PHASE DEPENDENCE IN ABOVE THRESHOLD IONIZATION IN THE PRESENCE OF A MICROWAVE FIELD

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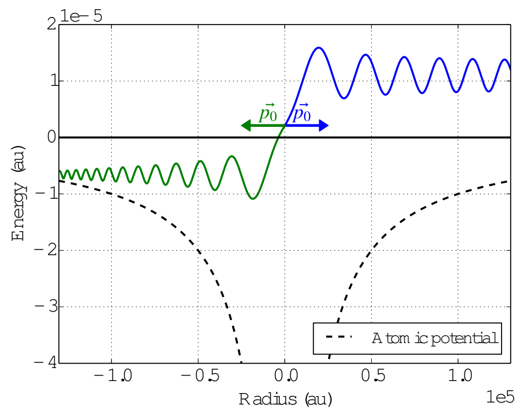

Figure 1: Electrons gaining or losing energy during the first microwave cycle depending of the initial launching direction. Here the phase of the microwave field is adjusted to provide a maximum energy transfer. The oscillations in energy are synchronized with the 14GHz microwave field.

Exciting an atom with high-frequency radiation in the presence of a low frequency field can result in energy transfer between the photoelectron and the low frequency field, depending on the phase of the low frequency field when the excitation occurs. We excite Li atoms with IR lasers in the presence of a microwave field. In a previous experiment, detection of highly excited states with excitation by a ps laser tuned above the limit clearly showed a phase dependence. The variation of the signal due to a phase change reach 0.1% of the total excitation in that case. We are using a new excitation scheme with a CW amplitude modulated laser, the modulation being phase locked to the microwaves. We now observe a signal variation of 10% of the total excitation. The ps pulses spreads the population over a broad energy spectrum while the modulated excitation keeps it in narrow bands. The modulated laser frequency can be tuned to couple one band to the highly excited states, enhancing the collection efficiency, additionally it is closer to the limit. Furthermore, the modulated laser allows the observation of phase dependent transfer to both higher and lower energies. The observations can be described with relatively simple models.