SPECTRAL LINESHAPES OF IR AMMONIA TRANSITIONS VERSUS PRESSURE AND TEMPERATURE

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Lineshape studies of molecular transitions have always been important in basic and applied research. Ammonia, among the molecular species, has been extensively measured not only because it is a component of the atmosphere of Jupiter and of other celestial bodies, and it is also present as a trace gas in the Earth atmosphere, but also because of its large molecular dipole and its singular inversion energy spectrum. The latter properties are important for developing theoretical models which should then be validated against the experimental results. However this much needed procedure has not been perfomed in a satisfactory way up to a few years ago, because pressure broadenings and shifts in ammonia were known with experimental errors usually around 10% and more than 30% respectively, and practically no measurements as a function of temperature were available. This unpleasant situation changed recently, when for a few transitions the errors have been drastically reduced to less than 3% and 10%, respectively [a,b]. Now these measurements have been extended to several other ammonia transitions obtaining results with have been discussed in the frame of a slightly modified ATC theory. The main results of this much closer comparison with respect to previous attempts, is that the theory describes very well the self broadening, has some limitations for self shift and does not agree well with the empirical laws describing the temperature behavior, expecially when wide temperature ranges are involved. Even more these empirical laws are completely at odd in those cases when the shift changes sign versus temperature as we have recently measured for the first time [c].

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[b] G. Baldacchini, F. D'Amato, M. De Rosa, G. Buffa, and O. Tarrini, J. Quant. Spectrosc. Radiat. Transfer 55, 745 (1996)
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