# NIBLES: an HI census of local SDSS galaxies

W. van Driel[1], S. Schneider[2], M. Lehnert[1] and the NIBLES Consortium

[1] Observatoire de Paris, GEPI, 92195 Meudon, France wim.vandriel@obspm.fr
[2] Univ. of Massachusetts, Astronomy Program, Amherst, MA 01003, U.S.A.

**Abstract:** NIBLES (Nançay Interstellar Baryons Legacy Extragalactic Survey) is a Key Project proposed for the 100m-class Nançay Radio Telescope (NRT) in France (e.g., Monnier Ragaigne et al. 2003). Its aim is a census of the H I gas content and dynamics of 4,000 Sloan Digital Sky Survey galaxies in the Local Volume (900<cz<12,000 km/s). The galaxies were selected based on their total stellar mass (absolute z-band magnitude $M_z$), and are distributed evenly over the entire range of $M_z$ covered by local SDSS galaxies (-10 to -24 mag, for $H_0$=70 km s$^{-1}$ Mpc$^{-1}$). A related survey (TICLES) was proposed for CO(1-0) line observations at the IRAM 30m. An NRT pilot survey is being made of over 600 galaxies. NIBLES will be complementary to the ALFALFA and EBHIS blind H I surveys, which will detect a different ensemble of local galaxies, and which our pilot survey results indicate will detect ∼40-45% of the NIBLES sample. NIBLES is an open collaboration and anyone interested in the science and willing to contribute to the project is welcome to join the score of NIBLErS.

Science goals of this project are:

Provide a complete and statistically robust analysis of the density of baryons in the local Universe, and determine the phase in which these baryons reside. That is, determine the co-moving space density of $H_2$, H I, stellar mass, and dynamical mass;

Determine the H I Mass Function and the CO luminosity function and the joint probability distribution of H I mass/CO luminosity and other galaxy characteristics (i.e., infrared luminosity, morphological type, stellar mass, stellar age, etc.);

Determine the H I/CO gas content and fraction as a function of total stellar mass (fit from the optical/near-infrared spectral energy distribution and M/L$_z$), dynamical mass (estimated from H I and CO line widths), morphological type, and average stellar density;

Determine the systematic relationships and variability between dynamical, stellar, and gas masses (e.g., do the estimated dynamical masses change in proportion to total baryonic mass?);

Compare galactic gas fractions and metallicity, to determine the effective yields of the largest sample of galaxies available and to allow for the most detailed comparison with theoretical models of the evolution of galaxies. This will enable us to determine the relative influence of outflows and infall on the evolution of galaxies. We will use metallicities determined from the SDSS data and compare them with the overall gas fractions to determine the effective yields as a function of galaxy type, dynamical and stellar masses, and stellar mass surface densities. Comparing these results with chemical evolution models will provide a robust test of our understanding of gas recycling yet performed.

The H I data that are presently available in the literature are largely insufficient for our proposed studies; of the 4000 galaxies in the NIBLES sample, only 13% have published H I data, half of which concern only the gas-rich spiral galaxies in the highest luminosity range (-20.5<$M_z$<-23.5). Also the data that will ultimately be provided by the Arecibo ALFALFA and Effelsberg EBHIS blind surveys (Giovanelli et al. 2005; Winkel et al. 2007). will not be sufficient; our ongoing NRT pilot survey indicates that they will detect 40-45% of the NIBLES sample.

NIBLES selection criteria are: (1) high quality SDSS magnitudes, and high quality SDSS optical spectra, (2) within the Local Volume (recession velocity of 900<cz<12,000 km/s), (3) sampling of each 0.5 magnitude wide bin in $M_z$, with a maximum of 200 galaxies for the most populated bins, and of all galaxies (minimum 20) for the poorer bins, (4) focus on the most nearby objects in each $M_z$ bin, as these will have the highest H I flux densities.

Pilot surveys: in 2007 we obtained 500 hours of telecope time at Nançay for NIBLES pilot surveys. To date, 340 galaxies have been observed for 30 minutes (half the intended average time per object in NIBLES). The data have a typical rms noise level of 3.5 mJy at a 10 km/s velocity resolution, comparable to the point source detection sensitivity of the blind ALFALFA and EBHIS surveys. The overall detection rate is 66%, and similar over the entire 12 magnitude range in $M_z$. We estimate that ∼40-45% of the NIBLES sample galaxies would be detectable by ALFALFA or EBHIS, based on the sensitivities of these surveys and our detected H I fluxes.

This shows that NIBLES, which will on average have a two times longer integration time than the NRT pilot surveys, will provide a unique H I census of optically selected Local Volume galaxies. NIBLES will be complementary to the ALFALFA and EBHIS blind H I surveys of galaxies in the Local Volume. In general, blind H I surveys provide a basis for determining whether there are classes of galaxies being missed in an optically selected sample, such as

gas-rich Low Surface Brightness objects, but the NRT data will be better for detailed studies of the properties of the SDSS galaxies themselves.

## References

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