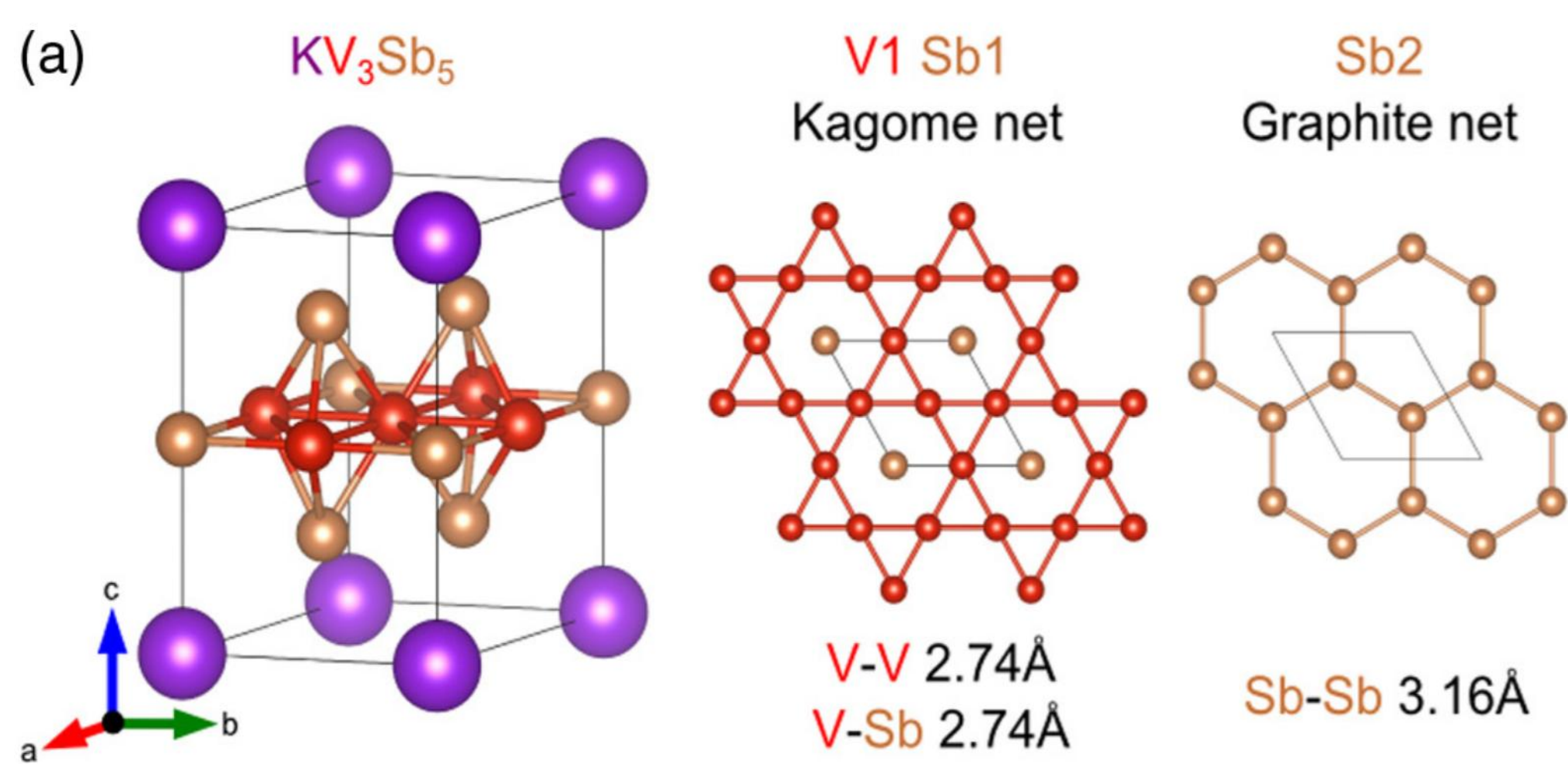
