Call identifier: **FP7-NMP-2008-SMALL-2**
Project acronym: **MAGNONICS**
GA number: **CP-FP 228673-2 MAGNONICS**

SEVENTH FRAMEWORK PROGRAMME
COOPERATION
NMP THEME

COLLABORATIVE PROJECT
(Small or medium-scale focused research project)

Publishable summary

Project acronym: **MAGNONICS**

Project full title: ***MAGNONICS: MASTERING MAGNONS IN MAGNETIC META-MATERIALS***

Grant agreement no.: **CP-FP 228673-2 MAGNONICS**

Please provide an executive summary.

Project Acronym and Number: MAGNONICS FP7-NMP-2008-SMALL-228673

Project Title: Mastering magnons in magnetic meta-materials

Start and End Dates : 15/9/2009 till 14/9/2012

EU Contribution : 3.499.820 €

Topic: Magnonic (spin wave) phenomena in magnetic nano-materials and devices; Nanostructured magnetic (magnonic) metamaterials with GHz and THz dynamics and/or with negative electromagnetic properties.

Nanomanufacturing Techniques: Protein based colloidal crystallisation (bottom-up), electron beam and photo lithography; focused ion beam etching; etched nanosphere lithography; precision electrodeposition; atomic layer deposition; various conventional sputtering and evaporation techniques.

Dynamical Characterisation Techniques: All-Electrical Spin wave Spectroscopy; conventional and microfocus Brillouin Light Scattering (BLS) spectroscopy; time resolved scanning Kerr Microscopy (TRSKM); THz spectroscopy.

Theoretical Methods: Electromagnetic and spin dynamics models for band gap and effectively continuous properties describing excitations in magnonic metamaterials, including micromagnetics (all aspects), plane wave method (PWM) (magnonic dispersions), dynamical matrix method (DMM) (magnonic spectra and dispersions), numerical and semi-analytical discrete dipole models (static and dynamics of arrays of magnetic nano-particles produced by the protein based colloidal crystallisation), MatLab based finite-difference time domain (FDTD) solution of full Maxwell equations with account of ferromagnetic resonance phenomena (electromagnetic response of magnonic metamaterials), and mixing rules (effective permeability of magnonic metamaterials consisting of arrays of magnetic elements).

Achievements: Establishing of new types of magnonic metamaterials, in particular including 3D magnonic arrays produced by the protein based colloidal crystallisation and 2D all-ferromagnetic binary magnonic metamaterials, and of functional magnonic architectures (including that enabled by designer coupling between long wavelength electromagnetic and short wavelength spin waves); establishing of theoretical methods by which to calculate the effectively continuous (including electromagnetic) properties of magnonic metamaterials and of concepts of design of the metamaterial responses.

Potential Applications: Electromagnetic antennas (e.g. patch antennas); signal conditioning devices (e.g. microwave filters); and then magnonic devices and logic architectures, including magnonic filters, logic gates, programmable gate arrays etc.

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References to review articles: V. V. Kruglyak, S. O. Demokritov, and D. Grundler, "*Magnonics*", J. Phys. D – Appl. Phys. **43**, 264001 (2010).

A summary description of the project context and the main objectives

MAGNONICS consortium combines nanofabrication, dynamical characterization, and theoretical modelling within a multinational collaboration that has strived to explore novel nano-structured magnetic metamaterials that exhibit high-frequency responses artificially tailored at the nanoscale. These so called magnonic nano-materials form a new class of meta-materials with collective magnonic and associated electro-magnetic responses giving rise to new complex but potentially very rewarding functionalities. At the same time, they provide an added value to existing magnetic devices and conventional meta-materials. The study of magnonic metamaterials forms a sub-field of a wider field of research called magnonics.

The main goal of the MAGNONICS project has been to realise, on the one hand, new nanotechnologies and, on the other hand, this new class of meta-materials, i.e., magnetic metamaterials, and hence to prove the concept of magnonics.

MAGNONICS project has explored several key aspects of magnonics and magnonic metamaterials, ultimately required to make magnonics a pervasive technology. Firstly, the project has adopted existing and developed novel nano-manufacturing technologies for the specific tasks of magnonics. Secondly, the project has used some state-of-the-art existing and newly developed novel dynamic characterisation techniques to perform seminal experiments that will guide the development of magnonics and magnonic metamaterial for the decades ahead. Thirdly, the project has developed theoretical methods as required for the description and predicting of outcomes of the dynamical testing of magnonic metamaterials. Finally, the project has brought to the table a few novel concept of devices and architectures in which magnonic metamaterials could be used providing functional benefits.

As a result, the project has strived to achieve its technical objectives of:

1. Using new nanotechnologies to fabricate novel macroscale periodic magnetic structures with nanoscale features and to characterise their structural and static properties;

2. Characterising and understanding dynamic magnetic properties of the fabricated periodic magnetic structures, and revealing their inherent novel collective dynamic properties at high frequencies, thereby demonstrating that they form magnetic metamaterials;

3. Incorporating the created magnetic metamaterials into working miniature devices in place of continuous materials, thereby demonstrating various ways of exploitation of their useful functionalities.

The findings of MAGNONICS project provide a major contribution to reforming current and underpin future applications of magnetic materials in high-tech data communication, processing, and storage devices, forming the IT spine of the new European knowledge driven economy. In longer term, the uncovered basic understandings of the magnonic phenomena will underpin the competitiveness of European high-tech industry on the international hi-tech knowledge-rich functional materials with impacts ranging from high speed magnetic data storage to data communication technologies.

A description of the main S & T results/foregrounds.

