Superconductivity without mirror symmetry

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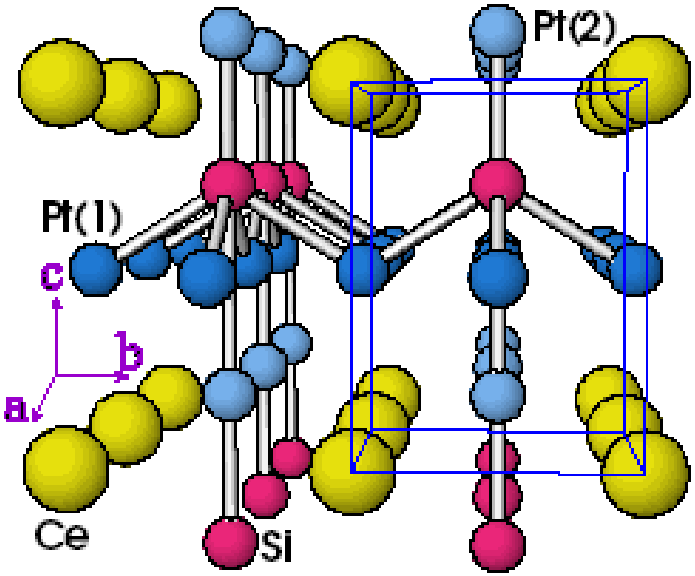
Superconductors are emerging as a new important technology in the energy sector. The symmetry of the environment that free electrons see before entering a superconducting state has long been known to be important for understanding the superconductor itself . With a series of co-workers, we have examined what occurs when one of the usual symmetries, mirror plane symmetry, is not present. We have found that the a variety of possible superconducting states are not not stable when this symmetry is broken. We have also found that a new type of superconducting state exists when a magnetic field is applied.
Phys. Rev. Lett. **92**, 097001 (2004).



$CePt_3Si$ - P4mm; $CePt_3B$-type

Crystal structure of $CePt_3Si$ (Figure from E.Bauer *et al.*, *Phys. Rev. Lett.* **92**, 027003). In this superconductor, electrons live in an environment which is missing a mirror symmetry.

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Education:

One undergraduate (Evgeni Zlatanov) and three graduate students (Raminder Kaur, Shantanu Mukkerjee, and Zhichao Zheng) contributed to this research.

Outreach:

The PI mentored an undergraduate student through a research project in the research experiences for undergraduates (REU) program at the University of Wisconsin-Milwaukee (UWM). The PI also participated in a one day program to allow high school physics teachers to see what physics research is being conducted at UWM.

The PI explaining superconductivity to a group of high school physics teachers.