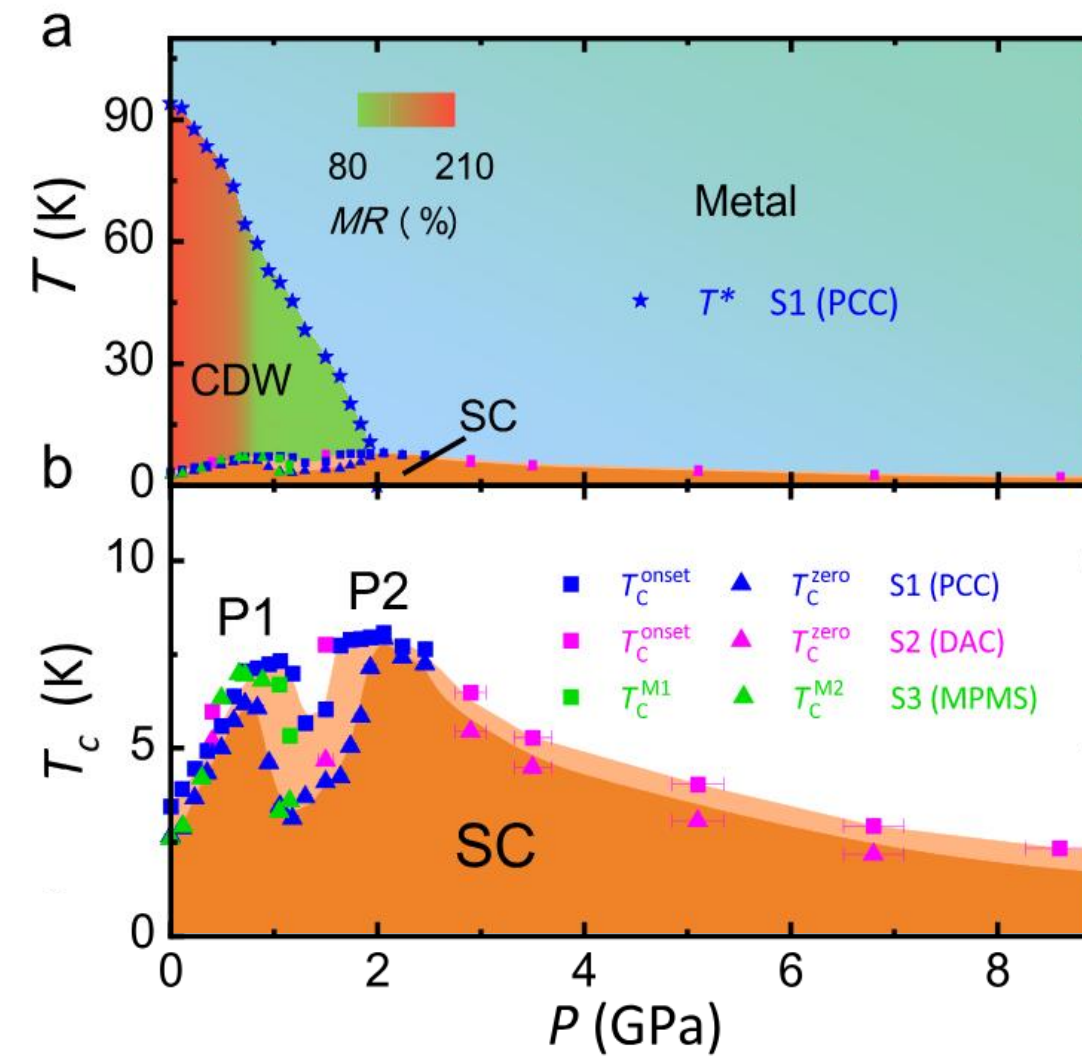


