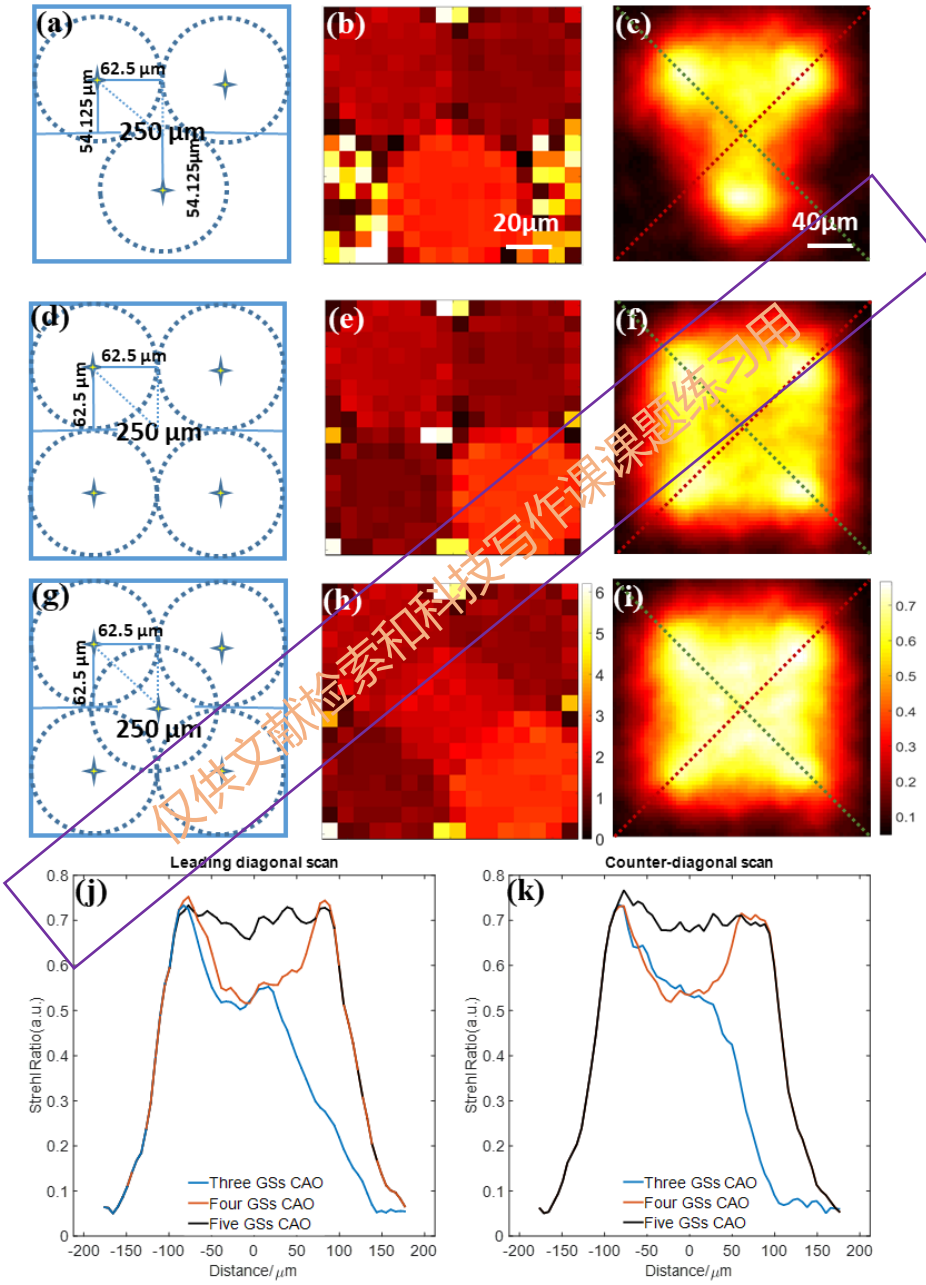

Figure 1. The distributions of the guide stars, *phasecor*, Strehl Ratio of the CAO system with (a-c) three, (d-f) four, and (g-i) five guide stars in a 250 μm×250 μm FOV. (j-k) The profile of the Strehl Ratio of the CAO system with three, four, and five guide stars along leading diagonal line (green dotted line), *ASR(Three GSs CAO)* = 0.35, *ASR(Four GSs CAO)* = 0.45, *ASR(Five GSs CAO)* = 0.49, and counter-diagonal line (red dotted line), *ASR(Three GSs CAO)*= 0.34, *ASR(Four GSs CAO)*=0.44, *ASR(Five GSs CAO)*=0.48.

