MODELING OF SATURATED ABSORPTION IN GAUSSIAN BEAM

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If the Saturated Absorption resonance modeling has generated an abundant literature when it is based on "monochromatic" ElectroMagnetic Fields (EMF), the time of interaction of the molecules with the impinging EMFs due to the finite transit path is quasi exclusively considered under the approximation of a decay rate of the population, providing Lorentzian resonance shapes. If the reasons of this over simplification can be understood, they largely miss the real interaction resonance shape. Actually, numerous transverse profiles of the EMF are Gaussian shaped, hence, this shape is experienced by the traveling molecules at low pressure when they cross the EMFs. An accurate description of the interaction is crucial for analyzing the collisional processes under these circumstances (the radiative processes can be ignored in the Infrared range). Under low pressure conditions, those include inelastic collisions (probably not dominant), Velocity Changing Collision, Phase Interrupt Collisions or Resonant Collisions.

We will try to discuss a model based on a 2-level system under weak saturation, including the recoil effect and the different collisional processes under a Gaussian EMF. Analytical solutions can be obtained for a specific Doppler shift. Then, only a Doppler shift numerical integration is required.

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