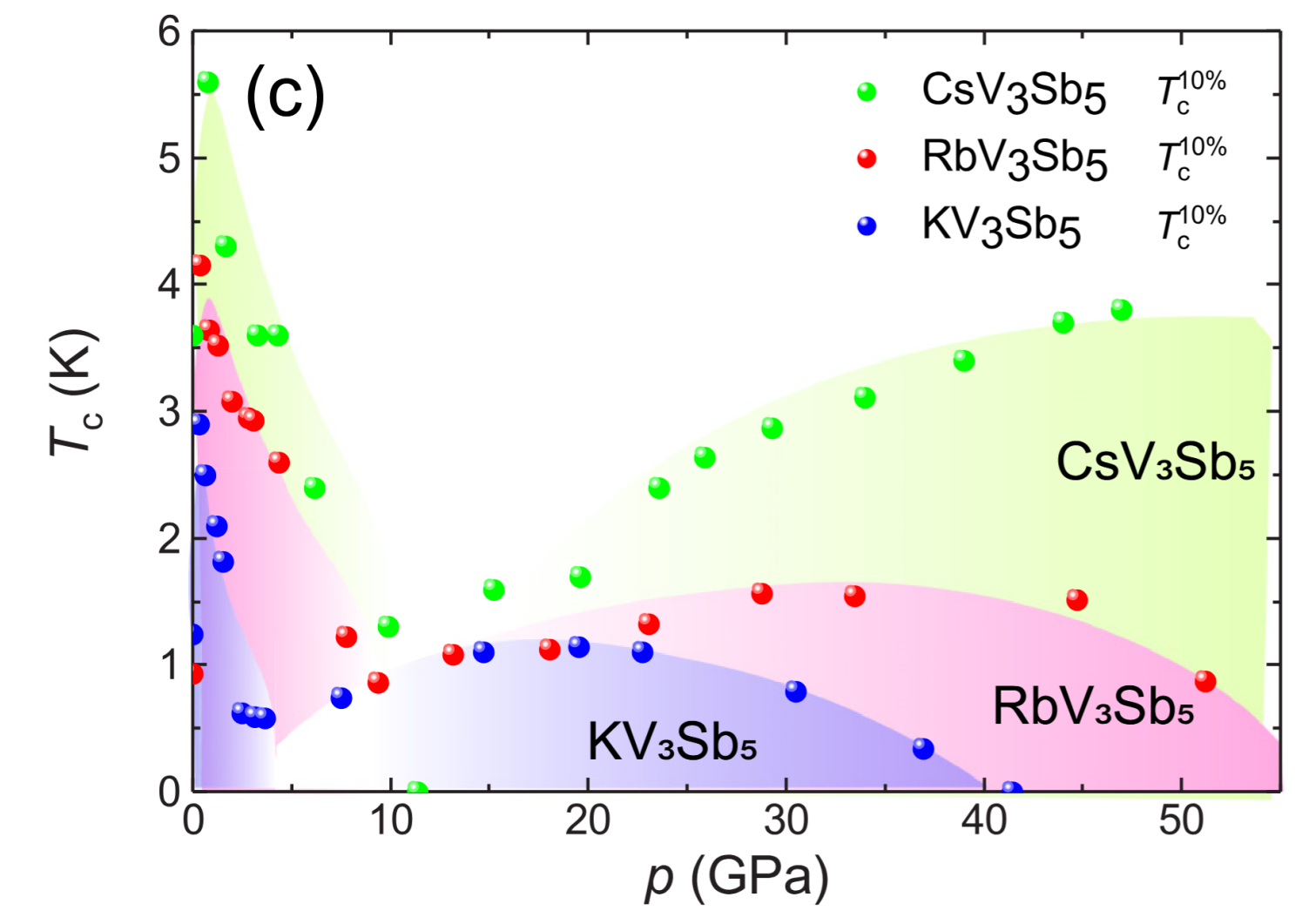
Introduction



Crystal structure of AV_3Sb_5 ($A = \text{Cs}, \text{Rb}, \text{and K}$) [1]



