OPTICAL SELECTION OF SLOW MOLECULES USING TRANSIENT LINE NARROWING, APPLICATION TO SF_6

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A novel effect has been found which reduces the linewidth of absorptions to below their linewidth defined by the limited average interaction time between the molecules and the laser light. For transit-time broadened transitions it will be demonstrated that transient line narrowing can reduce the linewidth by a factor of five whilst increasing signal to noise ratio. Using the Cambridge 10μm CO_2-Laser Spectrometer absorptions in room temperature SF_6 have been recorded with a half-width-half-maximum of 1.4 kHz which implies a transverse velocity distribution with an effective temperature of only 1K. This method practically eliminates shifting and broadening effects like the second order Doppler effect.