

## Curriculum Vitae

### Saeed Kamali Moghaddam, Ph.D.

University of Tennessee Space Institute, *Department of Mechanical, Aerospace and Biomedical Engineering*

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### Personal Information

- Citizenship: Sweden and Iran; The US Green Card holder via EB1A
  - Languages: Swedish, English, Persian, and also some knowledge in Japanese, Arabic, and Urdu.
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### Education

- M.Sc. in Engineering Physics, with a project in Particle Physics. Thesis title: “pd reactions at WASA”, Uppsala University, Uppsala, Sweden, 2000
  - Ph.D. in the Experimental Condensed Matter Physics, Department of Physics in the Ångström laboratory, Uppsala University, Uppsala, Sweden, December 9, 2005. Thesis title: “3d Transition Metals Studied by Mössbauer Spectroscopy”. Supervisors: Profs. Roger Wäppling and Lennart Häggström. The thesis can be downloaded from:  
<http://www.dissertations.se/dissertation/9233afcf59/>
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### Professional Experience

**2000-2001** Uppsala University, Research Assistant at Dept. of Electron Spectroscopy for Chemical Analysis (ESCA). Supervisor: Nobel Laureate, Prof. Kai Siegbahn.

**2001-2005** Uppsala University, Dept. of Physics. (While a PhD Researcher)

Taught (Lectured and Laboratory Supervisor) the following courses:

- Introduction to Mechanics
- Wave Mechanics.
- Electricity
- Thermodynamics
- Classic Physics
- Analytical Mechanics
- Mössbauer Spectroscopy

Day-to-day supervision of Project and Master’s Students:

- Low Dimensional Magnetism in  $\text{TlCoSe}_2$ , Daniel Stichtenoth, 2002-2003.
- Designing the Temperature Controller for Low Temperature Measurements, Lars Krieger, 2002-2003.
- Characterization of Magnetic Nanoparticles, Hanna Lindfors, 2002-2003.
- Metallurgical Behaviour of Iron in Brass, Stefan Buschhorn, 2003-2004 and Karin Taichmann, 2004.
- Theoretical Modeling for Hyperfine Fields in FeNi/Co Superlattice Systems, Sebastian Panknin, 2004-2005.
- Iron-rich Silicides in Fe/FeSi/Fe Multilayers Studied via Mössbauer Spectroscopy, Bart Laenens, 2004-2005.

**2003-2005** Member of the board at the Physics department, Uppsala University, Uppsala, Sweden.

**2006-2006** Postdoctoral studies at the Division for Spintronics at The Royal Institute of Technology (KTH), Stockholm, Sweden.

**2006-2007** Lecturer at the Physics department, Uppsala University, Uppsala, Sweden.  
**2007-2009** Research member at the Research and Utilization Division at Japan Synchrotron Radiation Research Institute (JASRI), SPring-8, Japan.  
**2009-2011** Research member at the Department for Applied Science, University of California Davis, USA  
**2011-2015** Research member at the Department of Chemistry, University of California Davis, USA  
**2015-2018** Adjunct Faculty at Motlow State Community College, Tullahoma, TN, USA  
**2015-** Research Associate Professor at the University of Tennessee Space Institute, Tullahoma, TN, USA  
**2016-** Adjunct Faculty at Middle Tennessee State University, Murfreesboro, TN, USA  
 Taught the following courses:

- Non-calculus-based Physics I, Calculus-based Physics I, Calculus-based Physics II.
- Survey of Physical Science.

- Reviewer for the following Journals:

*Applied Physics Letters*  
*Applied Sciences*  
*Applied Surface Science*  
*Beilstein Journal of Nanotechnology*  
*Colloids and Surfaces A: Physicochemical and Engineering Aspects*  
*Colloids and Surfaces B: Biointerfaces*  
*Crystals*  
*Current Applied Physics*  
*Electronics Letters*  
*Engineering Computations*  
*Hyperfine Interactions*  
*IEEE Transactions on Magnetics*  
*International Journal of Molecular Sciences*  
*Journal of Alloys and Compounds*  
*Journal of Cleaner Production*  
*Journal of Cluster Science*  
*Journal of Magnetism and Magnetic Materials*  
*Journal of Materials Processing Technology*  
*Journal of Nanoscience and Nanotechnology*  
*Magnetochemistry*  
*Materials*  
*Materials Chemistry and Physics*  
*Materials Research Express*  
*Metals*  
*Nanomaterials*  
*Nanoscale*  
*Physical Chemistry Chemical Physics*  
*Scientific Reports*  
*The Journal of Nanomaterials*

- Lead Guest Editor for Journal of Nanomaterials' Special Issue on: Magnetic nanostructures and their applications in medicine, 2016.

