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Identification of modes of vibration in a HeNe* temporary molecule and interference effects in slow He-Ne collisions[1] CRISTIAN BAHRIM, JOSEPH HUNT, Department of Chemistry and Physics, Lamar University — The model potential for electrostatic interaction between He($1s^2$) and Ne*($2p^5 3p$) atoms developed by Bahrim *et al.* (*Physical Review A* **56**, 1305 (1997)) leads to 36 adiabatic electronic potentials, which were successfully tested in calculations for experiments in atomic crossed beams and discharge cells. The existence of deep potential wells below 6 a_o suggests that modes of vibration could form within these wells during a He-Ne collision. We identify several modes of vibration by using a Morse potential which best fits the electronic potential wells. Further, a set of transitions between vibrational-electronic states is proposed. For experimental testing of our results an IR laser spectroscopy technique is proposed. The abundance of Ne*($2p_i$) atoms after collision and successful absorption of IR photons is discussed. Also, this paper explains the oscillations observed in quantum probabilities for intermultiplet transitions between $2p_i$ states of the Ne*($2p^5 3p$) atoms induced by collisions with He($1s^2$) atoms, which were reported in *Physical Review A* **56**, 1305 (1997). Our semi-classical model explains the formation of the quantum oscillations as being the result of the interference between matter waves associated to two collisional channels near the avoided crossing region between these channels.

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