

HiPeR特別セミナー

Physico-chemical properties of noble gases at extreme conditions

A.D. Rosa 氏

European Synchrotron Radiation Facility (ESRF), France •
BL scientist,
広島大学cross-appointment特任助教

2022年10月20日 (木) 16:30~

理学部 E 棟E002講義室

Knowledge of the physico-chemical properties of noble gases at extreme conditions is of high interest for a wide range of research domains including fundamental physics, material science and Earth science. Noble gases are not only important geochemical markers in Earth science to reconstruct planetary evolution process but also are ideal systems to test solid state calculations in fundamental physics and to study the microscopic mechanism of the martensitic transition, which is a fundamental phase transition for material science. This is due to their unique features that includes chemical inertness, fully filled electron shells and their wide range of atomic masses (3-136 amu). In this presentation, I will give an overview of extreme condition research on noble gases. I will show our recent results on the equation of states of noble gases studied at high pressure and either low or high temperature, the progression of the martensitic transformation in these systems and their solubility in Earth's mantle phases¹⁻⁶. I will focus on the consequences of these new results on Earth formation models and in particular for the volatile distribution processes occurring in the early Earth when the planet was completely molten and started to crystallize upon cooling. Finally, I will conclude with an outlook on future directions for this research as part of the collaboration between the ESRF (European Synchrotron Facility), Hiroshima University (Prof. T. Inoue, Dr. N. Ishimatsu) and Ehime University (Prof. T. Irifune).

1 Rosa, A. D. et al., *Phys. Rev. B* **97**, 094115, doi:10.1103/PhysRevB.97.094115 (2018).

2 Rosa, A. D., et al., *Phys. Rev. B* **105**, 144103, doi:10.1103/PhysRevB.105.144103 (2022).

3 Rosa, A. D., et al., *Earth. Planet. Sci. Lett.* **532**, 116032, doi:10.1016/j.epsl.2019.116032 (2020).

4 Dewaele, A., Rosa, A. D. et al. *Sci. Rep.* **11**, 15192, doi:10.1038/s41598-021-93995-y (2021).

5 Dewaele, A., Rosa, A. D. & Guignot, *J. Chem. Phys.* **151**, 124708, doi:10.1063/1.5119419 (2019).

6 A.D. Rosa, F. Zecchi, G. Garbarino, J. Rodrigues, E. Mijiti, T. Irifune, O. Mathon, A. Dewaele, N. Ishimatsu, Incorporation of noble gases in hydrous slab minerals and their transport to depth (in prep.)