- Member of International Board for 4<sup>th</sup> Seeheim Conference on Magnetism, Frankfurt, Germany, March 28<sup>th</sup>-April 1<sup>st</sup>, 2010.
  - Member of International Board for 5<sup>th</sup> Seeheim Conference on Magnetism, Frankfurt, Germany, September 29<sup>th</sup>-October 3<sup>rd</sup>, 2013.
  - Received several research funds, among others,
    - From Head of The Royal Institute of Technology in Stockholm, 2006-2007.
    - From the Japan Society for Promotion of Science (JSPS), 2007-2009.
    - From Karlsruhe Institute of Technology, 2010.
    - From PCI-Plano de Capacitacao Institucional (CBPF/CNPq) in Brazil, 2011.
    - From The Center of Laser Application, University of Tennessee Space Institute, 2015.
    - From The Center of Laser Application, University of Tennessee Space Institute, 2016.
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### **Collaboration with Biomedical Companies**

I have a substantial amount of administrative and management experience. I worked as a board member of the Physics Department at Uppsala University for three years, and I have worked in several different countries including Sweden, Japan, Germany, Brazil, and the US. I have also a strong ability and experience as team manager. This is apparent from my publications, and my professional history; and it is in part due to my character as well as my experience working in international research environments. For several years I was the manager of the West Coast Mössbauer Center, based at the University of California in Davis. Since 2015 I am managing a Mössbauer laboratory, based at University of Tennessee Space Institute, open to external users.

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### **Administrative Experience**

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### **Research Expertise**

I have been working with different growth, characteristic and measurement techniques, such as, sputtering, Electron Beam Evaporation, Molecular Beam Epitaxy, X-ray techniques, superconducting quantum interference device (SQUID) magnetometry, Magneto Optics Kerr Effect (MOKE) and Mössbauer Spectroscopy.

### **Synchrotron Expertise**

Synchrotron radiation is a standard source for almost all conventional techniques, especially in the third-generation synchrotron facilities, where insertion devices such as undulators and wigglers are used. The synchrotron radiation applications cover all natural sciences, ranging from material science to biophysics. Synchrotron radiation, which is based on the emission of electromagnetic radiation by relativistic electrons in magnetic fields, has several advantages over conventional X-ray sources, such as brilliance, polarization, collimation, continuous spectrum, and pulsation, to name a few. The photon energy from such a source ranges from a few tens eV up to several hundreds keV. This means that all the conventional techniques based on the interaction of X-rays with different kinds of materials can be

performed using such radiation.

Due to my research at the synchrotron facilities during the last decade, I have been working with different synchrotron-based techniques such as Nuclear Resonant Scattering (NRS), Nuclear Resonant Vibrational Spectroscopy (NRVS), Magnetic Compton Scattering (MCS), X-ray Magnetic Circular Dichroism (XMCD), High-Energy X-ray Diffraction (HE-XRD), Extended X-ray Absorption Fine Structure (EXAFS), X-ray Emission Spectroscopy (XES), and X-ray Absorption Spectroscopy (XAS).

### **Research Activities**

My present research is primarily based in nanostructured materials with a focus on magnetic nanoparticles, thin films and superlattices, and the applications of them in Spintronics, and in Biophysics with an emphasis on metallo-enzymes (e.g. results published on cover of *Angew. Chem. Int. Ed.* 52 (2013) 724).

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### **Other Experience**

- **2001** Reconstruction of an Mössbauer laboratory at Physics department, with four spectrometers including a low temperature conversion electron Mössbauer spectrometer, which is almost unique in the world.
- **2007–2009** Involved in design and development of high temperature measurements at the nuclear resonant spectroscopy beam line at Spring8.
- **2009–2010** Establishing an Mössbauer laboratory, The West Coast Mössbauer Center, where I was the manager until 2015, at the department of Chemistry at University of California. This lab had three spectrometers, including a low temperature one, with 9 Tesla magnetic field.
- **2015–** Establishing a Mössbauer laboratory at the University of Tennessee Space Institute.

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### **Computer Knowledge**

Experienced computer programmer including: MATLAB, C++ and FORTRAN. Experienced Windows XP, OS/X and Linux user.

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### **Research Interests and Background**

Since earning my PhD in Physics at Uppsala University in 2005, I have developed a strong international scientific profile. I have worked on a number of different physical systems and have established a wide range of collaborations with concomitant collaborative access to state-of-the-art research facilities worldwide.

