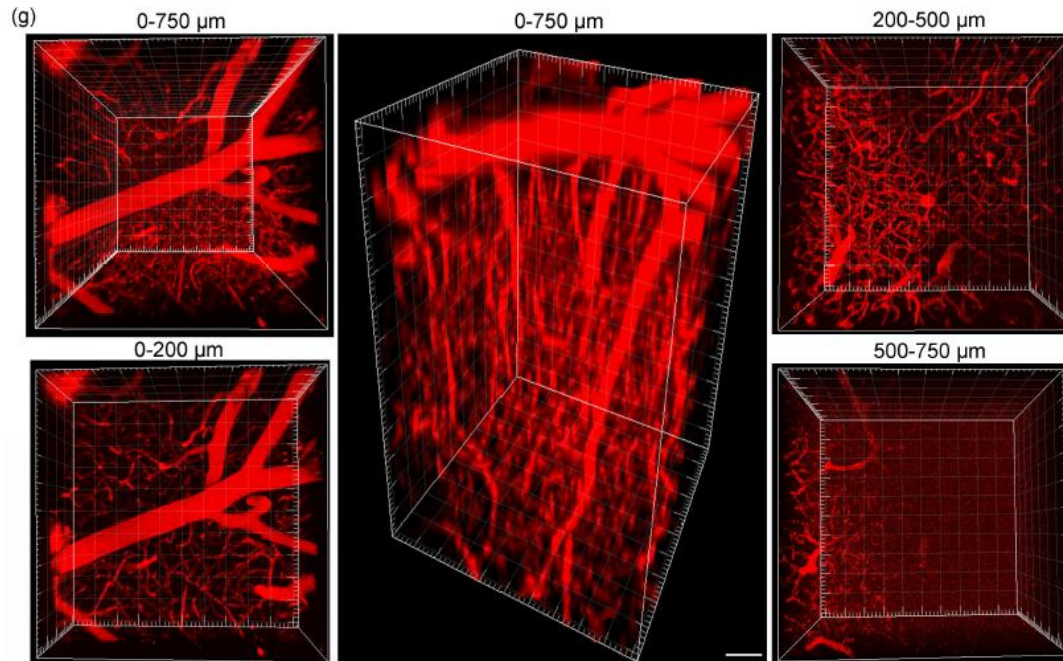


精准单血管栓塞技术 (2P)

Zhu et al. *Small Methods* 2022b

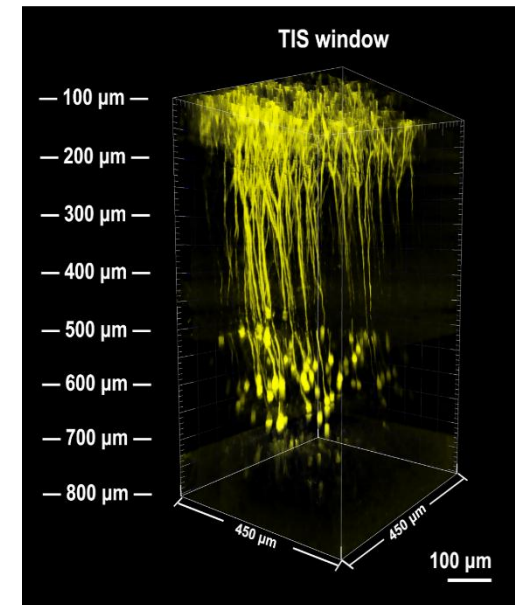


# 双光子/三光子显微成像



小鼠皮层深度血管结构及功能成像 (3P)

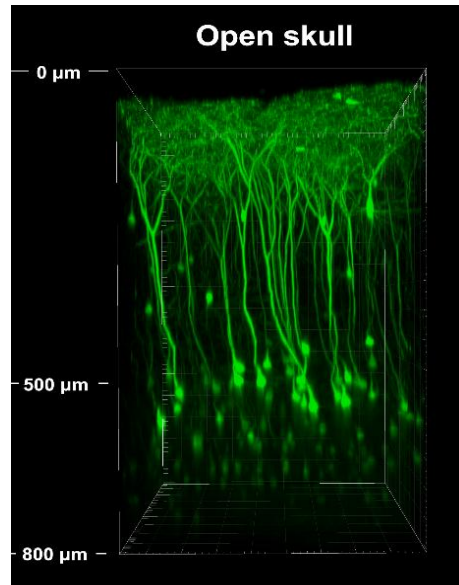
Xi et al. *Nano Research* 2020; Zhang et al. *ACS nano* 2022



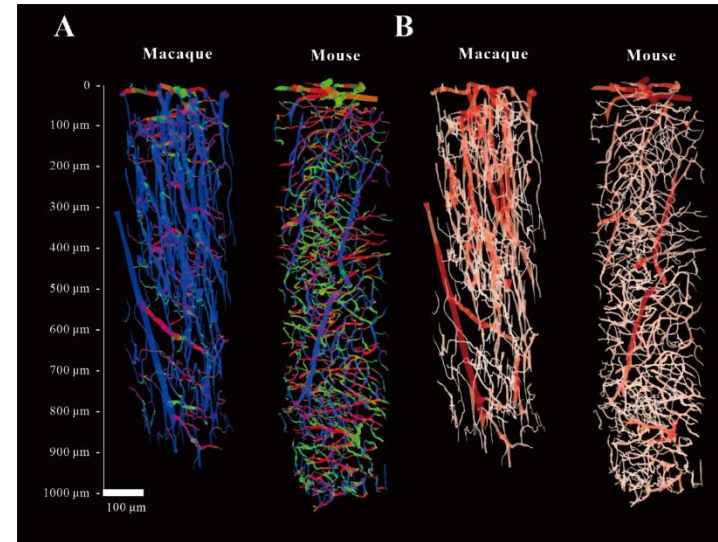
Thy1-EYFP (3P)

**三光子显微成像实现大深度显微结构成像，能够进行皮层深度血管成像，也可对神经元结构进行更深的三维重构**

# 双光子/三光子显微成像



Thy1-EGFP (2P)



小鼠与猕猴皮层血管结构比较 (3P)

## 2P

Laser 680nm-1040nm

Laser @80MHz

Depth -800um

Speed 512X512pixel@30Hz

## 3p

Laser 1200nm-2200nm

Laser @1MHz

Depth -1200um

Speed 512X512pixel@0.5Hz

## 主要参数描述

活体双光子/三光子荧光显微成像系统  
可进行活体神经元、血管等荧光标记的  
结构及功能成像

# 联系方式

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**平台地址：华家池校区中心北楼-115**