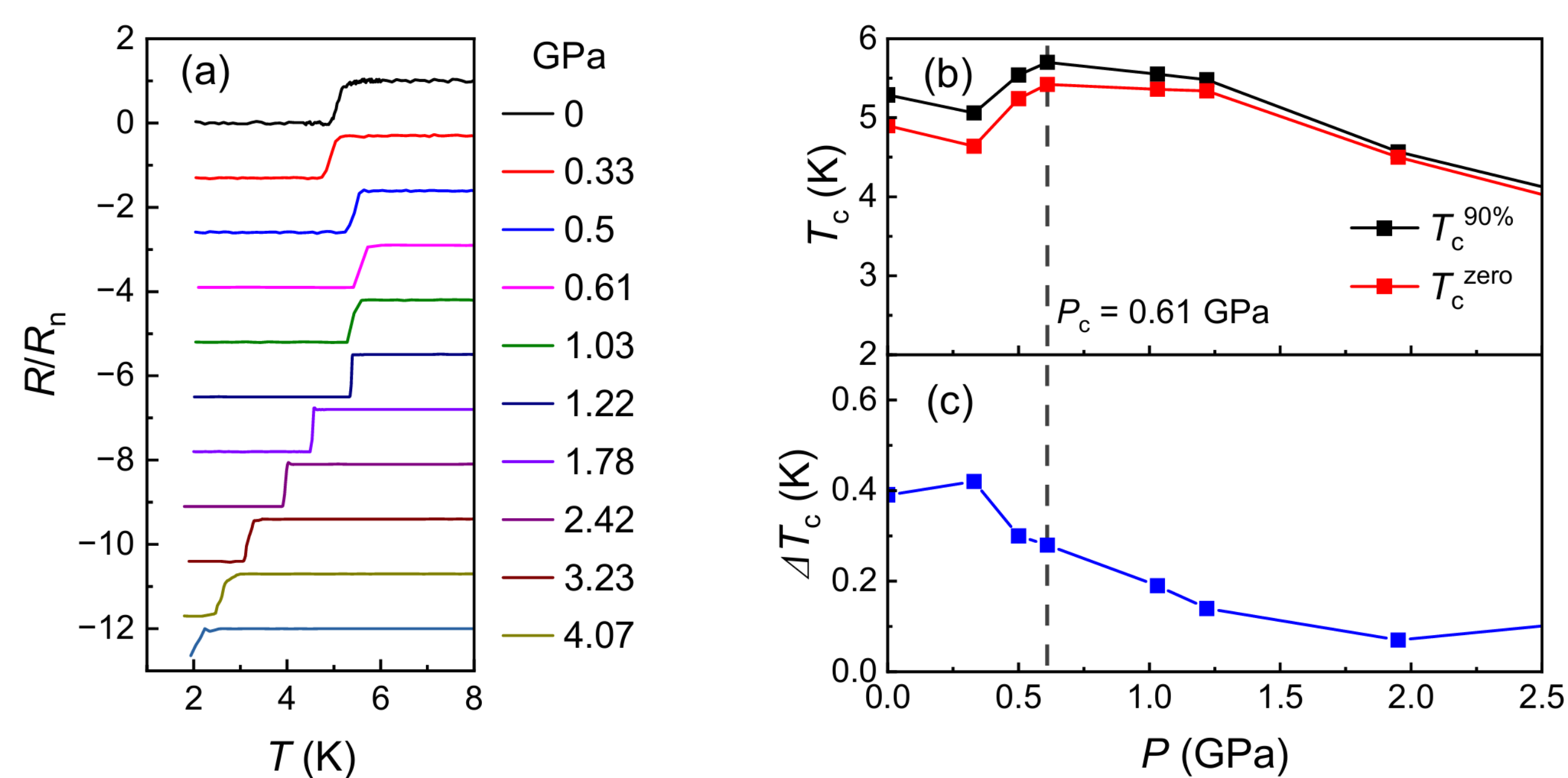
"M-shaped" phase diagram with pressure for CsV_3Sb_5 [7]



Double-dome superconductivity in AV_3Sb_5 [9]

