

Optical Spectroscopy Study on $R\text{Te}_3$ ($R = \text{La}, \text{Ce}, \text{Er}$): Evidence for Multiple Charge-Density-Wave Orders

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We performed optical spectroscopy measurement on single crystals of $R\text{Te}_3$ ($R = \text{La}, \text{Ce}, \text{Er}$), a kind of rare-earth-element tri-telluride charge-density-wave (CDW) compounds. The optical spectra are found to display very strong temperature dependence. In addition to a large and pronounced CDW energy gap that is already present at room temperature, as observed in earlier studies,¹ the present measurement revealed the formation of another energy gap at smaller energy scales at low temperatures for all the three compounds. Furthermore, the close of the larger energy gap in ErTe_3 is observed above 400 K in our high-temperature measurement.

The study yields evidence for the presence of multiple CDW orders or strong fluctuations in the rare-earth-element tri-telluride. However, the new CDW order in the light rare-earth-element tri-telluride $R\text{Te}_3$ ($R = \text{La}, \text{Ce}$), which was revealed by the present measurement,² was not identified before by other experimental techniques. We believe that even if the static CDW is not formed, the very strong CDW fluctuations are already present. The larger CDW gap feature well above the transition temperature in ErTe_3 also reveals the substantial fluctuation effects.

¹A. Sacchetti, L. Degiorgi, T. Giamarchi, N. Ru, and I. R. Fisher, Phys. Rev. B **74**, 125115 (2006).

²B. F. Hu, P. Zheng, et al. Phys. Rev. B **00**, 005100 (2011).