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第 321 回材料科学談話会

九州大学超顕微解析研究センター、微細構造解析プラットフォーム「ナノマテリアル開発のための超顕微解析共用拠点」共催

第 209 回ＨＶＥＭ研究会

のお知らせ

平成２８年7月５日

Univ. of Washington の Krishnan 先生をお招きし、磁性微粒子に関する研究をご紹介いただきます。皆様、奮ってご参加下さい。

【日　　時】平成２８年７月２０日（水）　１３時３０分 ～ １４時３０分

【会　　場】九州大学　伊都キャンパス　超顕微解析研究センター(CE21 棟)セミナー室

（〒810-0395　福岡県福岡市西区元岡７４４番地）

【講　　演】 Kannan M. Krishnan

Professor, University of Washington, Seattle, USA

Nanomagnetism: From materials to medicine and information

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交通手段の詳細や当研究会についてのお問い合わせは、下記の連絡先にお願いいたします。
各講演の概要と会場へのアクセスを次ページ以降に示します。

材料科学談話会世話人：波多　聰
ＨＶＥＭ研究会世話人：安田和弘・佐藤幸生・波多　聰
連　　絡　　先：村上恭和（九州大学　大学院工学研究院　エネルギー量子工学部門）
E-mail: murakami@nucl.kyushu-u.ac.jp

Kyushu, Japan, July 19/20, 2016

Nanomagnetism: From materials to medicine and information

Kannan M. Krishnan

Department of Materials Sciences & Engineering and Physics
University of Washington, Seattle, USA
kannanmk@uw.edu
http://depts.washington.edu/kkgroup/

Abstract

There has been a renaissance in magnetism and magnetic materials research on the nanometer length scale, largely driven by size-dependent scaling laws, exchange, proximity and interface effects, advances in chemical synthesis[1] and lithographic fabrication[2,3], and their demonstrated impact in information[4] and biomedical[5] technologies.

I will begin this lecture with a brief discussion of criteria that define Nanoscience and Nanotechnology and illustrate them with characteristic length scales and size effects that make magnetism ideal, not only for fundamental investigations, but also technological and biomedical developments on this length scale. I will then discuss bottom-up chemical synthesis of magnetic nanoparticles, followed by their self-assembly[6], and inter-particle magnetic interactions/order[7] studied by electron holography.

In the second part of this lecture, I will show that recent developments in the synthesis[8] and applications[3] of highly monodisperse and phase-pure magnetite nanoparticles, with negligible toxicity[9] and favorable biodistribution[10], allows for reproducible control of their magnetic relaxation[5], even in "harsh" biological environments, enabling a novel, tracer-based, whole-body imaging technique with no ionizing radiation, called Magnetic Particle Imaging (MPI) [11,12,13]. I will discuss the unique physics of MPI and present recent results in phantom and *in vivo* imaging of animal models for cardiovascular disease and molecular imaging of cancer.

In the final part of the talk, I will address the current status of magnetic information storage and discuss the development of next-generation bit-patterned media[4], based on large area *nanoimprint lithography,* proposed to sustain the current growth rate of recording densities. If time permits, I will conclude with a discussion of a novel concept of building Boolean logic gates[14], called magnetic quantum cellular automata, based purely on dipolar coupling of *e*-beam lithography fabricated nanoscale magnetic arrays[15].

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Kyushu, Japan, July 19/20, 2016

PROF. KANNAN M. KRISHNAN
Departments of Materials Sciences & Physics
University of Washington, Seattle, USA
http://faculty.washington.edu/kannanmk
http://depts.washington.edu/kkgroup/

Kannan M. Krishnan (Ph.D. 1984, UC, Berkeley) is Professor of Materials Sciences & Physics at the University of Washington, Seattle. His research interests are in Bioengineering at the intersection of Magnetism, Materials and Medicine, and in Condensed Matter Physics & Materials Engineering to develop paradigms for materials and devices in information and energy technologies. His recognitions include the Alexander von Humboldt Career Research Award (2016), IEEE Fink Prize (2012) and IEEE Distinguished Lecturer Award (2009), Guggenheim (2004) and Rockefeller (2008) Fellowships, the Burton Medal (MSA,1992), and the College of Engineering Outstanding Educator Award (UW, 2004), He is an elected member of the Washington State Academy of Sciences, and Fellow of the American Association for the Advancement of Science, the American Physical Society, the Institute of Physics (London), and the Institute of Electrical and Electronics Engineers. In 2010, he founded a start-up company, LodeSpin Labs LLC, presently developing tailored magnetic carriers for a range of biomedical applications.

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