

# Ames Laboratory scientist's calculation featured on cover of PRL

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Research performed by U.S. Department of Energy's Ames Laboratory Associate Scientist Durga Paudyal was recently featured on the cover of the November 13, 2015, issue of *Physical Review Letters*.

In his paper, "Complex Magnetism of Lanthanide Intermetallics and the Role of their Valence Electrons: Ab Initio Theory and Experiment," Paudyal and coauthors used electronic structure theory to explain how a mobile "electronic adhesive" helps localized [electrons](#) communicate and interact with one another.

The research was performed using compounds of gadolinium combined with three nonmagnetic elements: magnesium, zinc and cadmium.

In addition to supporting communications among localized electrons, Paudyal's research also discovered that the mobile electron adhesive flows up and down the energy scale, thus controlling the electrons near the top. These topmost electrons are the ones responsible for different, yet predictable changes of magnetic order when chemistry, temperature or pressure are changed individually or together.

"This discovery opens up many new opportunities in rare-earth based responsive and permanent magnet materials research," said Paudyal. "We'll be able to find out how they behave at working temperatures."

Other Ames Laboratory scientist authors on the paper included Yaroslav Mudryk, Vitalij Pecharsky and Karl Gschneidner, Jr. The scientists collaborated with lead author Leon Petit from the Daresbury Laboratory in the United Kingdom and Julie Staunton from Warwick University in the United Kingdom.

"We've seen a dramatic rise in the use of rare-earth materials as essential elements in everything from smart phones to computers, automobiles, LED and [compact fluorescent lights](#), and color displays in TVs and

monitors. These findings are critically important to furthering research related to these materials," said Gschneidner, who is a senior metallurgist at Ames Laboratory, a Distinguished Professor of [materials](#) science and engineering at Iowa State University, and the chief scientist of the Critical Materials Institute.

**More information:** L. Petit et al. Complex Magnetism of Lanthanide Intermetallics and the Role of their Valence Electrons: Theory and Experiment , *Physical Review Letters* (2015). [DOI: 10.1103/PhysRevLett.115.207201](#)

Provided by Ames Laboratory

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