Wells, Simbotin, and Gavrila Reply: The Comment [1] on our paper [2] touches upon delicate issues of atomic dynamics in strong fields that we can only briefly address here (see, however, [3]). To begin, we note that the Comment uses a different terminology than ours. According to our mathematical definition of a LIS (light-induced Floquet state) based on boundary conditions [see [2], text after Eq. (3)], it is obvious that we can speak of "materialization" and disappearance. The Comment refers to a dynamically evolving "state" of the atom in a sense that we have termed as a "diabatic path" (DP) [see [2], text after Fig. 3]. This caveat made, we focus on the criticism in the Comment of our statement (1). The criticism is epitomized by the conclusion: "Hence, the LIS are nothing more than dynamically shifted states of the bare atom ...." We consider this conclusion untenable for several reasons. To better illustrate them, we present in Fig. 1 an expanded version of Fig. 2 of [2]. The reasons are as follows:

(i) A given LIS does not belong in general to a single DP, and, consequently, it will not have an unambiguous connection to a field-free state [i.e., we see signatures of the same LIS in excess-photon ionization/above-threshold ionization (EPI/ATI) spectra originating from different initial states]. Thus, for $\omega = 0.12$, LIS1 (see Fig. 2 of [2], or present Fig. 1) lies on both DP's considered in [2] (one starting from $n = 0$, the other from $n = 2$). Moreover, by manipulating the pulse, it is possible to make the population starting in $n = 2$ to stay preponderantly on LIS1 at the avoided crossing between LIS1 and $n = 4$ ($\alpha_0 \approx 3.2$), rather than jump diabatically to state $n = 4$ [3,4]. What dynamically shifted field-free state should LIS1 then represent, $n = 0$ or $n = 2$? The correct interpretation is that we are dealing with two different DP's having as constituents the descending or ascending branch of LIS1. This situation is quite general, e.g., the EPI/ATI spectra show that LIS3 (see present Fig. 1) can be accessed not only along the DP starting from the $n = 0$ mentioned (via the descending branch of LIS1), but also along a DP starting from $n = 7$ [3]. (Note in Fig. 1 the number of LIS materializing at higher α_0 [5].)

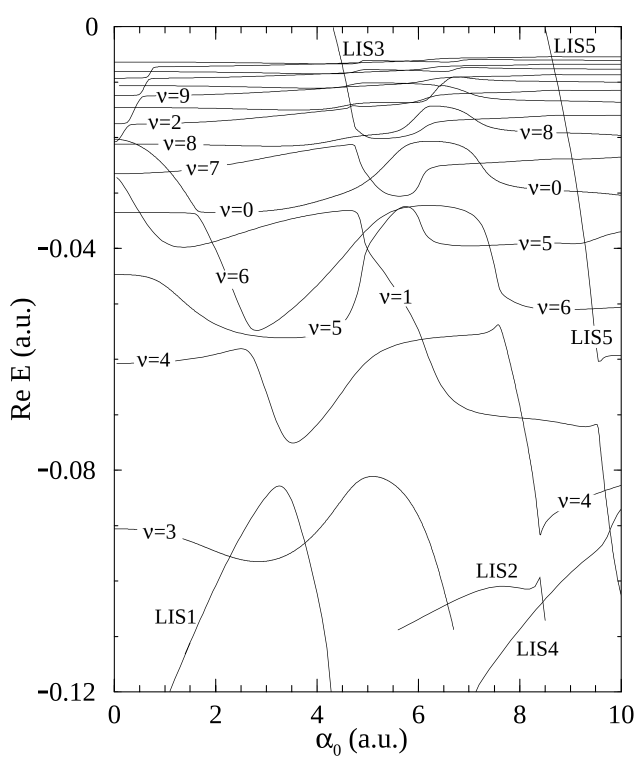

FIG. 1. Real part of Floquet quasienergies at $\omega = 0.12$ a.u.

(ii) Conversely, a field-free state does not define a unique DP. This is because the evolution of the atom does not depend only on the initial state but also on the pulse shape, and on the numerous possible adiabatic branchings at the various avoided crossings encountered. Moreover, at higher peak values of α_0, alternative DP's can appear due to "shakeup," starting from states adjacent in energy to the initial one. Thus, for $n = 2$, at $\alpha_0 > 5$, we find the extra DP's: (a) $n = 1$, LIS5, etc.; (b) $n = 1$, LIS4, etc.; (c) $n = 7$, LIS3, etc., with all of their possible branchings [3].

(iii) There are LIS which do not belong to any DP connecting to a field-free state, even for Coulomb-tail potentials (a fact quite common for short range potentials). For example, there is a LIS for $\omega = 0.24$, materializing at the bottom of the energy band $-\omega < E < 0$ at $\alpha_0 \approx 5$, with no DP leading to it in the energy band below [3].

Regarding the criticism of our statement (2), the literature alluded to refers to bulk ionization from Rydberg states, without considering the manifestation of LIS-Floquet states in EPI/ATI spectra; it is, therefore, irrelevant in our context.

We reemphasize that LIS are indispensable entities in the theory of intense-field atomic dynamics, ensuring its mathematical completeness, and having directly observable consequences. We consider our statements (1) and (2) reflect the situation adequately.

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[3] J. C. Wells, I. Simbotin, and M. Gavrila (to be published).
[4] With pulse duration $\tau = 121$, some 80% of the population stays in LIS1.
[5] Also note the extensions to higher α_0 of the DP's considered in [2], e.g., (a) $n = 0$, 6, 4, LIS1, LIS3, 7, 1, 3, Rydberg states, 8, 0, 6, 4, LIS2, etc.

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