## Resonant two-photon ionization of helium atoms studied by attosecond interferometry Supplementary material

L. Neoričić,<sup>1,†</sup> D. Busto,<sup>1,2,†</sup> H. Laurell,<sup>1</sup> R. Weissenbilder,<sup>1</sup> M. Ammitzböll,<sup>1</sup> S.

Luo,<sup>1</sup> J. Peschel,<sup>1</sup> H. Wikmark,<sup>1</sup> J. Lahl,<sup>1</sup> S. Maclot,<sup>1</sup> R. J. Squibb,<sup>3</sup> S. Zhong,<sup>1</sup>

P. Eng-Johnsson,<sup>1</sup> C. L. Arnold,<sup>1</sup> R. Feifel,<sup>3</sup> M. Gisselbrecht,<sup>1</sup> E. Lindroth,<sup>4</sup> and A. L'Huillier<sup>1</sup>

<sup>1</sup>Department of Physics, Lund University, Box 118, 22100 Lund, Sweden

<sup>2</sup>Institute of Physics, Albert Ludwig University, Stefan-Meier-Strasse 19, 79104 Freiburg, Germany

<sup>3</sup>Department of Physics, University of Gothenburg, Origovägen 6B, 41296 Gothenburg, Sweden

<sup>4</sup>Department of Physics, Stockholm University, AlbaNova University Center, SE-106 91 Stockholm, Sweden

## I. DETAILS ON THE MEASUREMENTS PRESENTED IN FIGURE 6B

The presented curves are obtained by performing a weighted averaging over N measurements according to

$$\bar{\varphi} = \frac{\sum_{i=1}^{N} \varphi_i w_i}{\sum_{i=1}^{N} w_i},\tag{1}$$

where  $w_i = 1/\sigma_i^2$  with  $\sigma_i$  being the standard deviation of the cosine fit applied to the energy-resolved sideband signal to extract the phase. The corresponding error is calculated as

$$\sigma_{\bar{\varphi}} = \sqrt{\frac{N}{N-1} \frac{\sum_{i=1}^{N} (\varphi_i - \bar{\varphi})^2 w_i}{\sum_{i=1}^{N} w_i} + \frac{1}{\sum_{i=1}^{N} w_i}}.$$
 (2)

In the case N = 1, the displayed error equals the error of the cosine fit for that data point.

We performed a total of five measurements across different energy regions, as indicated in the table below. Only data points with an error below 0.8 rad were taken into account when performing the weighted averaging.

No.	Energy region $[eV]$
1	24.6-24.7
2	24.6 - 24.75
3	24.6-25
4	25.1 - 25.6
5	25.2 - 26.1

 $<sup>^\</sup>dagger$  These two authors contributed equally; lana.neoricic@fysik.lth.se