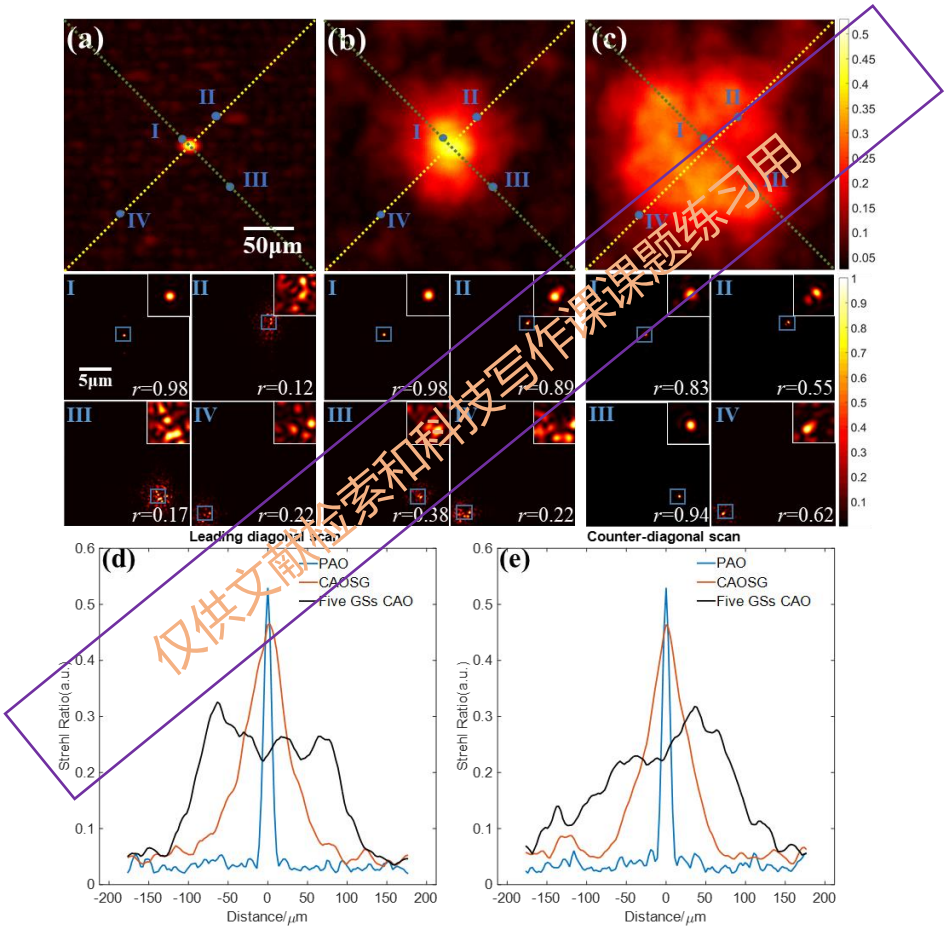

Figure 2. (a-c) 2D distribution of Strehl Ratio in a 250 μm×250 μm FOV with (a) PAO, (b) CAOSG, and (c) CAOMG. Every four higher resolution figures (19.5 μm×19.5 μm) below correspond to the specific patterns of the focal spots, which are located at the four positions I, II, III, IV in the figures above, respectively. The *r* is the correlation coefficient between the focal spot and the Airy Disk. (d) Distribution of Strehl Ratio on the leading diagonal line (green dotted line), *ASR(PAO)* = 0.09, *ASR(CAOSG)* = 0.23, *ASR(CAOMG)* = 0.49. (e) Distribution of Strehl Ratio on the counter-leading diagonal line (yellow dotted line), *ASR(PAO)* = 0.09, *ASR(CAOSG)* = 0.24, *ASR(CAOMG)* = 0.48.