MAGNONICS consortium has explored several key aspects of magnonics and magnonic metamaterials, addressing their nano-manufacturing, dynamic characterisation, theoretical modelling, and design of devices. As a result of this research, several important breakthroughs have been achieved either crossing the different work directions, or sometimes limited to particular ones. The three most significant breakthroughs are described first.

Perhaps, the most innovative and ground-breaking achievement of the project is the exploration of the protein based 3D arrays of magnetic nanoparticles as magnonic metamaterials. This achievement has become a result of the extensive development of the bottom-up fabrication of such structures using the protein based colloidal crystallisation process and then adaptation of the more conventional top-down nano-patterning techniques to place the structures enabling their state-of-the-art cryogenic measurements using the all-electrical spin wave spectroscopy (AESWS) at GHz frequencies. The sensitivity of the cryogenic AESWS measurements had to be improved remarkably, while a set of advanced theoretical tools has also to be developed to facilitate understanding of the measured signal. As a result, evidence of the propagation of the magnonic signal through such three-dimensional (3D) magnonic metamaterials was produced at the very end of the project. Unfortunately, the success could not be extended to the THz domain, albeit the excellent prospects for refinement of the THz spectroscopy as a technique for studies in magnonics suggest that such measurements could prove successful in future.

The next in significance achievement came from the advancement of the top-down nonmanufacturing techniques that enables fabrication of arrays of magnetic nanoelements embedded within a matrix of another magnetic material. In a number of publications, a detailed understanding of their magnonic (both band gap and effectively continuous) properties has been delivered, which has facilitated by the remarkable development in both the sensitivity of the dynamical measurement techniques (including the Brillouin Light Scattering (BLS), time resolved scanning Kerr Microscopy (TRSKM), and the aforementioned AESWS) and theoretical modelling (including the plane wave method (PWM) and the micromagnetic simulations). The measurements have been bench-marked against those of single-constituent magnonic metamaterials (i.e. arrays of magnetic elements and antidots), culminating in the complete mapping of the 2D magnonic band structure by BLS. The latter has been enabled by the further advancement of the dynamical matrix method (DMM).

Finally, the project has witnessed a remarkable success in exploration of applied aspects of magnonics and magnonic metamaterials. Theoretical evidence of the negative effective permeability at frequencies reaching some hundreds GHz has been delivered. The developed concepts and recipes for the permeability calculation could now be applied to a range of designer magnonic metamaterials. In additional, a novel (and unforeseen at the time of proposal submission) concept of magnonic data architectures driven by free space microwaves has been developed and experimentally demonstrated as a result of overcoming the bottle-neck of coupling between long wavelength electromagnetic and short wave wavelength spin waves.

Here we provide a list of further S&T achievements of smaller scale but high importance for the fields of magnonics, magnonic meta-materials and technologies, and also more generally for magnetics research:

Comprehensive theoretical understanding of the band gap and effectively continuous properties of the created magnonic metamaterials has been achieved.

The plane wave method (PWM) has been extended to the calculation of magnonic band structure of thin slabs of 1D and 2D magnonic crystals and validated via comparison with experimental results.

The PWM has been developed to the calculation of magnonic spectra of antidot lattices and successfully used to interpret experimental data acquired using the AESWS and BLS.

The PWM has been also extended to the calculations of the magnonic band structure in planar magnonic crystals for an arbitrary chosen direction of the external magnetic field. The method has been successfully used for the interpretation of the data in the rhombic antidot lattices measured by BLS.

The PWM has been developed for calculations of magnonic spectra in the re-programmable magnonic crystal, i.e., in the ferromagnetic and antiferromagnetic ordered Py stripes. Then it has been validated by comparing numerical results with the experimental data obtained with broadband microwave spectroscopy.

The nearly free magnon model (an analogue of the nearly free electron model) has been defined and used to describe analytically the magnonic band gap width in 2D bi-component Co/Py magnonic crystals. The results have been successfully used for the interpretation experimental data obtained with BLS.

The negative effective permeability in meta-material based on 1D planar magnonic crystals has been predicted based on the PWM calculations. The figure of merit for a negative refraction has been estimated and its value has been found to be promising for the future development.

The Goos-Haenchen shift for spin waves in the exchange limit has been predicted. It has been found that the Goos-Heanchen shift critically depends on the exchange coupling between two ferromagnetic materials.

The finite element method has been developed in the frequency domain for the calculations of the magnonic band structure in 1D planar magnonic crystals with nonuniform composition across the thickness. The developed method opens the prospects for the calculations of the magnonic band structure in 3D magnonic crystals of finite thickness.

Based on the PWM calculations the materials composition of the 3D bi-component magnonic crystals based on the protein-based colloidal magnonic arrays have been determined to have absolute magnonic band gap in 3D.

The dynamical matrix method (DMM) has been developed to deal with dipole-coupled particles and arrays of antidots and to evaluate the BLS cross section, and applied to systems experimentally investigated within the project: chains and 2D arrays of magnetic dots, square arrays of antidots.

Thermally excited spin waves in planar one- and two-dimensional magnonic crystals have been studied using both conventional (k-vector resolved) and micro-focused (spatial resolved) BLS measurements in arrays of dense magnetic elements (dots and stripes) and antidots (periodic arrangement of holes embedded into a continuous magnetic film), and the results have been compared with calculations performed by micromagnetic simulations, the PWM, and the DMM.

In addition, micro-focused BLS technique has been applied to reveal the propagating spin waves emitted by a nanocontact by Spin- Transfer Torque effect. The generation of spin waves by using a dc spin polarized current is important to inject spin waves into magnonic crystal and devices in alternative to conventional microwave antennas.