I have worked with excellent researchers including Nobel Prize Laureate in Physics, Prof. Kai Siegbahn, head of High Energy Physics Department at Uppsala University, Prof. Sven Kullander, and head of the spectroscopy division at UC Davis, Prof. Stephen P. Cramer. Furthermore, my research has been performed at a number of highly ranked Universities and Research centers including: Uppsala University; The Royal Institute of Technology in Stockholm (KTH); SPring-8 (which is the world's largest Synchrotron facility); the University of California Davis and Lawrence Berkeley National Laboratory (LBNL); Karlsruhe Institute of Technology in Germany; PCI-Plano de Capacitacao Institucional (CBPF/CNPg) in Brazil.

The access to such well-equipped research centres, Universities and synchrotron facilities will not only enable me to perform my own research at various places, but also can help my colleagues to perform their experiments at different laboratories.

My collaborators include workers such as: Dr. Johan Åkerman, a recognized name in research in spintronics and spintronic industry, Prof. Pieter Stroeve, a leading expert in producing iron-oxide nanocrystallines; Prof. Börje Johansson, one of the most famous theoreticians in condensed matter physics and a member of The Royal Swedish Academy of Sciences; Prof. Charles Johnson, a world-known scientist in Mössbauer spectroscopy, Prof. Hiroshi Sakurai, an experienced researcher in thin films and superlattices; Dr. J. J. Saiz Garitaonandia, a well-known name in producing magnetic nanogold; Prof. Marina Andreeva, one of the most famous scientists in nuclear resonant scattering branch; Prof. Valery Uzdin, Prof. Arun Bansil, and Prof. Bernardo Barbiellini, world-wide recognized theoreticians; Prof. Nick Le'Brun, an experienced researcher in biophysics; Prof. Kirill Kovnir, a famous scientist in materials science and magnetism; Prof. Yury Kolenko, an experienced scientist in nanomaterials; Dr. Yoshiharu Sakurai, one of the most famous names in magnetic Compton scattering; as well as many others.

My research program is designed to both be of international standard and plays an important role in collaboration with leading industrial research laboratories.

One of the projects involves layered systems, Fe/Cr, MRAM/MTJ, Exchange Spring Magnets and spin valves, with a common property, which is the presence of interfaces, playing vital roles for the functionality. Nuclear resonant scattering is a unique method in that sense that it provides local (atomistic) information about the magnitude of the Fe atomic moment, its atomic environment and its symmetry, and about the s-electron density at the Fe nucleus in the sample. The method is sensitive enough to allow the study of monolayers although this relies on the use of isotopically enriched material for the Fe layers or other Mössbauer isotopes. In a fingerprint-type of way it may give information on the presence of different magnetic and/or crystallographic phases in the sample, and of particular relevance in the present context, the oxidation state of Fe. I am currently working in this project, which is the first experiment to study interfaces of such systems by nuclear resonant scattering technique. While the MTJ oxidation process and the composition at the bottom interface has been studied in the past using various techniques, there has not been any attempts to study MTJs with nuclear resonant scattering.

The other project concerns nanoparticle systems, iron oxide and spinels, with common properties, which are the presence of superparamagnetism, exchange interaction between particles and dispersivity playing vital roles for the functionality. Also, here nuclear resonant scattering will be a powerful technique combined with magnetization measurements and Mössbauer spectroscopy. Other synchrotron-based techniques such as Nuclear Resonant Vibrational Spectroscopy (NRVS), giving partial phonon density of states, and Magnetic Compton Scattering, giving the magnetic spin moment of the nanoparticles will be applied.

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### **Professional Memberships**

- American Chemical Society.
- American Physical Society.
- Swedish Physics Society.

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### **Teaching**

I have a passion for teaching. I am an experienced teacher (see above) and I like to use a conceptual approach in the classroom (see also the separate teaching approach document). I have attended several courses to improve my educational skills:

- Teaching methods for students doing master's degree projects, Uppsala, Sweden, 23-25 April 2002.
- Teaching and Communication in a laboratory environment, Uppsala, Sweden, 6 September 2004.
- Use of Internet-based teaching, Uppsala, Sweden, 9-13 September 2006.

- Pedagogical course for University teachers, Uppsala, Sweden, 5<sup>th</sup> March-29<sup>th</sup> April 2012.

I have been teaching at Uppsala University and University of California Davis, and since 2015 I have been intensively teaching various Physics-related courses at University of Tennessee Space Institute, Middle Tennessee State University, and Motlow State Community College.

