The net result of a GBT/ALPACA program will be (a) mapping of dispersion and scattering vs location in M31 and inferring the strength of turbulence across the galaxy; (b) mapping of the Faraday RM across M31 and estimation of the mean magnetic field by using M31's contributions to both DM and RM; (c) constraints on the contributions to DM, RM, and SM from the circumgalactic medium of M31; and (d) similar analyses and conclusions for galaxies in Virgo.

Observations: pulse and burst detection across M31 can be done with a commensal program to map HI that is discussed by D. J. Pisano and collaborators. A survey in the direction of the Virgo cluster could also be done as a commensal program but might require a dedicated survey.

ALPACA Searches for FRBs/Magnetars in Nearby Galaxies

Duncan Lorimer (WVU; duncan.lorimer@mail.wvu.edu)

Evidence in favor of a magnetar origin for fast radio bursts (FRBs) has gained significant credence recently, thanks to a detection of FRB-like pulses from a known Galactic magnetar, SGR 1935+2154, as well as an FRB in the spiral arm of the nearby galaxy M81. An important prediction of the FRB--magnetar connection is that FRBs should be detectable, in nearby galaxies with high star formation rates. As discussed by Bochanek et al. (2020), an excellent candidate for such searches is the prototypical starburst galaxy M82. We are currently monitoring this galaxy using the 20 m radio telescope at the Green Bank observatory in West Virginia. We take advantage of a high-speed data connection between Green Bank and West Virginia University, as well as a deep-learning based pipeline to automatically classify likely FRB candidates.

So far, from 28 days of M82 observations, no bright FRBs were detected. We have amassed a sample of >200 FRB-like signals with signal-to-noise ratios below 10, with some of these appearing to repeat at consistent dispersion measures. From a Poissonian analysis, we conclude that not enough pulses are currently present to claim a statistically significant FRB detection.

Our current experiment is clearly sensitivity limited and the wide field of view of ALPACA coupled with the GBT's superior sensitivity. For a power-law luminosity function of magnetars in M82 with an exponent of -1.5, typical of pulsars, we would achieve our current level of depth within 30 minutes! In addition, the multi-beaming capability of ALPACA would greatly facilitate any detection of fainter candidates which are currently ambiguous with the single pixel of the 20 m. A deep observation of M82 would place definitive constraints on magnetars in this galaxy and undoubtedly lead to follow-up studies of individual objects. We envisage scaling the experiment up to a larger campaign to target other nearby galaxies for a more comprehensive census on the timescale of a single PhD student.