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Referee's report on the doctoral thesis of Attila Bartha entitled

"Ground state investigations of Ce and U intermetallic compounds"

The refereed doctoral thesis reports on a very comprehensive investigation of physical properties, in particular the magnetic ones, of several single crystalline Cerium and Uranium intermetallic compounds. Particular emphasis is given to the ground state properties ranging from complex magnetic structures to non-Fermi liquid behavior. The exact choice of compounds is not explained by the student but they fall into three groups that are closely related to each other by their crystal structure. Modification of the ground state properties of Cerium and Uranium by the interaction with neighbouring atoms (transition metals and *p*-elements here) is of utmost interest to both experimentalists and theoreticians in the fundamental material science. The study of the physical properties of these intermetallic compounds were done solely on single crystals using state-of-the art macroscopic and microscopic experimental techniques.

From the formal point of view, the presented work has 105 pages with clearly structured chapters. The manuscript is written in a clear English with only a small number of typographical and grammatical errors. The overall presentation of the essential content is appropriate and complete. Equations, tables and figures follow the expected standards for publication in peer-reviewed journals. Basic description of the underlying theories and used experimental techniques is adequate; focus is mostly put on the experimental results. References are relevant although sometimes not placed aptly (e.g. in a Figure caption instead of the main text of the "Previous results" Section). In general, the experimental results Chapter would benefit from a better separation between the known results and new findings.

The presented results are accurate, original and relevant in the field of f-electron intermetallics. In particular the angle dependent magnetization data are unique and rare measurements which give results justifying further microscopic investigation of Ce_2RhIn_8. To be highlighted is also the convincing magnetic structure determination for $URhIn_5$ and U_2RhIn_8.

It is only a pity that the enormous amount of experimental work is missing deeper interpretation and synthesis to place the results in the general context of *f*-electron systems. Not even an attempt at identifying any systematics (e.g. correspondence between Cerium and Uranium, the role of the *p*-element) is done. In many sections of the manuscript, ground state properties of related compounds are stated but the analysis is never brought further than a listing. Only p. 74 contains a very shy proposal on the structural parameters influencing the physical properties: *p*-element size and local tetragonal factor (i.e. compression of the U-Ga/In cage along the *c*-axis). In the very same direction goes the 4th Chapter; it actually only summarizes the presented experimental results, no conclusions are given.

Overall, I have only very few reserves to the presented manuscript. The experimental work in the doctoral thesis of Attila Bartha shows careful data analysis, when needed supported by simulations. Generally several techniques are combined to substantiate the results. Five publications in peer-reviewed journals reflect the scientific quality of the presented work, constituting a significant contribution to its field of research. The doctoral candidate proves that he is able to carry out scientific research in an independent way. I recommend this thesis to be accepted by the committee and I do believe that after a successful defense Attila Bartha can be awarded the PhD degree.

Despite the work being of high quality, the student should address several questions and comments during the thesis defense:

* At the bottom of page 38 resistivity fit parameters are given. Can you compare with other related materials? Can you draw any conclusion from the comparison? What is the meaning of the saturation of the positive Hall resistivity (Fig. 3.5)?

* The magnetic contribution to the field-dependent magnetoresistance of Ce_2IrIn_8 with magnetic field applied along the *c*-axis (Fig. 3.8) goes from negative to positive between 5 K and 3.5 K and the opposite for the linear component according to your analysis. Is there any interpretation in this? Why the linear coefficient *A* changes sign? What the temperature dependence of the β parameter (Eq. 3.4) means? How reliable is finally the proposed decomposition to three components (in other words, why the magnetic contribution could not have also some linear part as you show in the 3.5 K data)?

* Some of the figures would benefit from having error bars shown (e.g. the B-T phase diagram of Ce_2RhIn_8 in Figs. 3.12 – 3.16) to indicate the uncertainty of the determination.

* EMU (a non-SI unit) are used in some of the magnetic measurement results (magnetic moment in many Figures in Chapter 3, sometimes in the text).

* Fig. 3.18 clearly shows a two-fold symmetry (correctly indicated in the text) in the paramagnetic state (3 K – 4 K). From the known crystal structure of Ce_2RhIn_8 (single Ce site, tetragonal structure) I would expect a four-fold in-plane symmetry above T_N. Can you explain this? A two-fold symmetry would be possible only for a mono-domain sample with some orthorhombic distortion or due to shape anistropy or mis-aligned sample (canted). Also, a reduction to the two-fold symmetry at lower temperatures may be expected. But your observation indicates the opposite. Would you have some interpretation for this? If I understand correctly, Fig. 3.20 shows the same result as Fig. 3.18, only in the polar representation. But the Figure caption and labels give different values for temperature than the text. In the end, you conclude about the easy magnetization plane. Cannot you simply compare *a*-, *b*- and *c*-axis magnetization curves in one Figure? Can the conclusion about easy magnetization direction can be drawn from it?

* Could you push the comparison of the hexagonal CeT_2X_3 compounds further? Why disorder on the *X* site is crucial for Al-containing compounds, not for Zn?

* The 2nd paragraph of the Introduction presents an idea that *f*-electron systems do not suffer from electronic and structural disorder. What is this idea based on? What do you mean?

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