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### **Conferences and Workshops**

- 6<sup>th</sup> Patras University EuroConference on Properties of Condensed Matter Probed with X-Ray Scattering, Patras, Greece, September 2001.
  - 5<sup>th</sup> Seeheim Workshop on Mössbauer Spectroscopy, Seeheim, Germany, May 2002.
  - International Conference on Magnetism, Rome, Italy, July 2003 (Poster Presentation).
  - International Conference on the Applications of the Mössbauer Effect, Muscat, Oman, September 2003 (Poster Presentation).
  - Atomically Controlled Surfaces, Interfaces & Nanostructures/ 13<sup>th</sup> International Congress on Thin Films-ICTF-13, Stockholm, Sweden, June 20-23, 2005 (Poster Presentation).
  - International Conference on the Applications of the Mössbauer Effect, Montpellier, France, September 5-9, 2005 (Poster Presentation).
  - Eighteenth Annual Meeting of Organization for Users of Synchrotron Radiation, Max-lab, Lund, Sweden, September 28-29, 2005 (Poster Presentation).
  - First International Workshop on Nanomaterials, Kish Island, Iran, March 8-11, 2006 (Invited talk).
  - International Conference on the Applications of the Mössbauer Effect, Kanpur, India, October 14-19, 2007 (Poster Presentation).
  - Workshop on Mössbauer Spectroscopy and Synchrotron Radiation and their applications in Material Sciences, Tehran, Iran, April 14-15, 2008 (Invited talk).
  - Workshop on X-ray and Neutron Techniques for Nano-Structural Research, SPring8, Japan, August 21-23, 2008 (Poster Presentation).
  - The 21st Congress of the International Union of Crystallography (IUCr2008), Osaka, Japan, August 23-31, 2008 (Poster Presentation)
  - 21st International Microprocesses and Nanotechnology Conference (MNC2008), Fukuoka, Japan, October 27-30, 2008 (Poster Presentation)
  - Innovation and Technological advancements in Industry and Mining, Tehran, Iran, January 12-15, 2009 (Invited talk)
  - Workshop on The synchrotron based techniques and their applications in Nanotechnology, Tehran, Iran, January 13, 2009 (Invited talk)
  - American Chemistry Society, Spring meeting 2010, San Francisco, USA, March 21-25, 2010 (Oral Presentation)
  - Forth Seeheim Conference on Magnetism, Frankfurt, Germany, March 28-April 1, 2010 (Invited talk)
  - Fifth Seeheim Conference on Magnetism, Frankfurt, Germany, September 29-October 3, 2013 (Invited talk)
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### **Seminars**

- Monthly or Weekly Seminars given at Material Physics, Physics department, Uppsala University, Uppsala, Sweden 2001-2005.
- Monthly or Weekly Theoretical Seminars given by Condense Matter and Theoretical Magnetism Sections, Physics department, Uppsala University, Uppsala, Sweden 2001-2005.

- Monthly Seminars given in framework of FRAM (Fundamental Research in Applied Magnetism), Physics department, Uppsala University, Uppsala, Sweden 2001-2005.
- Yearly lectures given by Noble Prize Laureates given at Ångström Laboratory, Uppsala University, Uppsala, Sweden 2000-2004.
- Yearly Ångström lectures given by the outstanding physicists in the world, Ångström Laboratory, Uppsala University, Uppsala, Sweden 2001-2005.
- Tens of dissertations held at Ångström Laboratory, Uppsala University, Uppsala, Sweden, 2000-2005.
- Other interesting seminars held at Ångström Laboratory, Uppsala, Sweden, 2000-2005.
- Monthly or Weekly Seminars given at JASRI, JAEA and RIKEN, Japan, 2007-2009.
- Monthly or weekly seminars given at UC Davis, USA, 2009-2015.
- Monthly or weekly seminars given at UTSI, USA, 2015-
- Monthly or weekly seminars given at MTSU, USA, 2016-

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### **Equipment and Major Collaboration**

I have a Mössbauer laboratory comprising of both Mössbauer spectrometer in transition mode and Conversion Electron Mössbauer spectrometer setups. Based on this equipment I am planning to establish a Mössbauer Center providing Mössbauer services worldwide. As biomedical companies worldwide have numerous Fe-based products, they are very interested to be able to characterize these products using Mössbauer spectroscopy. I have already in contact with some of these companies, and the contracts with them bring a huge number of funding to the institute. Some of these companies are:

