Benvenuto, Casati, and Shepelyansky Reply: In our Letter [1] we had shown that chaotic diffusive ionization of molecular Rydberg states can take place for relatively high orbital momentum l when the quantum defect is negligibly small [namely, $4 < l < l_c = (3/\omega)^{1/3}$]. Also in our diffusive ionization it was assumed that the minimal distance between electron and core $r_{\min} \approx l^2/2$ always remains much larger than the core size $d \ll (3/\omega)^{2/3}$. Farrelly, Bellamo, and Uzer (FBU) [2] claim that the main mechanism of ionization is due to the change of orbital momentum which will lead to direct collisions with the core when $r_{\min}$ becomes comparable with d. While from [1] it is clear that this direct collision mechanism is not important for ionization [see discussion after Eq. (7) in [1]], here we give more detailed analysis to confirm this statement.

First, let us stress that FBU make their computations in the frame with circular polarized effective electric field [Eq. (7) in [1] and Eq. (1) in [2]]. This frame (KHF) is obtained, via the Kramers-Henneberger transformation, from the original frame (OF) with rotating core [Eqs. (1)–(4)]. According to this transformation the quantity ℓ computed by FBU is related to the angular momentum l of the electron in OF by $\ell = l + \delta\ell$ with $\delta\ell \approx d\omega r \cos(\omega t)$, where r denotes the distance between the electron and the center. The same estimate for the variation $\delta\ell$ also directly follows from (7). For typical initial conditions with the orbit size $r_0 \approx n_0^2 \approx 1$ the difference between ℓ and l is small since $d\omega \ll 1$. In this case both l and ℓ can be used to estimate the minimal distance between electron and core $r_{\min} \approx l^2/2$. However, for large orbit size (or small initial Keplerian energy $E_0 \approx -1/r_0$) the value of $\delta\ell$ can become comparable with the initial value of l leading to large oscillations of ℓ. Such oscillations are seen in Fig. 1(b) of the Comment. However, the electron angular momentum l remains approximately constant during ionization so that the condition $r_{\min} \approx l^2/2 \gg d$ is preserved and ionization proceeds without direct collisions in agreement with the statement of [1]. This is clearly evident from Fig. 1 in which we plot $r_{\min}/d$ for two typical chaotic ionizing orbits. The reason for large oscillations of ℓ is due to growth of interaction in KHF (7) with r_0 while in OF interaction decreases with r_0 and the variation of l remains small. We cannot reproduce Fig. 1(b), since FBU do not provide the absolute scaling of the figure, and therefore we do not know the initial value of r_0. However, according to their Fig. 1(b) ionization occurs only after four orbital periods. After each period the maximal energy change is $\Delta E \approx 0.015$ (see Fig. 1 in [1]), and therefore we can estimate that the initial size of the orbit is $r_0 \sim 1/\Delta E \sim 100$. The choice of such large $r_0 \sim 100$ gives large ℓ fluctuations, and this led FBU to incorrect conclusions about the importance of direct collisions.

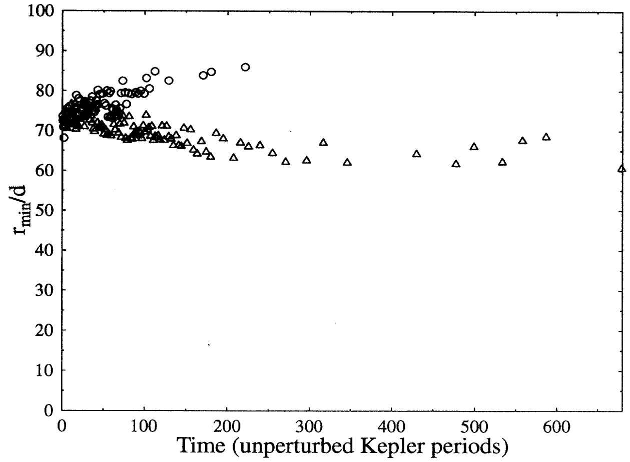

FIG. 1. Dependence of $r_{\min}$ on time for two chaotic ionizing orbits from Fig. 2(a) in the Letter [original frame (1–4)] with $n_0 = 2.25$, $\omega = 4$, $d = 6.25 \times 10^{-4}$, $n_s = 1$. Initially (a) $l = -m = 0.3$, orbit is ionized after $t_{\rm ion} = 221$, ionization energy $E_{\rm ion} = 6.9 \times 10^{-3}$ (circles); (b) $l = m = 0.3$, $t_{\rm ion} = 679$, $E_{\rm ion} = 6.8 \times 10^{-4}$ (triangles).

Let us also mention that for the system studied in [2] the energy change is always given by the Kepler map (6) even if the direct collision takes place. Indeed, the Kepler map nicely describes the one-dimensional hydrogen atom where each collision is a direct collision (see Ref. [6] in [1]) and an electron is ionized after many such collisions.

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