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Evidence for a Peierls phase-transition in a three-dimensionnal multiple charge-density-waves solid.

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We studied the ultrafast photoinduced charge-density-wave (CDW) to metal phase transition in a complex solid, namely Lu5Ir4Si10. After melting the charge ordering using infrared laser pulses, the consequent charge redistribution is probed with fs time resolution through the spectral weight analysis of the transient optical response over a broad energy range.
The time-dependent spectral weight reveals a signature of the CDW melting and the time-scale of this photo-induced phase transition. This new kind of analysis allows us to show that the charge order remains preserved until the lattice distorts sufficiently to induce the phase transition.
These results are completed by ab-initio modeling of the electronic band structure, identifying the orbitals involved in the CDW and the electronic transitions leading to the photo-induced melting of the charge order. This allows us to reveal the Peierls origin of multiple CDW in this three-dimensional solid.

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