A GBT Legacy Survey of 18cm OH towards the Outer Galaxy (100 < l < 140, -3 < b < 3)

M. Busch (JHU/ANU, mpbusch@jhu.edu) and J. Dawson (Macquarie/CASS)

Large surveys of hydroxyl (OH) emission in the Galaxy have always historically been hampered by the sensitivity requirements of observing the 18cm emission in the diffuse ISM. We are requesting 850 hours of GBT time with ALPACA to map the Outer Galaxy in 18cm OH emission to extreme sensitivities allowed by the GBT (~3mK noise per channel, 2 hours per pointing). Similar OH surveys towards the Inner Galaxy, like the Parkes SPLASH survey, have encountered contrast problems with the continuum and excitation temperatures and thus the interpretation of the OH profiles are difficult. In the Outer Galaxy, the low continuum temperature (about 1K above CMB) allows for a relatively straightforward interpretation of LTE-like 18cm OH emission profiles in the range of 5-30mK towards the Outer Galaxy. Due to Galactic rotation, velocity features along the line of sight are well separated, and distinct studies of gas populations (i.e. Perseus or Outer Arm) are possible. In the Inner Galaxy, the kinematic distance ambiguity hinders the separation of features greatly. A legacy survey of 18cm OH would provide an invaluable database of three of the four ground state OH lines (the 1612 MHz line is usually unusable due to RFI at Green Bank). The utilization of all three lines can characterize masers and discover new masers as well, as masing 1720 MHz OH is known to trace supernova shockwaves and other shockwaves in the diffuse ISM. On the other hand, the 1667 and 1665 MHz OH lines have been shown to be a great utility tool in studying the diffuse molecular gas that is commonly missed by CO surveys (e.g. “CO-dark” molecular gas). A 40-pixel instrument with the sensitivity allowed by the GBT would revolutionize our understanding of this mysterious gas phase and how it intersects the atomic and dense molecular phases of the ISM by comparing to similar large-scale archival CO and HI surveys. A large statistical study like this one would allow investigations into how the dark molecular gas affects star formation laws, the development of hydride chemistry in the diffuse ISM and an accurate accounting of dark baryons (in the form of H2 missed by CO) outside the solar circle. A survey of this size with the GBT would take approximately 33,000 hours with a single pixel, showcasing the necessity of the ALPACA instrument.