The 3-dimensional (3D) version of the Fast Fourier technique (FFT) for calculating the magneto-dipolar interaction field in continuous ferromagnetic structures has been implemented, so that large-scale simulations of 3D micromagnetic problems have become possible.

The combined Ewald-FFT method for the calculation of the magneto-dipole interaction field in ordered and disordered systems of fine magnetic particles has been developed. In particular, this method enables highly efficient numerical simulations of magnetization processes in magnetoferritin-based crystals. Basing on this method, two software packages capable of extracting the key magnetic parameters of a single magnetoferritin particle, which serves as the building block for corresponding crystals, have been developed. These tools allow one to precisely determine the magnetic moment of a single MF particle and its uniaxial and cubic magnetic anisotropy constants.

Numerical simulations of quasistatic magnetization processes measured by MOKE in 2D hexagonal arrays of magnetic nanodisks have been performed. Such simulations, combined with BLS experiments on the unpatterned magnetic film used for the production of the 2D nanodisk array, allow the exact determination of magnetic parameters of the film material (magnetization, exchange stiffness constant and the surface anisotropy constant), which is the mandatory prerequisite for studying the system dynamics.

Time-domain micromagnetic simulations of spin-wave excitations observed by FMR, BLS, and TRSKM techniques in 2D arrays of magnetic nanodisks has allowed to unambiguously identify the experimentally observed modes, and to find out the spatial structure of corresponding magnons in the nanodot arrays under study.

A concept for a spin wave filter based on the antidot lattice cut out into a thin magnetic film has been proposed and verified by numerical simulations. It has been shown, that such a filter exhibits large frequency gaps in the transmitted magnon spectrum. Positions and widths of these gaps can be controlled not only by changing the lattice geometry (number of antidot columns, antidots lattice constants, antidot diameter), but also by simply varying the external magnetic field.

A concept for focusing spin waves in thin magnetic films has been suggested, basing on the usage of the Fresnel-like ‘zone plate’, consisting of slits with predefined lengths, which are cut out in such a thin film. Using numerical simulations, we have shown, that a column of these slits is able to increase the power of magnetization oscillations at a given point up to 5 times due to the constructive interference of spin waves transmitted through such a ‘zone plate’. The position of the focus point can be controlled by the sizes of slits and the external magnetic field.

The method for ‘bending’ the wave front of an initially plane spin wave, employing the site-dependent damping has been proposed. The spatially varying damping leads to a bending of magnon ‘rays’ due to the corresponding change of the magnon refraction index. Using a site-dependent damping which increases towards the edges of a thin magnetic stripe, we could show that this method allows to achieve, e.g., the effective focusing of spin waves for the wave propagating along such a stripe. The degree of focusing and the position of the region where the magnetization oscillation power is strongly enhanced may be controlled separately by varying the spatial profile of the damping constant by using, e.g., the ion irradiation with the site-dependent intensity.

A list of 11 potentially exploitable results is also supplied within “The final plan for the use and dissemination of foreground”.

A description of the potential impact and the main dissemination activities and the exploitation of results.

The MAGNONICS project has produced basic scientific understanding and knowledge that underpin the development of a novel technology while its side results will have many technological applications on other areas of science and technology.

The project's results have an immense potential for new applications in electronics and microwave communications. The main benefits from use of magnetic materials and specifically magnonic metamaterials in electronics and telecommunications devices are controllability by external magnetic fields, non-volatility, and re-configurability, all of which have been demonstrated within MAGNONICS. The exploitation of propagating spin waves rather than spin polarised currents and localised spins will make it possible to reduce the energy consumption of magneto-electronic devices. The broad frequency spectrum of magnons means that such devices will have enough head-room to easily adapt to the continuous increase in data rates.

There are two different ways how magnetic crystals could be used. In the first of them, the wavelength of the excitation of interest (e.g. EM radiation) is much greater than the period and patterned features of the magnonic crystal. Thus, the latter behaves as an effectively continuous metamaterial with a frequency response determined by the folded band spectrum of magnons. These entirely new electromagnetic materials could be utilized in a variety of applications where tuning the transmission, absorption and reflection of electromagnetic radiation is crucial, e.g. as in microwave telecommunications. In the second approach, magnons themselves are used as carriers of information in magnonic circuits with features comparable in size to the magnonic wavelength. This gives rise to strong interference and diffraction of magnons, in turn leading e.g. to formation of the output in logic devices or the band spectrum of magnons in magnonic crystals.

Within the first approach, the main useful functionality of magnonic metamaterials is the opportunity to tailor their electromagnetic response by modifying their magnonic spectrum via nano-patterning or by applying external magnetic field. The interaction between constituent elements of magnonic crystals is strong enough to support collective magnonic excitations, and so magnonic crystals behave as a quasi-continuous metamaterial. MAGNONICS has yielded new recipes for tailoring collective magnonic responses of such metamaterials. Their electromagnetic response reflects their tailored magnonic responses, thus potentially leading to novel commercially exploitable material properties. As far as the second approach (based on the use magnons as carriers of information) is concerned, the main useful functionality of magnonic crystals is their frequency and wavelength selectivity, which directly results from their periodicity and the associated magnonic band spectrum.

MAGNONICS has actively pursued the strategic aim of the NMP Work Programme to develop "added value materials with higher knowledge content, new functionalities and improved performance". The major factor determining the selection of the nano-fabrication techniques exploited and further developed within this project has been the need to fabricate large-area samples with perfectly periodic structure on the nanometre scale. This need is common within the family of metamaterials, and so the design and processing know-how generated in this project will be of direct and strong impact upon the metamaterials research in its most general meaning. Further impact is expected in the area of nano-fabrication of bit patterned data storage media and arrays of phase locked spin transfer torque nano-oscillators, in which the addressability of individual data bits and the phase locking of the nano-oscillators respectively both rely upon their perfect ordering over large areas.

