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Broadband spatial self-phase modulation of few-layer graphene sheet in solution RUI WU, YINGLI ZHANG, FEI BIAN, SHICHAO YAN, RUI WANG, WENLONG WANG, XUEDONG BAI, XINGHUA LU, JIMIN ZHAO, Institute of Physics, Chinese Academy of Sciences — Spatial self-phase modulation (SPM) was found for a suspension of few-layer graphene flakes. Multiple concentric conical diffraction rings was observed as a 532nm cw laser beam passes through the nearly transparent suspension, of which self-focusing occurred. The dependence of ring numbers and ring diameters on the laser intensity was recorded, from which we obtained the third order optical nonlinearity $n_2$of the sample. In our case n_2=10^{-9} m^2/W, which is the one of the largest among the reported carbon materials including carbon nanotubes and C_{60} samples. We also found that the intensity threshold for observing the diffraction rings is as low as about 0.6W/cm^2, which is the smallest compared with most of the reported sample having spatial SPM, including nematic liquid crystals. Furthermore we found that both 267nm and 800nm ultrashort laser pulses can also easily generate spatial SPM. This large and broadband optical nonlinearity is a manifestation of the few-layer graphene's conical-shaped band structure, which is true for a relatively large energy scale.

Jimin Zhao
Institute of Physics

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