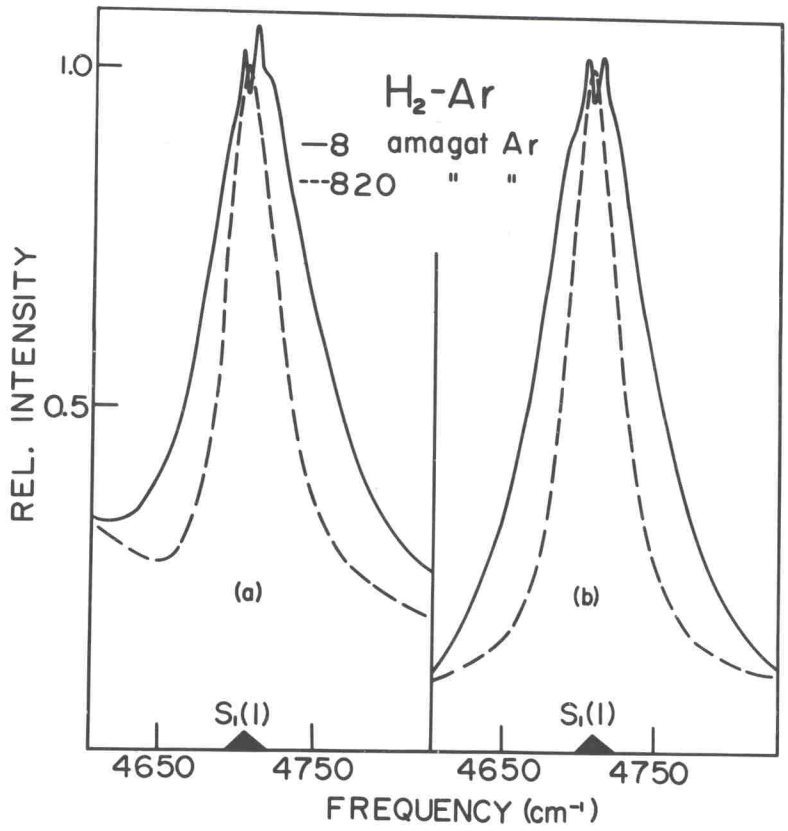

FIG. 2. (*a*) The observed spectrum in the region of the $S_1(1)$ line at low and high densities, and (*b*) the isolated symmetrized $S_1(1)$ lines.

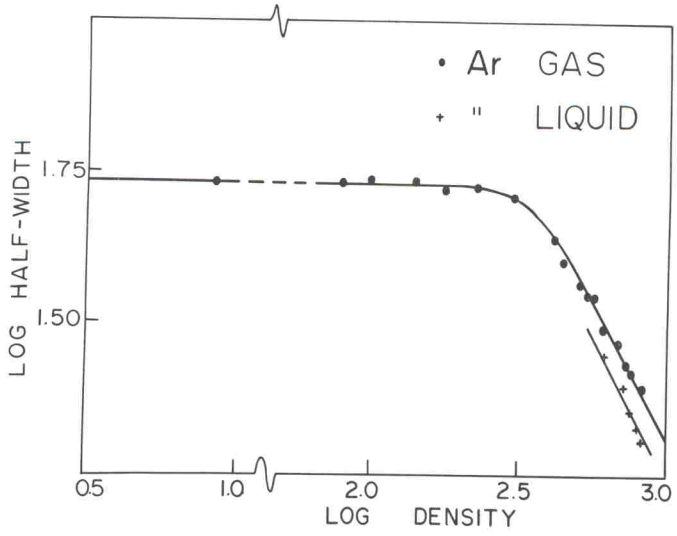

FIG. 3. Variation of the half-width $\Delta\nu_{1/2}$ of the symmetrized $S_1(1)$ line of hydrogen with the argon density in gaseous and liquid H_2–Ar systems.

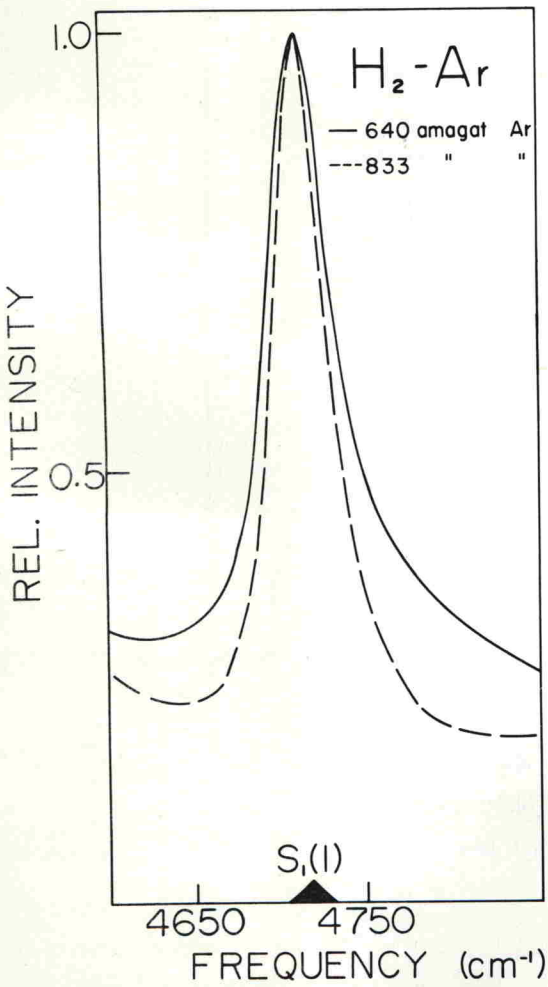

FIG. 4. The region of the $S_1(1)$ line in the collision-induced spectrum of hydrogen in a liquid H_2–Ar system at 115 K under pressures of 19 and ~1500 atm.

drupolar interaction. At higher densities the collision path of the H_2 molecule is modified by the presence of nearby Ar atoms and the collision duration is effectively increased. As shown by Zaidi and Van Kranendonk (1971) in the following note, this effect can be treated as a diffusion phenomenon and the experimental value of $\Delta\nu_{1/2}$ can be used to calculate the diffusion coefficient of hydrogen in argon at high densities. In particular, their theory gives $\Delta\nu_{1/2} \alpha 1/\rho_{Ar}$ at high densities in accordance with the experimental result.

It is interesting to note that density narrowing is also present in the H_2–Ar liquid system and that the diffusion theory of Zaidi and Van Kranendonk seems to be also applicable in this case. The two spectra in Fig. 4 show the $S_1(1)$ region for the liquid system at two densities, 640 and 833 amagat, obtained by pressurizing the liquid at 115 K up to ~1500 atm; a significant narrowing of the $S_1(1)$ line is evident. Values of $\Delta\nu_{1/2}$ for a few densities in the range given above are plotted in Fig. 3. These indicate general agreement with the law, $\Delta\nu_{1/2} \propto 1/\rho_{Ar}$, as was found for the gaseous system. It might also be noted that the line for the liquid falls below that of the gas by an amount which is in good agreement with the $\sqrt{T}$ variation expected for translational broadening and also for the diffusion coefficient. This emphasizes the essential similarity of collision-induced spectra of liquid and gaseous system which has been pointed out previously by Welsh and Kriegler (1969).

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