In the appendices below, we present the lists of the project's publications and conference presentations.

List of Publications

Published

1. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, A. O. Adeyeye, S. Neusser, B. Botters, and D. Grundler, "Magnetic normal modes in squared antidot array with circular holes: A combined Brillouin light scattering and broadband ferromagnetic resonance study", IEEE Trans. Magn. 46, 172 (2010); http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=5393224.

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71. D. V. Berkov, “Synchronization of spin-torque driven nanooscillators for point contacts on a quasi-1D nanowire: Micromagnetic simulations”, (submitted).

72. M. Arikan, Y. Au, G. Vasile, S. Ingvarsson, and V. V.Kruglyak, “Broadband injection and scattering of spin waves in lossy width-modulated magnonic crystal waveguides”, (submitted).

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74. J. - C. Eloi, M. Okuda, S. E. Ward Jones, and W. Schwarzacher, “Protein Brownian rotation at the glass transition temperature of a buffer probed by superparamagnetic nanoparticles”, (in preparation).

75. M. Okuda, S. Ward Jones, J.-C. Eloi, W. Schwarzacher, S. Erokhin, and D. V. Berkov, “Precise anisotropy characterization for ferritin-templated magnetic nanoparticles”, (in preparation).

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77. E. K. Semenova and D. V. Berkov, “Self-focusing of spin waves in magnetic nanostripes with a site-dependent damping”, (in preparation).

78. E. K. Semenova and D. V. Berkov, “Tunable magnonic spin wave filter based on an antidot lattice”, (in preparation).

79. R. V. Mikhaylovskiy, E. Hendry, F. Y. Ogrin, and V. V. Kruglyak, “Low Temperature Time Domain THz Spectroscopy of Terbium Gallium Garnet Crystals”, (in preparation).

80. C. Davies, A. Francis, and V. V. Kruglyak, “Interplay between magnonics and spintronics in spin-motive force generation devices”, (in preparation).

81. M. Madami, S. Tacchi, G. Gubbiotti, G. Carlotti, J. Ding, A. O. Adeyeye, J. W. Klos, and M. Krawczyk, "Spin wave dispersion in Permalloy antidot array with alternating holes diameter", (in preparation).

82. S. Mamica, “Tailoring of partial band gaps in three-dimensional magnetoferritin-based magnonic crystals”, (in preparation).

83. M. J. Correia, W. Figueiredo, M. Okuda, J. - C. Eloi, S. Ward Jones, and W. Schwarzacher, “Effective energy barrier distributions for random and aligned magnetic nanoparticles with both cubic and uniaxial anisotropies”, (in preparation).

Presentations

1. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, A.O. Adeyeye, S. Neusser, B. Botters, and D. Grundler, "Magnetic normal modes in squared antidot array with circular holes: a combined Brillouin light scattering and broadband ferromagnetic resonance study", 19th Soft Magnetic Materials Conference (SMM-19), Torino, Italy, September 2009. Invited

2. V. V. Kruglyak, "Magnonics: Mastering Magnons in Magnetic Meta-Materials (Project Overview)", UK Nano Forum & Emerging Technologies 2009, London, UK, November 2009. Poster

3. M. Krawczyk, J. W. Kłos, S. Mamica, and M. Sokolovskyy, "MAGNONICS: Mastering magnons in magnetic meta-materials", The Day of the UE Programs, Adam Mickiewicz University, Poznań, Poland, October 19, 2009. Poster

4. V. V. Kruglyak, "Magnonics: Mastering Magnons in Magnetic Meta-Materials (Project Overview)", Metamorphose Meeting, Brussels, Belgium, December 2009 ("Metamorphose'2009"). Talk

5. W. Schwarzacher, "Periodic 3-D arrays by protein crystallization", Metamorphose'2009. Talk

6. D. V. Berkov, "Micromagnetic modelling: studying static and dynamic behaviour of mesoscopic ferromagnets", Metamorphose'2009. Talk

7. G. Duerr and D. Grundler: "All Electrical Spin Wave Spectroscopy in the GHz Frequency and sub-ns Time Domain", Metamorphose'2009. Poster

8. G. Gubbiotti, M. Madami, S. Tacchi, M. Sepioni, and G. Carlotti, "Collective spin excitations in laterally confined magnetic nanostructures", Metamorphose'2009. Poster

9. S. Mamica, M. Krawczyk, L. Giovannini, R. Zivieri, D. Bisero, and F. Nizzoli, "Magnons in magnetic metamaterials: Theoretical analysis", Metamorphose'2009. Poster

10. G. Duerr, S. Neusser, and D. Grundler: "Spin wave propagation in magnetic antidot lattices", 2nd TUM-Nanomagnetism Workshop, Munich/Garching, Germany, January 2010. Talk

11. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, A. O. Adeyeye, Sebastian Neusser, Bernhard Botters, and Dirk Grundler, "Angular dependence of magnetic normal modes in NiFe antidot lattices with different lattice symmetry" 11th Joint MMM-Intermag Conference, Washington, DC, Maryland, USA, January 2010 ("Intermag'2010"). Talk

12. M. Madami, F. Montoncello, G. Capuzzo, L. Giovannini, F. Nizzoli, G. Gubbiotti, S. Tacchi, G. Carlotti, H. Tanigawa, and T. Ono, "Experimental evidence of field-induced localization of spin excitations in NiFe elliptical rings by micro-focused Brillouin light scattering", Intermag'2010. Invited Poster