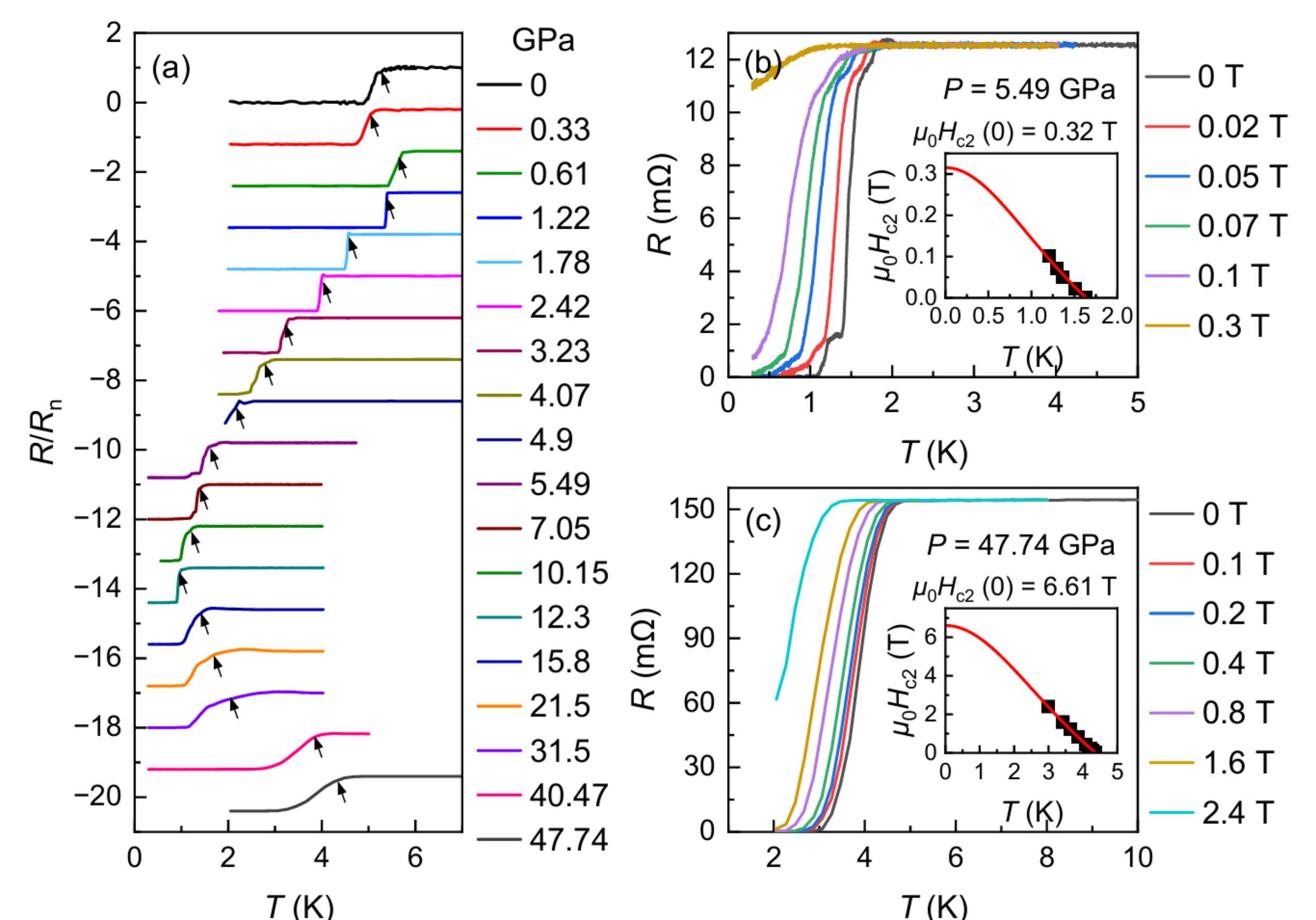
The V-based kagome metals AV_3Sb_5 ($A = \text{Cs}, \text{Rb}, \text{and K}$) have emerged as a prominent class of materials, featuring a unique electronic structure of a kagome lattice which hosts flat bands, Dirac points, and van Hove singularities (VHSs) [1-4]. This system exhibits a variety of emergent phenomena, including charge density waves (CDWs), nematicity, and superconductivity (SC) [2,5,6]. The complex intertwining of these ordered states has attracted great attention. In the case of CsV_3Sb_5 , the CDW and SC exhibit a highly complex interplay under hydrostatic pressure, as manifested by the unique "M-shaped" superconducting phase diagram [7]. Meanwhile, the double-dome SC under pressure is observed in the family of AV_3Sb_5 [8]. By introducing Ta substitution at the V sites, the long-range CDW is gradually suppressed, while the SC gets effectively enhanced [9], showing the competition between the CDW and SC. By investigating the evolution of SC in the absence of long-range CDW order, further insights into the underlying interplay between these phases can be provided. In this work, we conducted a high-pressure study on $\text{Cs}(\text{V}_{0.86}\text{Ta}_{0.14})_3\text{Sb}_5$ samples. A double-dome SC is revealed under high pressure. Meanwhile, the non-monotonic evolution of SC under low pressure suggests an additional tuning mechanism of pressure on the SC in this system.

The evolution of SC under low pressure



- The non-monotonic evolution of SC in the absence of long-range CDW order.
- Possibly attributed to the pressure-induced shift of VHS aligned to the Fermi surface (FS) [10].

