Development of Spectrometer Using Superconductor Mixer Receiver (SUMIRE)

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Thanks to the high sensitivity and high spatial resolution of ALMA, many unidentified molecular lines have been detected in various sources [*e.g.*, 1-3]. In order to identify these lines, it is essential to measure the rest frequencies of the molecular transition lines accurately. For the molecular spectroscopy in the submillimeter wavelength in a laboratory, we have been developing an emission-type molecular spectrometer by using state-of-art radio astronomical technics (Figure 1) [4]. The spectrometer is equipped with a 200 cm glass cylinder cell, an ALMA-type cartridge heterodyne receiver with 2SB SIS mixers in the 230 GHz band corresponding to ALMA Band 6, and wide-band digital autocorrelation spectrometer XFFTS. By using the four 2.5 GHz digital spectrometers, a total instantaneous bandwidth of the 2SB SIS receiver of 8GHz can be covered with a frequency resolution of 88.5 kHz. Recently, we applied anti-reflection grooves on the surface of the gas cell windows and receiver window to reduce reflection. As a result, the standing wave seen on the measured spectra is greatly improved, and the system noise temperature is decreased from 300-400 K to 90-300 K. In addition, we are now fabricating a new cartridge receiver that covers the radio frequency from 275 – 500 GHz corresponding to the ALMA Band 7 and 8 receivers. With this receiver, we plan to measure higher-*J* transition lines of methanol, and its isotopologues, including D, ^{13}C, ^{17}O, and ^{18}O.

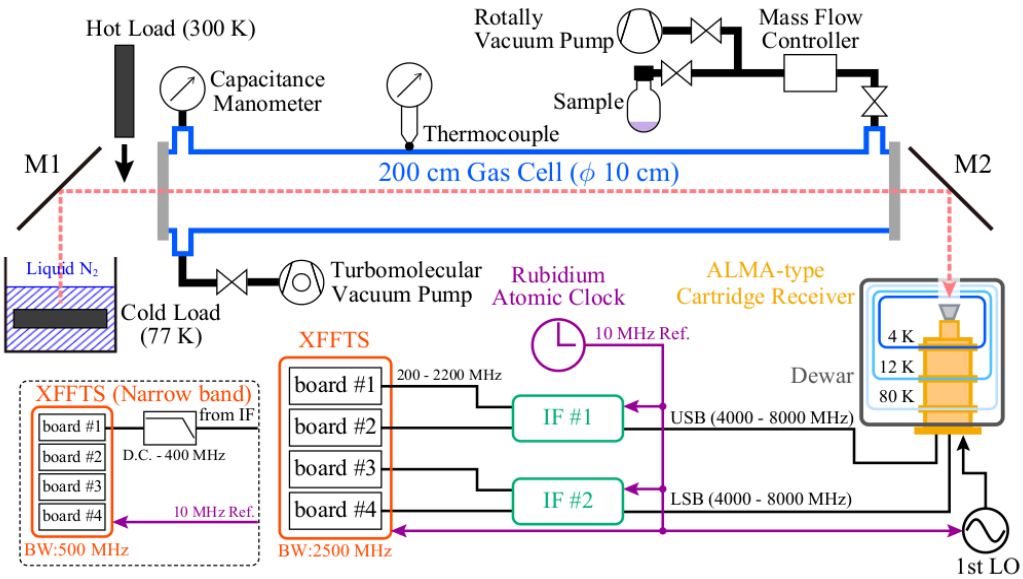

Figure 1: A block diagram of the SUMIRE system.

References

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