13. S. Ward Jones and W. Schwarzacher, "Alloys by precision electrodeposition", Pulse-plating symposium, Vienna, Austria, March 2010. Invited

14. D. Grundler, "Magnonics: Exploring Spin Waves on the Nanoscale", Spring Meeting of the German Physical Society, Germany, March 2010 ("GPS Spring Meeting'2010"). Invited

15. S. Neusser, G. Duerr, and D. Grundler, "Electrically detected spin wave propagation across the boundary of nanostructured", GPS Spring Meeting'2010. Poster

16. G. Duerr, S. Neusser, and D. Grundler, "Spin wave propagation in Permalloy antidot lattices", GPS Spring Meeting'2010. Poster

17. J. Topp, M. Kostylev, D. Heitmann, and D. Grundler, "Reversible folding of acoustic spin waves in a one-dimensional magnonic crystal", GPS Spring Meeting'2010. Talk

18. V. V. Kruglyak, "Magnonic Meta-Materials", Physics Colloquium, Radboud University, Nijmegen, The Netherlands, March 2010. Invited

19. S. E. Ward Jones, I. Kazeminezhad, and W. Schwarzacher, "Alloys by precision electrodeposition", EDNANO 7, Bristol, UK, April 2010. Poster

20. G. Carlotti, G. Gubbiotti, M. Madami, and S. Tacchi, "Collective spin waves in planar magnonic crystals", Trends in Spintronics and Nanomagnetism, Italy, May 2010. Talk

21. G. Carlotti, G. Gubbiotti, M. Madami, and S. Tacchi, "Spin excitations in magnetic nanostructures investigated by micro -focused Brillouin light scattering", 2nd Nordic Workshop on Spintronics and Nanomagnetism, Gimo, Sweden, May 2010. Talk

22. D. V. Berkov "Localized and propagating oscillation modes for spin-torque induced magnetic excitations in structures with different dimensionalities", SIAM Conference on Mathematical Aspects of Materials Science (MS10), Philadelphia, Pennsylvania, USA, May, 2010. Invited

23. S. Neusser, G. Duerr, and D. Grundler, "(Dem) Magnetismus auf der (Nano)Spur", Tag der Offenen Tür, Forschungsgelände Garching, Germany, May 2010. Poster

24. D. Grundler, "Magnonics: Exploring spin waves on the nanoscale", Physics Colloquium, University of Konstanz, Germany, May 2010. Invited

25. W. Schwarzacher, "Magnetoferritin – a model nanomagnetic system", International Workshop: Magnetic Phenomena in Micro- and Nano-Structures, Donetsk, Ukraine, May 2010 ("NoWaPhen'2010"). Invited

26. G. Duerr, S. Neusser, D. Grundler, H. Bauer, G. Woltersdorf, C.H. Back, S. Tacchi, M. Madami, and G. Gubbiotti, "Spin wave propagation in antidot lattices", NoWaPhen'2010. Invited

27. G. Gubbiotti, S. Tacchi, M. Madami, and G. Carlotti, "Brillouin light scattering studies of 1D and 2D magnonic crystals", NoWaPhen'2010. Invited

28. M. Krawczyk, J. W. Kłos, S. Mamica, and M. Sokolovskyy, "Towards materials optimization of the 3D magnonic band gaps", NoWaPhen'2010. Invited

29. V. V. Kruglyak, "Magnonic Meta-Materials", NoWaPhen'2010. Invited

30. M. Sokolovskyy, M. Krawczyk, J. W. Kłos, S. Mamica, "The demagnetizing field in magnetic periodic planar structures", NoWaPhen'2010. Poster

31. J. W. Kłos, M. Krawczyk, "The spin-wave spectra of finite arrays of cylindrical rods", NoWaPhen'2010. Poster

32. D. Grundler, "Spin waves in ferromagnetic nanostructures and magnonic crystals", University of Stuttgart, Germany, June 2010. Invited

33. S. Mamica, M. Krawczyk, and J. W. Kłos, "On the calculation of the band structure of 2D magnonic crystals by the plane-wave method", Journées Simulation Numerique XVIe édition (JSNUM 2010), Paris, France, June 2010. Talk

34. S. Neusser, "Anisotropic propagation and damping of spin waves in a nanopatterned antidot lattice", Hitachi Global Storage Research Laboratories, San Jose, USA, June 2010. Invited

35. S. Neusser and D. Grundler, "Anisotropic propagation and damping of spin waves in a nanopatterned antidot lattice", UCLA, USA, June 2010. Invited

36. D. Grundler, "Spin waves in arrays of magnetic nanostructures: towards reprogrammable artificial crystals", International Workshop "Ferromagnet-Semiconductor Hybrids", Bochum, Germany, June 2010. Invited

37. G. Duerr, S. Neusser, and D. Grundler, "Spin Wave Propagation in magnetic Antidot Lattices", 3. TUM-TU/e-DTU Joint Nanoworkshop, TU/e Eindhoven, June 2010. Poster

38. S. Tacchi, F. Montoncello, M. Madami, G. Gubbiotti, G. Carlotti, L. Giovannini, R. Zivieri, F. Nizzoli, A. O. Adeyeye, and N. Singh, "Propagating collective modes in a 2-D magnonic crystal consisting of interacting cylindrical dots", 7th International Conference on Fine Particle Magnetism, Uppsala, Sweden, June 2010 ("ICFPM'2010"). Poster

39. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, R. Zivieri, F. Montoncello, L. Giovannini, F. Nizzoli, N. Singh, and A. O. Adeyeye, "Magnonic modes in 1-D arrays of interacting rectangular dots", ICFPM'2010. Poster

40. R. V. Mikhaylovskii, E. Hendry, and V. V. Kruglyak, "Negative permeability from high frequency spin wave resonances in thin ferromagnetic films", Physics Colloquium at Kotelnikov Institute of Radio-Engineering and Electronics of Russian Academy of Science, Moscow, Russia, June 2010. Talk

41. M. Krawczyk, S. Mamica, J. W. Kłos, M. Sokolovskyy and J. Romero-Vivas, "Modeling spin-wave dispersion in one and two-dimensional magnonic crystals by structural changes", Progress in Electromagnetics Research (PIERS), Cambridge, Massachusetts, July, 2010. Talk

42. G. Gubbiotti, S. tacchi, M. Madami, and G. Carlotti, "From isolated to interacting magnetic nanostructures: a road to control spin wave Propagation", Joint European Magnetic Symposia, Krakow, Poland, August 2010 ("JEMS'2010"). Invited

43. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, H. Tanigawa, T. Ono, and M. Kostylev, "Propagating Collective Modes in a 2D Magnonic Crystal consisting of interacting square nanodots", JEMS'2010. Invited

44. R. Zivieri, F. Montoncello, L. Giovannini, F.Nizzoli, S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, A. O. Adeyeye "Band gaps in 1D magnonic crystals: a micromagnetic study", JEMS'2010. Talk

45. S. Mamica, M. Krawczyk, and J. W. Kłos, "Band gaps of 2D magnonic crystals with rods of elliptical cross-section", JEMS'2010. Talk

46. M. L. Sokolovskyy and M. Krawczyk, "A new treatment of the demagnetizing field for the plane-wave method", JEMS'2010. Poster

47. W. Schwarzacher, “Protein-guided assembly of (magnetic) nanostructures”, Fourth International Conference on Advanced Electromagnetic Materials in Microwaves and Optics, Karlsruhe, Germany, September 2010 (“Metamaterials’2010”). Invited

48. R. V. Mikhaylovskii, E. Hendry, and V. V. Kruglyak, “Negative permeability from high frequency spin wave resonances in thin ferromagnetic films”, Metamaterials’2010. Talk

49. H. G. Bauer, G. Woltersdorf, F. Hoffmann, K. Perzlmaier, S. Neusser, G. Duerr, D. Grundler, and C. H. Back, "Propagating spin waves in confined magnetic structures", IEEE 7th International Symposium on Metallic Multilayers, Berkeley, California, September 2010 (“MML’2010”). Invited

50. G. Gubbiotti, G. Carlotti, M. Madami and S. Tacchi, "Brillouin light scattering investigation of collective spin waves in 2D magnonic crystals", MML’2010. Invited

51. G. Gubbiotti, G. Carlotti, M. Madami and S. Tacchi, "Localised spin wave eigenmodes of a single ring-shaped nanomagnet studied by micro-focused Brillouin light scattering", MML’2010. Poster

52. M. O. Dvornik, M. L. Sokolovskyy, A. N. Kuchko, and V. V. Kruglyak, "Studying scattering of spin waves using micromagnetic simulations", MML’2010. Poster

53. R. Zivieri, F. Montoncello, L. Giovannini, F. Nizzoli, S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, N. Singh, and A.O. Adeyeye, "Magnonic modes in 1-D arrays of interacting rectangular nanodots", MML’2010. Poster

54. J. Topp, D. Heitmann, M. Kostylev, and D. Grundler, “Magnetic nanowires forming a reconfigurable artificial crystal”, 3rd International Conference on Advanced Nano Materials ANM2010, Agadir, Morocco, September 2010. Talk

55. M. L. Sokolovskyy, J. Romero-Vivas, J. Klos, and M. Krawczyk, “Investigation of the demagnetizing field of periodic planar structures using an analytical model and micromagnetic simulations”, X International Conference on “Nanostructured Materials” (NANO 2010), Roma, Italy, September 2010. Poster

56. R. Huber, P. Berberich, T. Rapp, J. Bachmann, K. Nielsch, and D. Grundler, “Spin wave resonances in ferromagnetic thin films prepared via atomic layer deposition”, Baltic ALD conference, Hamburg, Germany, September 2010. Talk

57. M. Okuda, J. -C. Eloi, S. Ward Jones, and W. Schwarzacher, “Structural analysis of protein based magnetic structure”, Bristol Nanoscience Symposium, UK, September 2010. Poster

58. J. W. Klos, “Spin waves in magnetic superlattices”, Seminar, Norrkoping, Sweden, September 2010. Talk

59. J. Romero-Vivas, M. Krawczyk, S. Mamica, J. W. Klos, and M. Sokolovskyy “Magnonic crystals - magnetic metamaterials with tailored dynamical properties”, EMRS-Fall Meeting, Warszawa, 2010. Talk

60. D. Grundler, “Magnonics: Exploring spin waves on the nanoscale”, Workshop on “Spin-wave aspects in spintronics“, Kaiserslautern, Germany, October 2010 (“Kaiserslautern’2010”). Invited

61. R. Huber, P. Berberich, T. Rapp, J. Bachmann, K. Nielsch, and D. Grundler, “Spin wave resonances in ferromagnetic thin films prepared via atomic layer deposition”, Kaiserslautern’2010. Poster

62. S. Neusser, G. Duerr, and D. Grundler, “Anisotropic propagation and damping of spin waves in a nanopatterned antidot lattice”, Kaiserslautern’2010. Poster

