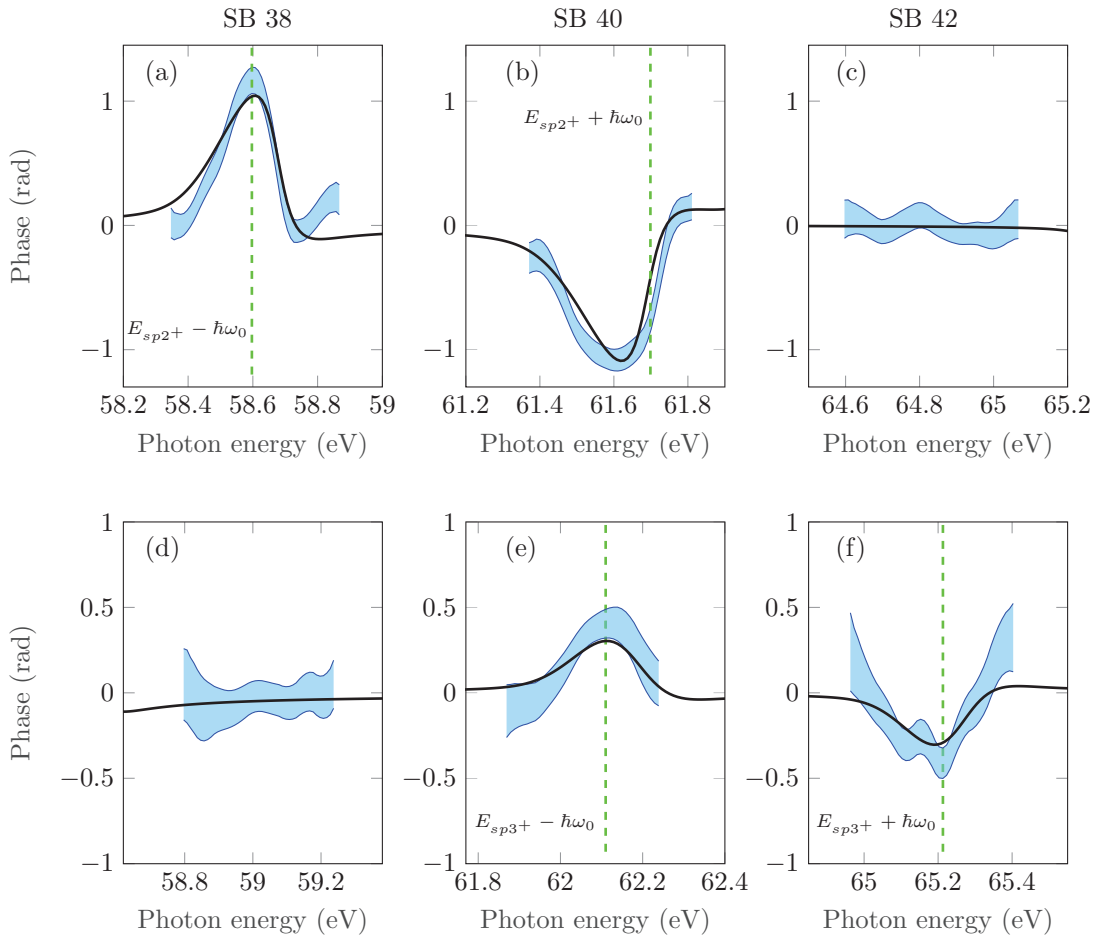

Figure 5. Phases measured (blue) in SB38 (first column), SB40 (second column) and SB42 (third column) in the cases where H39 is resonant with the $sp2^+$ state (first row) and where H41 is resonant with the $sp3^+$ state (second row). The shaded areas correspond to standard deviation around the measured value. A clear phase variation linked to the two resonances is observed on the sidebands originating from the resonant harmonics (SB38 and SB40 for $sp2^+$, SB40 and SB42 for $sp3^+$), while the phase on the other sidebands is flat. The theoretical calculations (black) agree very well with the measured phases.

amplitude measurements are not.

Both amplitude and phase measurements are compared to theoretical calculations using the finite pulse model introduced in [36]. The calculations, which take into account the bandwidths of the harmonics and IR pulses, reproduce well the measured amplitudes (figure 4(a)) and phases (figure 5). Furthermore, our measurements are in very good agreement with the ones carried out by Gruson *et al.* [25]. However, as already mentioned in section 3.1, the limitations of the spectral resolution in the two experiments have different origins. In [25], the dressing mid-IR pulses were 70 fs long (26 meV bandwidth), which reduced the influence of finite pulse effects, while the spectral resolution of the MBES was approximately 190 meV, which led to a smaller and broader phase variation of approximately 1.5 rad. In our case, the RABBIT spectrogram is deconvolved from the MBES response (95 meV) but the IR pulses are 70 nm broad (135 meV).

4.2. Time domain

The measured spectral amplitude and phase, displayed in figure 4, are now used to reconstruct, using a Fourier transform, the temporal characteristics of the two-photon EWP emitted through the $sp2^+$ resonance. Note that the phase evolution below the 30%-threshold does not affect significantly the reconstruction. Figure 6(a) shows the temporal intensity (blue solid curve) and phase (blue dotted curve) of the wave packet. The temporal profile shows a large Gaussian-like peak centered at the origin with a duration of 6 fs FWHM reflecting the ionizing XUV pulse. On this time scale, the dominant ionization channel is