Session:	Ground-Based Instrumentation II
Presentation Number:	085.04
Title:	**Research Experience for Teachers at Green Bank: High-Precision Calibration, Baselines and Nonlinearities with the GBT**
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The traditional methods for calibrating single-dish radio telescopes assume that the system gain is linear: detected power is taken to be proportional to the power incident on the antenna. The assumption is wrong at some low level and noticeably breaks down when observing an object that has a large dynamic range. The high sensitivity, clean beam, and very stable electronics of the Green Bank Telescope (GBT) allow us to detect nonlinearities that would be masked in most other radio telescopes. In particular, the signal processing components of the GBT produce an output power that exhibits at least a quadratic dependence on incident power. Our study indicates that measuring and compensating for the nonlinearity is rather trivial and improves calibration when observing objects with a high dynamic range. Once measured, the nonlinearity is shown to be stable over a typical observing run (~6-8 hours) with evidence of stability for up to several weeks.
We also investigated ways to improve spectral-line calibration and baseline shape when observing over a band that is many GHz wide, as is typical with many high frequency GBT projects. We have found that baselines are seriously degraded when using the traditional methods of calibration via scalar values for the system temperature and calibration noise diode that are averaged over the entire bandwidth of the observations. System calibration and baselines are shown to be substantially improved when we use noise diode and system temperature values that have a frequency resolution of a few MHz.
Incorporating this research and the general topic of radio astronomy into the high school science classroom will also be discussed.
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