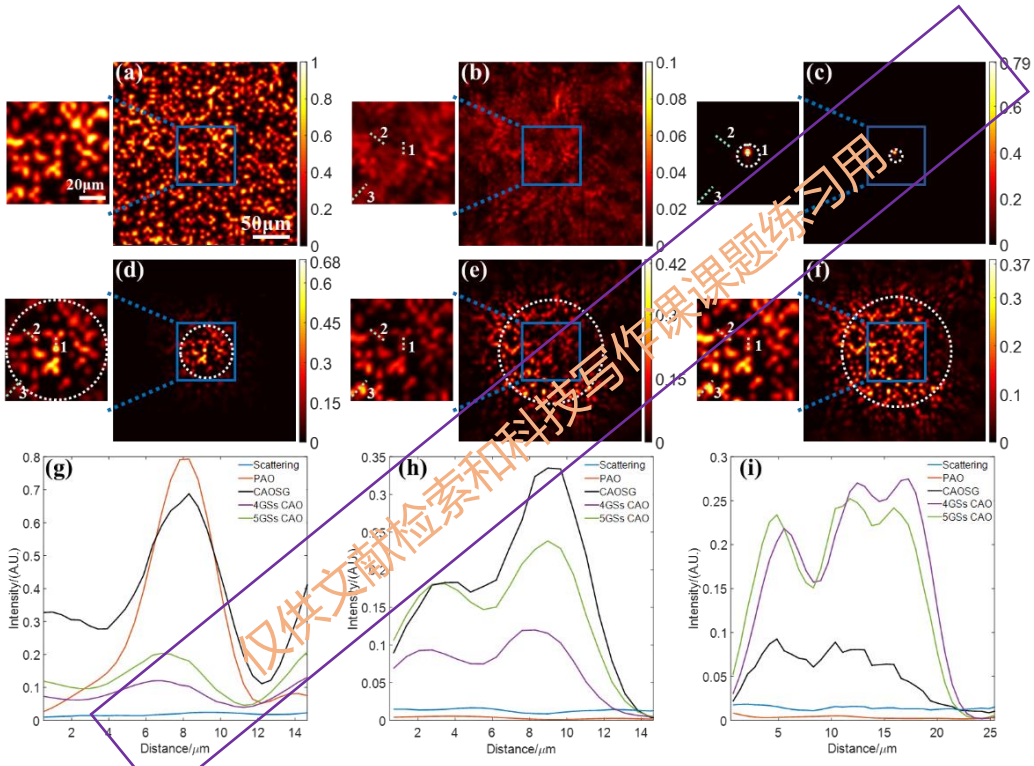

Figure 3. Comparison of imaging of fluorescent beads (7.8 μm diameter) through random phase mask in a 250 μm×250 μm FOV, (a) ideally, (b) before correction, (c) after PAO correction, (d) CAOSG correction and CAOMG correction with (e) four guide stars and (f) five guide stars. Higher resolution images (76 μm×76 μm) are also shown on the right side. Also, the intensity profiles along the green dotted line 1, 2 and 3 are shown in the (g-i), respectively. The white dotted circles are intended to determine the corrected FOV.

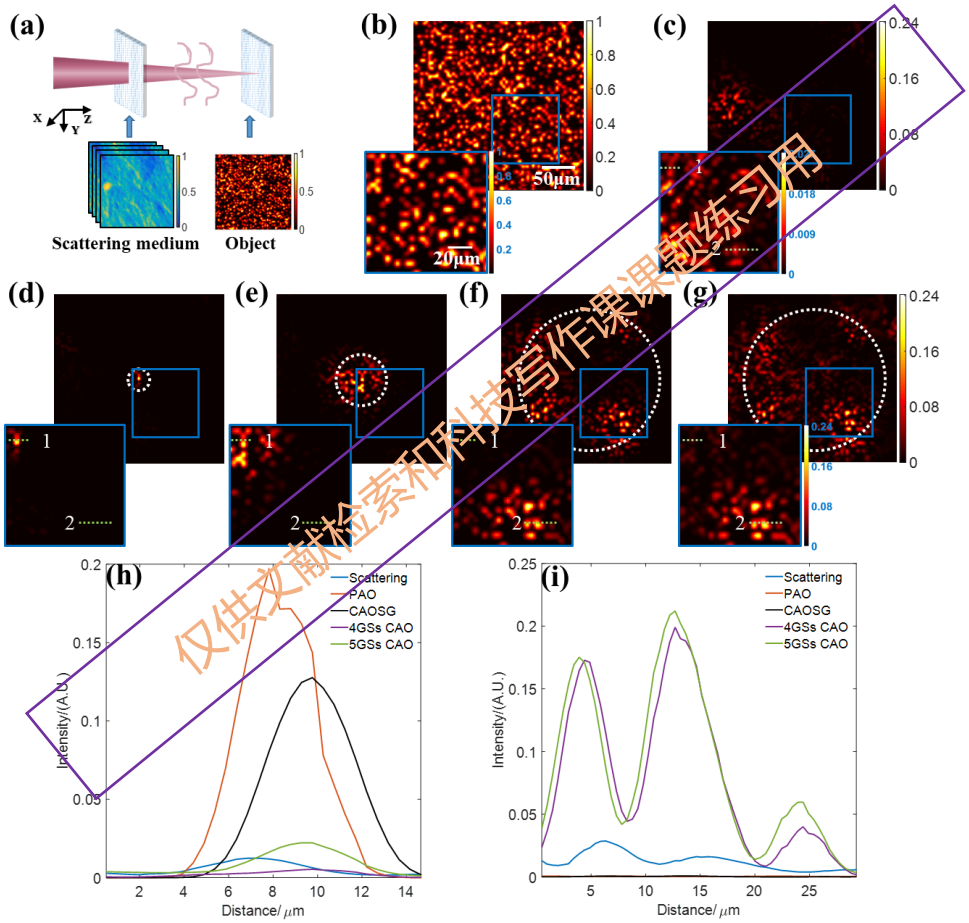

Figure 4. Fluorescent imaging of beads through mouse brain tissues. (a) the schematic diagram of the imaging configuration. 30 slices of mouse brain are placed the half focal length after the front focal plane of the objective and the beads are located in the focal plane. Comparison of imaging of fluorescent beads (7.8 μm diameter) (b) in the ideal optical system, (c) through the mouse brain tissue before correction, (d) after PAO correction, (e) CAOSG correction and CAOMG correction with (f) four and (g) five guide stars in a 250 μm × 250 μm FOV. Higher resolution images (98 μm × 98 μm) are shown in the left corner. (h-i) The intensity profiles along the green dotted line 1 and 2 are indicated in (d-g). The white dotted circles are intended to determine the corrected FOV.