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capsule separates the AgCl from the brass holder body to prevent decomposition and to protect the material of the window from pressure developed by O-ring (7), and nut (2). Pipe (9) is the main body of the absorption cell. The gas or liquid whose absorption characteristics are to be investigated is admitted through tube (8).

The shoulders on the outside rim of the AgCl window can be machined on a lathe at a spindle speed of 200 rpm. This spindle speed is suitable also for repairing scratched or partly decomposed windows. A plane surface of the window can be turned clean and flat using a well-polished round-nosed surface tool followed by polishing on a fine felt.

This design has been used in several all-metal spectroscopic absorption cells and vacuum windows here. No material decomposition or cold flow deformation has been observed wlth this design.

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[1]M. H. Greenblat, Rev. Sci. Instrum. **29**, 738 (1958).

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Low Temperature Nozzle Beam Source*

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A nozzle beam source that can be operated to 3 K with helium gas is described. At this lowest temperature the full width at half maximum in velocity is 9%, the gas flow rate is 3.3 atmospheric ml /min of room temperature helium, and the density is 4.6×10^{12} atoms/cm^3 measured 2.5 cm from the source.

A compact variable energy high intensity nozzle beam source has been constructed and operated with helium gas to temperatures as low as 3.0 K. The source is shown in Fig. 1. The cold finger is designed so that liquid helium from a standard storage container can be transferred to the cold finger to provide the necessary coolant.[1] This method is extremely attractive for molecular beam work, for it (i) operates in any position, (ii) is a very compact system,

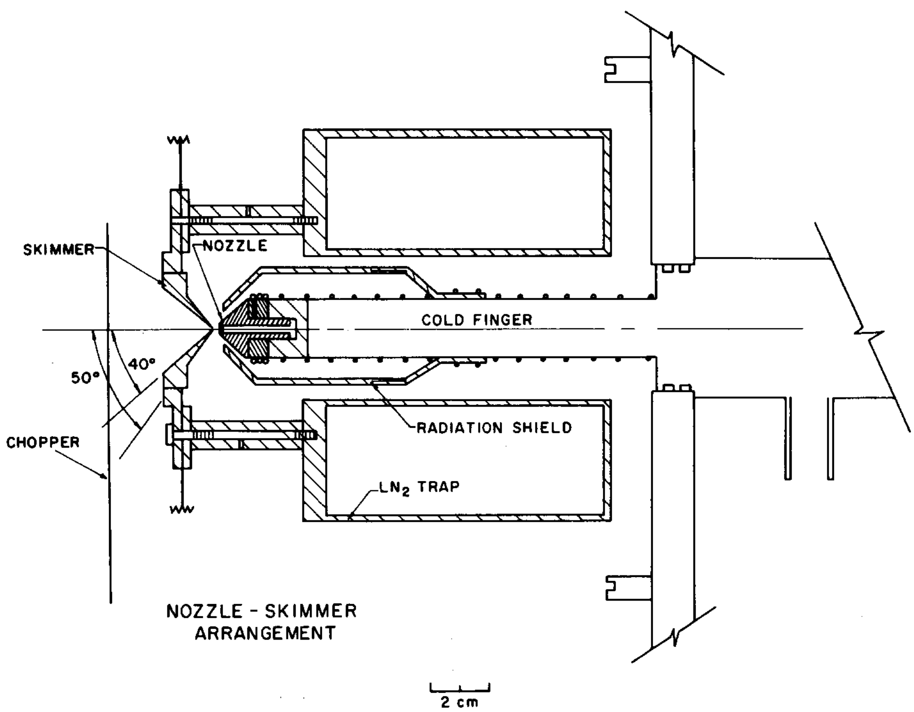

FIG. 1. Low temperature nozzle–beam source. A wall at the skimmer separated the nozzle–skimmer and skimmer–detector regions so differential pumping could be used. Typically the pressures in both regions when operating and cold were in the low 10^{-6} and 10^{-5} Torr region, respectively. An electron bombardment detector was located 14 cm downstream from the chopper.

