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**Hole Activation in III-Nitrides via IR Pumping**

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Beamline(s):U10B

This proposal outlines an investigation of free carrier (hole) generation in p-AlGaN and p-GaN through electronic absorption of mid-infrared light at appropriate wavelengths (100 to 500 meV, or 2.5 to 12.4 um, or 806 to 4029 $cm^{-1}$). We hoped to determine whether intense IR light heavily focused on p-doped GaN and AlGaN epitaxial films can effectively inject holes from deep acceptors into the valence band, leading to enhanced conductivity. Two key issues are: 1.) Will IR radiation affect conductivity at all? & 2.) If so, what wavelengths provide the greatest stimulation, and 3.) what beam intensity is necessary? For these reasons, we requested beam time for Brookhaven National Laboratory's U10A beam line. This line is capable of focusing intense IR power into narrow areas that are on the order of typical semiconductor laser dimensions.

One day of experimentation was performed on Mg-doped GaN and AlGaN MSM devices by shining the FTIR beam normally on these samples and measuring changes in current with a transimpedance amplifier. No response was found. It is believed that the intensity of IR light is not high enough at the appropriate wavelengths to elicit a photoconductive response. One idea is to fabricate waveguides such that light can pass laterally through the device as opposed to normally, thereby giving IR light a greater chance to photoexcite holes from the acceptor region to the valency. Work is currently being performed in this area at GEGRC.