



UNIVERSITY of
DENVER

PHYSICS AND ASTRONOMY

Presents

Interaction of Ferromagnetic and Superconducting Permanent Magnets: Superconducting Levitation



Tuesday, October 20, 2015

4:00 PM

**F.W. Olin Hall Room 105
2190 E. Iliff Avenue**

Presented by

Ludwig Schultz



Institute of Metallic Materials, Leibniz Institute of Solid State and Materials Research (IFW) Dresden;
Institute of Materials Science, TU Dresden; evico GmbH Dresden

New means of urban transportation and logistics will become realistic with superconducting magnetic bearings using bulk high-temperature superconductors. The advantage of superconducting magnetic levitation is that it is passively stable without any electronic control, but with attracting and repelling forces to suspend a vehicle pendant or standing upright from zero to high speed. These are perfect conditions for a rail-bound, individual transport with cabins for 4 to 5 passengers, requested call by call. They will levitate without noise over a track made of rare-earth permanent magnets, saving energy and travel time. A big step forward in this vision has been made in Dresden. The world largest research and test facility for transport systems using bulk high-temperature superconducting material in the levitation and guidance system, in combination with a permanent magnet track, was put into operation. A vehicle for 2 passengers, equipped with linear drive propulsion, a noncontact energy supply, a second braking system, and various test and measurement systems is running on an 80 m long, oval driveway. In the presentation, the principle of superconducting levitation by flux pinning in high-temperature superconductors will be described. Based on this, an overview of the SupraTrans II research facility and future directions of superconductivity-based magnetic levitation and bearing for automation technology, transportation, and medical treatment under enhanced gravity will be given. Also the superconducting hoverboard (pictured above), recently presented by Lexus, will be discussed.

Ludwig Schultz received the Ph.D. in physics from the University of Goettingen in 1976. In 1978 he was a postdoctoral fellow at IBM's Thomas J. Watson Research Center in Yorktown Heights, New York. From 1980 to 1993 he was a staff scientist and then head of the High Temperature Superconductors and Magnetic Materials Department at the Siemens Research Laboratories, Erlangen. In 1993 he became a Full Professor of Metallic Materials and Metal Physics at the TU Dresden and Director of the Institute of Metallic Materials at the Leibniz Institute of Solid State and Materials Research (IFW) Dresden. From 2008 to 2013 he was the Scientific Director of IFW Dresden. Since October 1, 2014 he is officially retired, but still active in materials research. He is also a Fellow Professor of the University of Ulsan (South Korea) and is affiliated to the International Laboratory of High Fields and Low Temperatures at Wroclaw (Poland). He has served on many Executive Boards and committees like German Physical Society (DPG). In 2011/12 he was the President of the "German Association for the Advancement of Science and Medicine (GDNAE)". In addition to chairing many conferences, he served as co-chair of the 2014 InterMag Conference in Dresden. Presently he is the Editor-in-Chief of the *Journal of Alloys and Compounds*. He has been awarded many honors and prizes, including the *European Materials Gold Medal* of the Federation of European Materials Societies (FEMS). Recently he became an Honorary Member of the German Association of Materials Science (DGM). His research program has included superconducting materials, magnetic materials, amorphous and nanocrystalline materials, and electrochemical and mechanical properties of alloys. In these fields he published more than 1000 publications with more than 27000 citations. Contact: Ludwig Schultz, IFW Dresden, Helmholtzstrasse 20, 01069 Dresden, Germany; e-mail: l.schultz@ifw-dresden.de.

HOST: Dr. Xin Fan, (303) 871-2783, Xin.Fan@du.edu

Join us for refreshments & follow-up discussions in Physics Building Room 116, 5:00-6:00 PM