63. G. Duerr, A. O. Adeyeye, G. Gubbiotti, and D. Grundler, “Spin-Wave Modes in Arrays of Bistable Ferromagnetic Nanowires”, Kaiserslautern’2010. Poster

64. M. Krawczyk, J. W. Kłos, S. Mamica, M. Sokolovskyy, J. Romero-Vivas, and M. Mruczkiewicz, “Nowe metamateriały: projekty realizowane w ramach 7PR UE”, The Day of the UE Programs, Adam Mickiewicz University, Poznań, Poland, October, 2010. Invited

65. D. Grundler, “Magnonics - Controlling spin waves on the nanoscale”, International Workshop on Spin-Torque Related Phenomena in Magnetic Structures, Duisburg, Germany, October 2010. Invited

66. D. Grundler, “Non-linear processes and anisotropic damping in nanomagnonics devices”, International Workshop on Spin Dynamics in Nanomagnets: Dissipative versus Non-Dissipative Processes, Duisburg, Germany, October 2010. Invited

67. G. Duerr, F. Brandl, K. Thurner, S. Neusser, R. Huber, T. Schwarze, and D. Grundler, “Spin waves in individual and periodic permalloy nanostructures“, Nanosystems Initiative Meeting, Garching, Germany, October 2010. Poster

68. S. Neusser and D. Grundler, “All-electrical spectroscopy on spin wave propagation in nanostructured antidot lattices“, International Conference on Magnetism and Magnetic Materials, Atlanta, USA, November 2010 (“MMM’2010”). Talk

69. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, S. Goolaup, A. O. Adeyeye, N. Singh, and M. P. Kostylev, “Field controlled propagationof collective spin modes in array of NiFe stripes of alternating widths”, MMM’2010. Talk

70. M. Madami, G. Carlotti, G. Gubbiotti, F. Scarponi, S. Tacchi, and T. Ono, “Spatial profile of spin excitations in multilayered rectangular nanodots studied by micro-focused Brillouin light scattering”, MMM’2010. Talk

71. M. Madami, G. Carlotti, G. Gubbiotti, S. Tacchi, K. Nakano, and T. Ono “Spin Excitations in micrometric-sized NiFe slotted rings studied by micro-focused Brillouin light scattering”, MMM’2010. Poster

72. S. Tacchi, F. Montoncello, M. Madami, G. Gubbiotti, G. Carlotti, L. Giovannini, R. Zivieri, F. Nizzoli, A. O. Adeyeye, and N. Singh” Spin-wave band structure of collective modes in a 2-D magnonic crystal consisting of interacting cylindrical dots“, MMM’2010. Talk

73. J. W. Kłos, M. Sokolovskyy, M. Krawczyk, “Bulk and edge modes in two-dimensional magnonic crystal slab”, MMM’2010. Poster

74. S. Neusser, G. Dürr, D. Grundler, S. Tacchi, M. Madami, G. Gubbiotti, M. -Y. Im, P. Fischer, M. Dvornik, F. Y. Ogrin, and V. V. Kruglyak, “Magnetization reversal in arrays of zigzag stripes“, MMM’2010. Poster

75. M. Dvornik, M. L. Sokolovskii, A. M. Kuchko, and V. V. Kruglyak, “Micromagnetic method of s-parameter characterization of magnonic devices“, MMM’2010. Talk

76. D. Grundler, “Magnonic crystal behavior in 1 D and 2 D periodic nanomagnets”, Thales Group, Paris, France, November 2010. Invited

77. D. Grundler, M. P. Kostylev, D. Heitmann, and J. Topp, “Reprogrammable forbidden frequency gaps in an artificial crystal based on periodic magnetic nanostructures”, Fall Meeting of the Materials Research Society, Boston, USA, November-December 2010. Talk

78. E. Ahmad, E. Sirotkin, M. Dvornik, O. Dmytriiev, R. Mikhaylovskiy, F. Ogrin, and V. Kruglyak, “Fabrication of magnonic meta-materials using the etched nano-sphere lithography”, Condensed Matter and Materials Physics conference, Warwick, UK, December 2010. Poster

79. D. Grundler, “A reconfigurable magnonic crystal formed by interacting ferromagnetic nanowires”, International Conference on Nanomaterials and Nanotechnology NANO2010, Namakkal, India, December 2010. Invited

80. D. Grundler, “Magnonic crystal behavior in 1 D and 2 D periodic nanomagnets”, Paul-Scherrer-Institut, Villingen, Switzerland, January 2011. Invited

81. G. Duerr, K. Thurner, S. Neusser, R. Huber, and D. Grundler “Fast Spin Wave Propagation in Permalloy Nanowires“ 3nd TUM-Nanomagnetism Workshop, Munich/Garching, Germany, January 2011. Talk

82. M. Madami, G. Carlotti, G. Gubbiotti, and S.Tacchi, “Spin excitations’ profiles of single nanomagnets studied by micro-focused Brillouin light scattering”, II Italian Conference on Magnetism, Torino, Italy, February 2011 (“Magnet’2011”). Poster

83. G. Gubbiotti, S. Tacchi, M. Madami, and G. Carlotti, “Magnonics: Spin wave propagation control on the nano scale”, Magnet’2011. Poster

84. R. Zivieri, F. Montoncello, L. Giovannini, S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, and A. O. Adeyeye, “Collective magnonic modes in chains of rectangular magnetic dots”, Magnet’2011. Poster

