Fluorescence imaging is becoming an important tool in biomarker-guided diagnosis, staging, typing, and prognosis of cancer. However, in vivo fluorescence imaging suffers from suboptimal signal-to-noise ratio and shallow detection depth, caused by the strong tissue autofluorescence under external excitation and by the scattering and absorption of short-wavelength light in tissues. In this project, we tackle these limitations by using a novel type of optical probe, Zn$_2$Ga$_3$Ge$_2$O$_{10}$:Cr$^{3+}$ (ZGGO:Cr) nanoparticles with very-long-lasting near-infrared (NIR) persistent luminescence. This allows optical imaging to be performed in an excitation-free and hence autofluorescence-free manner.

The ZGGO:Cr nanoparticles were fabricated by a solvothermal method, followed by calcination at high temperature. ZGGO:Cr nanoparticles pre-charged by ultraviolet light exhibited NIR persistent luminescence (emission peaking at 696 nm and 713 nm) in the first biological transparency window (650–950 nm). Our studies reveal promising potential of these ZGGO:Cr nanoparticles as nanoprobes to detect chemical or biological changes, especially in the applications of cell tracking and tumor targeting.