**Proposal for Time on the 20-Meter Telescope**

**Pilot Project for Research on Neutral Hydrogen in the M31 Halo**

**Ellie White**

**Mentors: Dr. Frank Ghigo and Dr. Felix J. Lockman**

This is a proposal to request the use of the 20-Meter Telescope to carry out a pilot project, with the intent to determine the feasibility of doing sensitive (rms ≤ 0.03 K) mapping of a large region to the north of the M31 galaxy. The goal of the main project is to search for high-velocity neutral hydrogen (HI) clouds in the northern portion of the M31 halo, as a follow-up to previous studies of M31 done by Braun and Thilker (2004), and Wolfe et al (2016). By taking 20-Meter measurements to determine the shape, mass, and kinematics of high-velocity HI clouds in that region, we can investigate different hypotheses of the origins of the HI clouds in M31’s halo. Such hypotheses include the possibility that the HI clouds are a result of past gravitational interactions between M31 and other galaxies (or dwarf galaxies), are the baryonic component of dark matter halos, are condensations of hot gas from the circum-galactic medium, or are dwarf galaxies surrounding M31.

Before attempting to map a large region of the M31 halo, this pilot project must be undertaken in order to determine the 20-Meter’s capabilities. The pilot project will consist of taking on-off scans at three separate locations in the western region of the M31 halo, at the coordinates RA 0:20:00, Dec +45°00’00”; RA 0:20:00, Dec +46°00’00”; and RA 0:20:00, Dec +47°00’00”. These scans will be performed in high-resolution spectral line mode with a bandwidth of 15.625 MHz, a channel spacing of 15.26 kHz (3.22 km/s), and a center frequency of 1421.875 MHz.

A fourth on-off scan will be taken as a calibration measure at a location where HI is well-known to exist in M33, at coordinates RA 1:30:00, Dec 30º00’00”. Since we are trying to achieve an rms of better than 0.03K, it is estimated that each of these four on-off sequences will require 3600 seconds to complete; 1800 seconds on-source and 1800 seconds off-source.

If it seems that the main project is feasible based on the results from this pilot program, a second proposal will be submitted requesting the time needed for full mapping of the northern region of M31 with the 20-Meter.

The total time needed for this pilot project is estimated to be 14400 seconds of telescope time (3600 seconds for 4 separate scans). Thank you for considering this request.