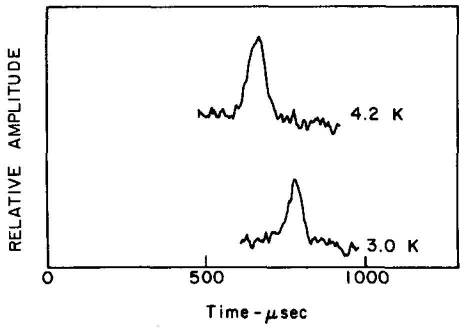

FIG. 2. Time-of-flight results for the source at various temperatures. The signals were obtained by signal averaging with a resolution of 4 μsec per channel.

(iii) allows for rapid cool-down and warm-up, and (iv) it can be pumped to obtain temperatures below 4.2 K.

The nozzle is a watch jewel with a 26 μ diam hole sealed in a brass holder which makes intimate contact with the cold finger through a flat indium gasket.[2] A stainless steel tube 0.031 cm i.d., by 0.056 cm o.d. wrapped several times around the cold finger is used for gas precooling and helium gas transfer into the stagnation region of the source. For the cold finger, it is optional whether to use a liquid nitrogen cooled shield around the finger, however, in this work it was used both as a radiation shield and as the support for the skimmer (0.05 cm diam). The nozzle–skimmer distance could be changed by moving the skimmer and it was initially adjusted at room temperature to give maximum signal. For most of the measurements this was set at 0.195 cm. An electron bombardment detector located 14 cm from the chopper was used to detect the beam.

The time-of-flight signals for this source at various temperatures are shown in Fig. 2. For the case where the cold finger was pumped, the temperature was obtained from the time-of-flight information. This gave $T=3.0$ K. The results of time-of-flight are shown in Table I. The velocity corresponds v_m to that obtained from the maximum in the time-of-flight results. Additionally the absolute beam density was measured for different gas flow rates and these are also indicated in Table I.[3] The results of Vyse *et al.* of beam intensity vs stagnation pressure were also confirmed.[4]

TABLE I. Experimental results.

T K	v_m m/sec	HWHM[a] $\Delta v/v$	$N\times10^{-12}$ [b] cm^{-3}	Total He flow rate atm ml/min at 300 K
4.2	208	0.059	2.2	9.0
3.0	178	0.046	4.6	3.3

[a] Uncorrected for slit chopping function which was 22 μsec in width (FWHM).
[b] Located 2.5 cm downstream of nozzle.

Because of the very small relative velocity between helium atoms in the beam at these low temperatures, there may be considerable self scattering.[5] One possible means of observing this is to measure beam intensity as a function of nozzle–detector distance. Between the nozzle–detector distances of 2–6 cm the $1/r^2$ relation appeared satisfied. It is still possible and quite likely that self scattering could be observed for distances less than 2 cm, but this could not be checked in this work.

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[2]B. Baratz, Ph.D. thesis, Princeton University, 1967; Watch jewel obtained from William Langer Jewel Bearing Plant, Rolla, N. Dakota 58367.
[3]R. S. Grace, D. P. Morrow, J. P. Aldridge, and J. G. Skofronick, Rev. Sci. Instrum. **43,** 696 (1972).
[4]R. Vyse, D. Axen, and M. K. Craddock, Rev. Sci. Instrum. **41,** 87 (1970).
[5]I. Estermann, O. Simpson, and O. Stern, Phys. Rev. **71,** 238 (1947).

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A Gas-Phase EPR Cavity*

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The design of an X-band cylindrical TE_{011} cavity resonator with a 25 mm diam axial access hole for gas-phase EPR studies is described. The empty cavity is tunable over a frequency range of at least 8.0–10.0 GHz and critical coupling is attained over this range with a novel variable coupling device.

In this Note we describe the design details and fabrication of a cylindrical TE_{011} X-band cavity for gas-phase EPR studies. This design incorporates the following important features: (1) A 25 mm access port to accommodate a quartz gas-flow tube; (2) tunability from at least 8.5–9.5 GHz; (3) adequate coupling of the desired mode over this