THEORETICAL CALCULATION OF THE N₂ BROADENED HALF-WIDTHS OF H₂O

Q. MA, NASA/Goddard Institute for Space Studies and Department of Applied Physics and Applied Mathematics, Columbia University, 2880 Broadway, New York, NY 10025; R. H. TIPPING, Department of Physics and Astronomy, University of Alabama, Tuscaloosa, AL 35487; R. R. GAMACHE, Department of Environmental, Earth and Atmospheric Science, University of Mass. Lowell, Lowell, MA 01854.

The water molecule is the most important Greenhouse gas and thus plays a pivotal role in atmospheric spectra. In addition to accurate intensities and frequencies, one also needs accurate self and foreign half-widths and shifts, and their temperature dependence. Over the years, a large number of theoretical calculations have been carried out by Gamache and his collaborators\(^a\). They used the complex Robert-Bonamy theory with a sophisticated interaction potential. The drawback of this method is that one has to carry out the calculations to a high-order perturbation in order to obtain converged results. However, by using the coordinate representation one is able to obviate the perturbation expansion and obtain results corresponding to a high cut-off order\(^b\). We present comparisons for the H₂O-N₂ system for a few lines using the same interaction potential for a comparison between the methods. We conclude that for lines having a large half-width, the convergence is rapid but, on the other hand, for lines with relatively small half-widths the convergence is very slow.