

This Week's Citation Classic®

Stewart G R. Heavy-fermion systems. *Rev. Mod. Phys.* 56:755-87, 1984. [Materials Science and Technology Division. Los Alamos National Laboratory. Los Alamos, NM]

A review is given of the physical properties of materials that exhibit a high effective electron mass at low temperatures, the so-called "heavy electron" (or fermion) systems. These systems include three superconductors (CeCu_2Si_2 , UBe_{13} , and UPt_3) which show such unusual behavior that the possibility of nonstandard superconductivity cannot be ruled out. [The SC[®] indicates that this paper has been cited in more than 900 publications.]

A Review Written in Near Record Time

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John Wilkins, as associate editor of *Reviews of Modern Physics*, asked me to write a review of the very young field of heavy fermions in late 1983. When I projected the finished rough draft "dart board" version for the following April or May, I detected both a strong wish that I meet that deadline and some amount of skepticism/incredulity that I would devote the requisite energy and time to make it happen.

I was able to keep to my self-imposed deadline (being sole author helped) via the following regimen: The building at Los Alamos that I was in, the Center for Materials Research, had an essentially unused library up in the attic that you reached by climbing narrow concrete steps, followed by wending your way through the building's poorly lit plumbing, compressed gas supply, and storage area. So for six weeks solid I would go up there five days a week at eight in the morning and work the whole day.

What came out of these six weeks was then sent to five colleagues to critique, as well as to Wilkins. These people, as well as a student of John's, made significant and useful suggestions for improvement. These suggestions

then took a further week in early summer to write in, while I was visiting the Francis Bitter National Magnet Lab at MIT for six weeks. Not only did I, as well as my unofficial reviewers, work hard but the assistant editor who then got the manuscript ready for the October 1984 issue worked so hard that she took it with her on vacation.

In the end, the effort felt worth it. Putting all that I could into one article helped me think about the physics of these (still) fascinating compounds. Doing it quickly got the pain of interrupting my research over as quickly as possible. The fact that the review was then available to the community early on in a rapidly growing field helped people both in this area and those who just wanted to keep abreast of this new subfield of physics. One of these latter type of people who read the article (or so I was told by Gerry Brown at Stony Brook) was R.P. Feynman at my old alma mater, Caltech—certainly a high honor for any review writer.

The article's high citation rate is likely due to (a) its early appearance (the next thorough reviews^{1,2} of heavy-fermion experiments appeared in 1987) and (b) the fact that the field remains very active today, with new discoveries and understanding generating continuing interest. Since the data cited in the review remain essentially correct today (although clearly not complete), this continuing interest in these systems generates continuing citations. More recent reviews^{1,6} are evidence for this ongoing interest.

If I had the review to do over again, maybe I wouldn't follow Si Foner's (MIT) advice next time. While searching for a descriptive word in the rough draft for those systems between normal metals and those with really heavy effective mass electrons, I hit upon one word that Si strenuously objected to as unscientific. Well, this word still surfaces in talks the world over (since the rough draft saw fairly wide distribution) to describe such "middle-weight" fermion systems, but Si just couldn't stand the word. Everytime someone describes such a system as "pudgy," though, I can further trace just how far afield the influence of that rough draft wandered from the original six addressees.

- Ott H R. Characteristic features of heavy-electron materials. (Brewer D F. ed.) *Progress in low temperature physics*. Amsterdam. The Netherlands: North Holland, 1987. Vol. XI. p. 215-89.
- Ott H R & Fisk Z. Heavy-electron actinide materials. (Freeman A J & Lander G H. eds.) *Handbook on the physics and chemistry of the actinides*. Amsterdam. The Netherlands: North Holland, 1987. Vol. 5. p. 85-225.
- Lee P A, Rice T V I, Serene J W, Sham L J & Wilkins J W. Theories of heavy-electron systems. *Commun. Condensed Matter Phys.* 12:99-161, 1986. (Cited 410 times.)
- Fuide P, Keller J & Zwicknagl G. Theory of heavy-fermion systems. *Solid State Phys.* 41:1-150. 1988. (Cited 125 times.)
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