A COAXIALLY ORIENTED BEAM-RESONATOR ARRANGEMENT FOURIER TRANSFORM MICROWAVE (COBRA-FTMW) SPECTROMETER: GOING CRYOGENIC

JENS-UWE GRABOW, SAMUEL PALMER, PATRICK THADDEUS, *Radio and Geoastronomie Division, Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138 and Division of Engineering and Applied Sciences, Harvard University, 29 Oxford Street, Cambridge, MA 02138.*

After the initial experiments of microwave spectroscopy in the time domain [a] it took more than two decades before the technique was re-born. First as a steady gas-waveguide [b], later as a molecular beam-resonator [c] application, the experiment became an established spectroscopic method. During the past years a number of improvements were introduced to the technique. Namely the coaxially oriented beam-resonator arrangement (COBRA) [d e] has dramatically improved the resolution and the sensitivity of the Fourier transform microwave (FTMW) spectrometer.

Our current efforts are aiming at an improvement of the COBRA-FTMW sensitivity by means of reduction of the thermal noise background, i.e. reducing the 300K thermal noise power of P_N = kTRB at room temperature to the equivalent of 77K - the temperature of liquid nitrogen.

We will present a detailed theoretical background which is needed to approach the expected gain in S/N for a spectrometer operated at temperatures significantly below the thermal environment.

---

[a] R. H. Dicke and R. W. Romer, Rev. Sci. Instrum. 26, 915(1955).
[b] J. Ekkers and W. H. Flygare, Rev. Sci. Instrum. 47, 448(1996).
[c] T. J. Balle and W. H. Flygare, Rev. Sci. Instrum. 52, 33(1981).
[d] J. U. Grabow and W. Stahl, Z. Naturforsch. 45a, 1043(1990).
[e] J. U. Grabow, W. Stahl, and H. Dreizler, Rev. Sci. Instrum. 67, 4072(1996).