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Ultrafast conductivity measurements in CVD graphene[1] JAMES HEYMAN, YILIKAL AYINO, ROLAN MANDERSON-JONES, JACOB STEIN, Macalester College, Department of Physics and Astronomy — We study carrier dynamics in CVD graphene films on Al_2O_3using time-resolved THz spectroscopy (TRTS). Excitation with a 50fs, 800nm pulse produces a conductivity change $\Delta\sigma$which we measure as a decrease in transmission of an ultrafast THz pulse. Ongoing work seeks to investigate TRTS in a magnetic field to directly probe scattering rates of photogenerated carriers. At present we report zero field measurements. We observe different recovery dynamics for low ($\Delta\sigma << \sigma_0$) and high ($\Delta\sigma > \sigma_0$) pump powers. For pump fluence $\varphi < 10^{12}$photons cm^{-2} ($\Delta\sigma << \sigma_0$) we find$\Delta\sigma \propto \varphi$ and observe a nearly exponential decay $\Delta\sigma \propto e^{-t/\tau}$with decay time $\tau \approx$ 2ps. At higher powers ($\Delta\sigma > \sigma_0$) $\Delta\sigma$ is sublinear in φ, and the decay rate decreases, with $\tau \approx$ 4psat $\varphi \approx 5 \cdot 10^{13}$photons cm^{-2}. Graphene's unusual conductivity relation, $\sigma \propto \sqrt{n}$, predicts the observed behavior, since $\Delta\sigma \propto \sqrt{n_0 + n_{photo}} - \sqrt{n_0}$ is approximately linear for $n_0 >> n_{photo}$, while $\Delta\sigma \propto \sqrt{n_{photo}}$for $n_{photo} >> n_0$. Here n_0 and σ_0 are the equilibrium carrier density and conductivity in these p-type films. At high pump powers we also observe a rapid initial recovery on $\sim$500fs timescale which is not described by this simple model.

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