亮点报道：大视场高分辨宽波段介观显微物镜

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介观显微物镜具有复杂的光学结构与优秀的像差优化，可以同时实现高数值孔径和超大的成像视场，能显著提升光学显微镜的成像通量。然而大视场下色差优化难度极大，无法满足多样化荧光成像的要求。

为解决目前介观物镜成像波段单一，成像视场不足的问题，来自中国科学院苏州生物医学工程技术研究所的史国华研究员团队设计了介观视场下的平场复消色差物镜结构，研制出目前世界上亚微米分辨率下，成像视场最大，工作波段最宽的介观显微物镜。其具备 8 mm 视场直径，0.5 数值孔径 (NA)，且成像波段可达 400~1000 nm，具备独有的能同时在可见光波段及近红外波段介观成像的能力。

将该物镜与 20 倍 0.5NA 的商业物镜进行了定量对比，结果显示该介观物镜与商业物镜具备相似的成像质量，却拥有超过商业物镜 40 倍的成像视场面积。该团队搭建了激光点扫描介观成像系统，获得了 488 nm 连续光激发的单光子荧光成像结果，以及 920 nm 飞秒脉冲光激发的双光子荧光成像结果。单光子成像具备更高的信号强度，而双光子成像具备更高的成像对比度，这也是首次在介观物镜上实现单、双光子同步成像。该物镜在大尺度样本高分辨成像方向具有重大潜力，如脑图谱绘制，跨脑区单、双光子成像，类器官高分辨成像等。

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Highlights: Wide-field, high-resolution, and broad-band mesoscopic objective lens

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Current mesoscopic objectives are limited to a single imaging wavelength band, either visible or near-infrared, and cannot meet the requirements for diverse fluorescence imaging. Increasingly, application scenarios demand further enhancement of the imaging field of view (FOV) to achieve higher imaging throughput.

To overcome the current obstacles of narrow imaging wavelength band and insufficient imaging FOV in mesoscopic objectives, the research group led by Prof. Guohua Shi from the Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences, designed a flat-field apochromatic objective structure for mesoscopic fields and developed the world's largest imaging field and broadest working wavelength mesoscopic objective with submicron resolution. It features an 8 mm diameter FOV, 0.5 NA, and an imaging wavelength range of 400-1000 nm, with the unique ability to image in both visible and near-infrared wavelengths.

Single-photon imaging provides higher signal intensity, while two-photon imaging offers higher imaging contrast. This is also the first time that simultaneous single- and two-photon imaging has been achieved with a mesoscopic objective. This objective has significant potential for high-resolution imaging of large-scale samples, such as brain mapping, cross-brain region single- and two-photon imaging, and high-resolution imaging of organoids.

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