Grobe and Fedorov Reply: Katsouleas and Mori [1] raise an important point. They indicate that the well-known Lorentz force can destabilize the atom if the laser field $\mathcal{E}$ is sufficiently strong such that the average drift velocity $[V_z \equiv (\mathcal{E}/\omega)^2/4c]$ exceeds the spreading velocity $[V_s \equiv d\Delta x(t)/dt \approx 1/\Delta x_0$, where $\Delta x(t)$ denotes the width of the wave function and $\Delta x_0 = \Delta x(0)]$. However, we cannot agree with some conclusions of [1] about the importance of the relativistic drift for the spreading mechanism and the validity of the dipole approximation. Below we formulate our present understanding of the situation.

In a relativistic three-dimensional picture there are three different ionization regimes for a given laser pulse duration T: The polychotomy regime $[\Delta x_0 \omega^2 < \mathcal{E} < \Delta x(T)\omega^2]$ is characterized by a fully developed localized wave function. This regime is conventionally associated with high-frequency stabilization of the ground state. In the spreading regime $[\Delta x(T)\omega^2 < \mathcal{E} < (4c/\Delta x_0)^{1/2}\omega]$ discussed in [2] the electric field strength $\mathcal{E}$ is so large that the atomic binding potential is rather irrelevant for the dynamics, and wave-packet spreading of the initial ground state is the main decay mechanism. For even larger values of $\mathcal{E}$ $(V_s < V_z)$ we enter the relativistic drift regime discussed above. We have sketched these three regimes in Fig. 1 for a very short laser pulse $(T = 6 \times 2\pi/\omega)$.

Furthermore, we have indicated in Fig. 1 the final ground-state population after the end of the pulse for several field peak strengths $\mathcal{E}$ computed for photodetachment of the model potential of [2]. The survival population approaches the asymptotic value predicted by [2] clearly in the spreading regime where destabilizing effects due to the Lorentz force can be safely neglected. In this regime the dipole approximation is justified. Only for field strengths larger than $\mathcal{E} \approx (4c/\Delta x_0)^{1/2}\omega$ $(\approx 0.65$ a.u. for our parameters) does the dipole approximation break down and the atom destabilize due to the relativistic drift.

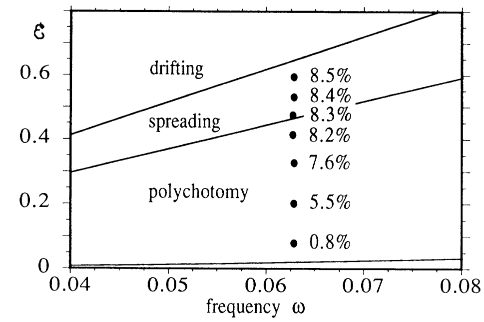

FIG. 1. The three strong field ionization regimes for the short-range potential [2] with the ground-state width $\Delta x_0 = 5.1$ a.u. The percentages correspond to the final ground-state population after a smooth 6-cycle laser pulse of frequency $\omega = 0.0628$ a.u. Note that the survival population has already nearly reached its asymptotic value $(8.6\% = 2(\Delta x_0)^2/[4(\Delta x_0)^4 + T^4]^{1/2}$, Eq. (2a), Ref. [2]) inside the spreading regime and below the drift border.

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