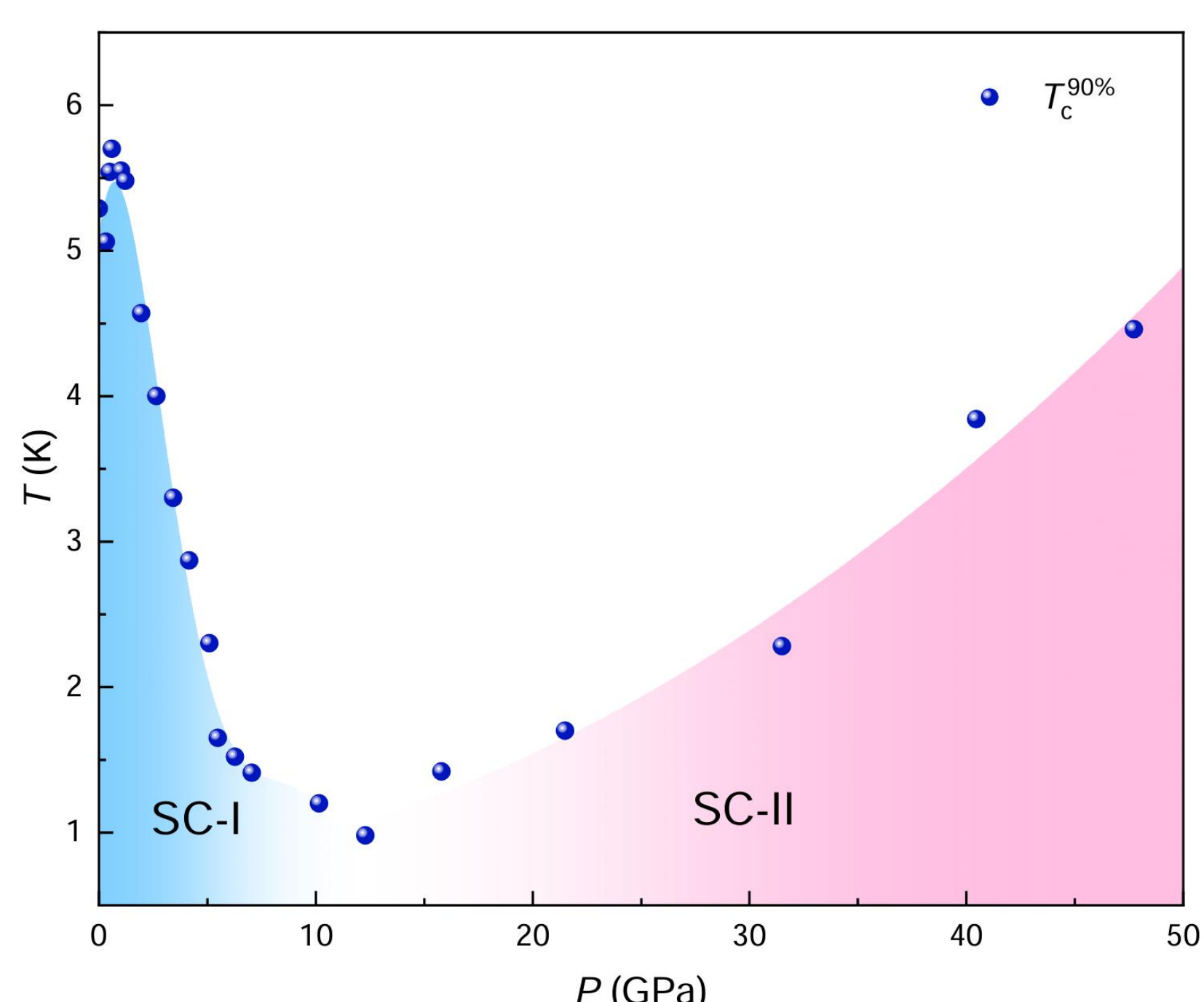
A double-dome SC under high pressure



- A double-dome evolution of SC under high pressure in $\text{Cs}(\text{V}_{0.86}\text{Ta}_{0.14})_3\text{Sb}_5$.
- Suggesting an intrinsic evolution driven by dimensional crossover as observed in CsV_3Sb_5 [11].

Conclusions

In summary, we investigate the transport properties of the doped kagome metal $\text{Cs}(\text{V}_{0.86}\text{Ta}_{0.14})_3\text{Sb}_5$ under pressure up to 48 GPa. Under low pressure, we observe a non-monotonic evolution of SC in the absence of long-range CDW order, which can be attributed to the pressure-induced shift of VHS near the FS. A double-dome SC is revealed under high pressure, suggesting a similar evolution driven by dimensional crossover as observed in CsV_3Sb_5 .



References

[1] Brenden R. Ortiz et al., Phys. Rev. Materials **3**, 094407 (2019)
 [2] Brenden R. Ortiz et al., Phys. Rev. Lett. **125**, 247002 (2020)
 [3] H. Tan et al., Phys. Rev. Lett. **127**, 046401 (2021)
 [4] J. Yin et al., Nature **612**, 647 (2022)
 [5] H. Li et al., Phys. Rev. X **11**, 031050 (2021)
 [6] Y. Xiang et al., Nat. Commun. **12**, 6727 (2021)
 [7] F. Yu et al., Nat. Commun. **12**, 3645 (2021)
 [8] C. Zhu et al., Phys. Rev. B **105**, 094507 (2022)
 [9] J. Liu et al., Sci. Rep. **14**, 9580 (2024)
 [10] Y. Luo et al., Nat. Commun. **14**, 3819 (2023)
 [11] F. Yu et al., Phys. Rev. Lett. **128**, 077001 (2022)