1. Amphastar Pharmaceuticals, Inc, Rancho Cucamonga, CA, USA. Contact Person: Dr. Ya-Chi Cheng.
2. Balchem Corporation, Ogden, UT, USA. Contact person: Dr. Rajan Athalye.
3. Baxter Healthcare Corporation, Round Lake, Illinois, USA. Contact person: Dr. Christopher Jones.
4. UIC, Incubator Laboratory Facility Vidasym, Inc., USA. Contact person: Dr. Yung-wu Chen.
5. Mineral Science; Imerys Inc., San Jose, CA, USA. Contact person: Dr. Jie Lu.
6. Framatome Inc. Lynchburg, VA, USA. Contact person: Dr. Beverly Cyrus.
7. Dr. Yogesh Satpute, Fe-based medical components, Lupin limited, Pune, India
8. Dr. Suryanarayana Mulukutla, Mylan Laboratories Limited, Hyderabad, India

I have an international scientific network:

1. Prof. Kiril Kovnir; Novel Materials for Energy; Department of Chemistry, Iowa State University, Ames, IA, USA
2. Prof. Arun Bansil; Theoretical Physics; Physics Department, Northeastern University, Boston, MA, USA
3. Prof. Bernardo Barbiellini; Theoretical Physics; Physics Department, Northeastern University, Boston, MA, USA
4. Prof. Steven Chemtob; Mineral Science; Department of Earth and Planetary Science, Washington University, USA; McDonnell Center for the Space Science, Washington University, St. Louis, MO, USA
5. Dr. Yoshiharu Sakurai; Magnetic Compton Scattering; SPring-8, Japan
6. Prof. Susan Kauzlarich; Nano-Science; Chemistry Department, UC Davis, CA, USA
7. Prof. Philip Power; Transition Metals Chemistry; Chemistry Department, UC Davis, CA, USA
8. Prof. Nicholas Curro; Superconductivity; Physics Department, UC Davis, CA, USA

9. Prof. Ricardo Castro; Nano-Science; Department of Chemical Engineering and Materials Science, UC Davis, CA, USA
10. Prof. Subhash Mahajan; Nano-Science; Department of Chemical Engineering and Materials Science, UC Davis, CA, USA
11. Prof. Yayoi Takamura; Nano-Science; Department of Chemical Engineering and Materials Science, UC Davis, CA, USA
12. Prof. Subhash Risbud; Material Science; Department of Chemical Engineering and Materials Science, UC Davis, CA, USA
13. Prof. Pieter Stroeve; Nano-Science; Department of Chemical Engineering and Materials Science, UC Davis, CA, USA
14. Prof. Kaimin Shih; Material Science; Department of Civil Engineering, University of Hong Kong, Hong Kong, China
15. Prof. Hsing-Lung Lien; Nanoscience; Department of Civil and Environmental Engineering, National University of Kaohsiung, Taiwan
16. Prof. Virender Sharma; Ferrate; Chemistry Department, Florida Institute of Technology, Melbourne, FL, USA
17. Prof. Luis Rubio, Biophysical Compounds, Universidad Politécnica de Madrid, Spain
18. Prof. Nick Le Brun, FeS Clusters, University of Anglia, United Kingdom
19. Prof. Stephen W. Ragsdale, Biological Compounds, Dep. Of Biological Chemistry. Ann Arbor, MI, USA
20. Prof. Kenneth N. Raymond; Biochemical Compounds; Chemistry Department, UC Berkeley, CA, USA
21. Prof. Edward I. Solomon; Biophysical Compounds; Chemistry Department, Stanford University, CA, USA
22. Dr. Takehiko Tosha; Biophysical Compounds; RIKEN, SPring-8, Japan
23. Prof. David Tyler, Iron Chemistry, Chemistry Department, University of Oregon, Eugene, OR, USA
24. Prof. Ray-Kuang Chiang; Nano-Science; Department of Materials Science and Engineering, Far East University, Taiwan
25. Prof. Ajay Gupta; Nano-Science; Center for Spintronic Materials, Amity University, India
26. Dr. Johan Åkerman; Spintronics; Department of Material Physics, The Royal Institute of Technology (KTH), Sweden
27. Prof. Marina Andreeva; Nano-Science; Solid State Physics, Moscow State University, Russia
28. Prof. Louise Berben; Transition Metal Chemistry; Chemistry Department, UC Davis, CA, USA
29. Dr. Yoshitaka Yoda; Nuclear Resonant Scattering; SPring-8, Japan
30. Dr. Koji Ohara; High-Energy X-Ray Diffraction; SPring-8, Japan
31. Dr. Jose J. Saiz Garitaonandia; Nano-Science; Zientzia eta Teknologia Fakultatea, Spain
32. Prof. Valery Uzdin; Nano-magnetism; Condensed State Theory Group, St. Petersburg State University, Russia