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Study of Phonon Propagation in GaN RICCARDO SCHMID, MADELEINE MSALL, Bowdoin College — We have studied the propagation of heat in GaN crystals using phonon imaging. GaN is commonly used in semiconductor technology and our experiments can help understand how the material transports heat. Such information would enable the development of more efficient integrated circuits, critical in the construction of powerful computer components. Phonon creation is achieved by laser pulse heating. A thin superconducting bolometer measures the changes in the temperature after phonons have propagated through the crystal. The experiments are carried out at the superconducting critical temperature of the bolometer kept constant in a superfluid He bath ($T < 2.17$°K) by vacuum pumping. The data collected measures phonon flux with time for different crystal directions. The fastest phonon pulses reach the detector in $\sim$ 40ns, in agreement with calculated group velocities. We were able to observe phonon focusing for particular crystal directions. GaN crystals generally abound in imperfections due to the development of stacking dislocations during growth processes. Our experiments are carried out on thin crystals ($\sim 200\mu$m), with dislocation density $\sim 5 \times 10^6/\text{cm}^2$. The effects of imperfections on phonon propagation are evident from our observation of strong phonon scattering and enable us to quantify phonon defect interactions including angular dependance.

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