University of Groningen

Erratum

Carbone, Fabrizio; Baum, Peter; Rudolf, Petra; Zewail, Ahmed H.

Published in:
Physical Review Letters

DOI:
[10.1103/PhysRevLett.106.139901](https://doi.org/10.1103/PhysRevLett.106.139901)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2011

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Carbone, F., Baum, P., Rudolf, P., & Zewail, A. H. (2011). Erratum: Structural preablation dynamics of graphite observed by ultrafast electron crystallography (Physical Review Letters (2011) 106 (139901)). *Physical Review Letters*, 106(13), [139901]. <https://doi.org/10.1103/PhysRevLett.106.139901>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

**Erratum: Structural Preablation Dynamics of Graphite Observed
by Ultrafast Electron Crystallography
[Phys. Rev. Lett. 100, 035501 (2008)]**

Fabrizio Carbone, Peter Baum, Petra Rudolf, and Ahmed H. Zewail

(Received 4 March 2011; published 30 March 2011)

DOI: [10.1103/PhysRevLett.106.139901](https://doi.org/10.1103/PhysRevLett.106.139901)

PACS numbers: 61.82.-d, 07.78.+s, 63.20.K-, 78.47.-p, 99.10.Cd

In this paper, the following statement was reported: “The overall expansion of the lattice, which can be as much as 0.08 Å at the highest fluence of 44.5 mJ/cm², corresponds to 1.25% of the *c*-axis equilibrium value, 6.7 Å. This expansion is huge and beyond any thermal value. The thermal linear expansion coefficient ($\alpha = \frac{\Delta L}{L_0} \cdot \frac{1}{\Delta T}$, with *L* being the expansion and ΔT the temperature change) for graphite is $7.9 \times 10^{-6} \text{ K}^{-1}$ [1], and such a change would correspond to a temperature jump of more than 1500 K. Given our fluence and the heat capacity of graphite, the maximum expected temperature rise is around 40 K.”

In the calculation of the laser-induced temperature increase, there is an error due to a wrong unit conversion of the penetration depth. In the experimental conditions of this paper, given a penetration depth of 200 nm (as defined in [2]), a heat capacity *C* of $2.67 \frac{\text{J}}{\text{K} \cdot \text{cm}^3}$ (obtained as the effective heat capacity between 300 and 800 K [3]), and a reflectivity *R*(1.55 eV) = 0.35 [4], the actual temperature jump

$$\Delta T = \frac{F(1 - R)}{\delta C} \quad (1)$$

would be around 542 K. Given the linear expansion coefficient specifically for the *c* axis, $\alpha = 28 \times 10^{-6} \text{ K}^{-1}$ [1], with *L* being the expansion and ΔT the laser-induced temperature jump, the expansion corresponding to a temperature jump of 542 K would cause an increase of the *c*-axis lattice constant of 0.1 Å. These values are reasonably close to the observations made in this paper and suggest that most of the reported long-term dynamics is thermal in origin, while in the femtosecond regime lattice motions are driven by the out-of equilibrium electronic structure.

[1] M. S. Dresselhaus, *Graphite Fibers and Filaments* (Springer, Berlin, 1988).

[2] J. D. Jackson, *Classical Electrodynamics* (Wiley, New York, 1962).

[3] A. T. D. Butland and R. J. Maddison, *J. Nucl. Mater.* **49**, 45 (1973).

[4] A. B. Kuzmenko, E. van Heumen, F. Carbone, and D. van der Marel, *Phys. Rev. Lett.* **100**, 117401 (2008).