85. F. Montoncello, L. Giovannini, R. Zivieri, F. Nizzoli, S. Tacchi, G. Carlotti, G. Gubbiotti, M. Madami, N. Singh, and A. O. Adeyeye “Spin-wave band diagram in a 2-D magnonic crystal consisting of interacting disks”, Magnet’2011. Talk

86. D. Bisero, P. Cremon, M. Madami, S. Tacchi, G. Gubbiotti, G. Carlotti, and A. O. Adeyeye, “Nucleation and propagation of vortex states in dense chains of rectangular particles”, Magnet’2011. Poster

87. S. Neusser, “Spin dynamics in ferromagnetic antidot lattices: From quantization to magnonic effects”, Tohoku University, Sendai, Japan, February 2011. Invited

88. F. Brandl, R. Huber, S. Neusser, G. Dürr, and D. Grundler, “Spin waves in antidot lattices on suspended membranes”, Spring Meeting of the German Physical Society, Dresden, Germany, March 2011 (“GPS Spring Meeting’2011”). Poster

89. T. Schwarze, F. Brandl, R. Huber, S. Neusser, G. Dürr, and D. Grundler, “Temperature dependent propagating spin-wave spectroscopy on permalloy thin films”, GPS Spring Meeting’2011. Poster

90. R. Huber, P. Berberich, T. Rapp, J. Bachmann, K. Nielsch, and D. Grundler, “Spin wave resonances in ferromagnetic thin films prepared via atomic layer deposition”, GPS Spring Meeting’2011. Poster

91. J. W. Kłos and M. Krawczyk, “Tailoring of the spin-wave spectrum in magnonic crystals”, The Seminar of the Solid State Theory Division in Adam Mickiewicz University, Poznań, Poland, March 2011. Invited

92. R. Huber, T. Schwarze, T. Rapp, S. Neusser, and D. Grundler, "Spin wave resonances in periodically patterned ferromagnetic structures", poster presentation at the winter school of Nanosystems Initiative Munich, St. Christoph, Austria, March 2011.

93. S. E. Ward Jones and W. Scwarzacher, "Computer Simulation of the electro-deposition of magnetic alloys and multilayer films", EDNANO8, Milan, Italy, March 2011. Poster

94. M. Mruczkiewicz, M. Krawczyk, J. W. Kłos, and M. Sokolovskyy, “Effective magnetic parameters of one-dimensional magnonic crystals in the long-wavelength limit”, Progress In Electromagnetics Research Symposium, Marrakesh, Morocco, March 2011 (“PIERS’2011”). Talk

95. M. L. Sokolovskyy, M. Krawczyk, M. O. Dvornik, and V. V. Kruglyak, “Investigation of spin dynamics in planar two-dimensional magnonic crystals using the plane wave method and micromagnetic simulations”, PIERS’2011. Talk

96. J. W. Kłos, M.L. Sokolovskyy, and J. Romero-Vivas, “The Magnonic Spectra of Finite-thickness Slabs with Inclusions Forming 2D Lattices of Different Symmetry”, PIERS’2011. Talk

97. D. Grundler, "Magnonic crystals – artificial band structures for collective spin excitations in ferromagnetic nanostructures", Transregio TRR80 "From electronic correlations to functionality", Freising, Germany, May 2011. Invited

98. M. Okuda, J.-C. Eloi, S. E. Ward Jones and W. Schwarzacher "Magnetic properties of a 3D magnetic nanoparticle crystal assembled using hydrated apoferritin", European Materials Research Society (E-MRS) Spring Meeting, Nice, France, May 2011. Invited

99. F. Y. Ogrin, V. V. Kruglyak, and A. Hibbins, “Tuneable magnetic metamaterials: using ferromagnetic nanostructures to control the permeability of electromagnetic media”, International Magnetics Conference, Taipei, Taiwain, May 2011 (“Intermag’2011”). Talk

100. O. V. Dmytriiev, M. O. Dvornik, R. V. Mikhaylovskiy, E. Ahmad, F. Y. Ogrin, and V. V. Kruglyak, “Micromagnetics based calculation of permeability of meta-materials containing complex magnetic inclusions”, Intermag’2011. Talk

101. Y. Au, T. Davison, E. Ahmad, P. S. Keatley, R. J. Hicken, and V. V. Kruglyak, “Excitation of propagating spin waves with global uniform microwave fields”, Intermag’2011. Talk

102. D. V. Berkov and I. N. Krivorotov, "Numerical simulations of magnetization dynamics in a nanowire induced by a spin-polarized current injected via a point contact", International Conference "Recent Trends in Nanomagnetism, Spintronics and their Applications", Ordizia, Spain, June 2011 (“RTNSA-2011”). Talk

103. M. Mruczkiewicz, R. V. Mikhaylovskiy, J. Kłos, M. Krawczyk, and V. V. Kruglyak, “2D magnonic Crystals as Candidates For Metamaterials With Negative Permeability”, RTNSA-2011. Talk

104. D. Grundler, "Artificial crystals from ferromagnetic nanostructures", Seminar of LMU Munich, Munich, Germany, June 2011. Invited

105. G. Carlotti, G. Gubbiotti, S. Tacchi, and M. Madami, “Collective spin waves in artificial magnonic crystals”, MORIS-2011 Conference, Netherlands, Nijmegen, June 2011 (“MORIS’2011”). Talk

106. M. Krawczyk, M. L. Sokolovsky, j. W. Klos, S. Mamica, S. Neusser, G. Duerr, and D. Grundler, “Nonmagnetic materials in the plane wave based calculations of magnonic spectra”, MORIS’2011. Poster

107. G. Gubbiotti, “Controlling spin wave propagation properties on the nanoscale”, The European Conference on Physics of Magnetism 2011, Poland, Poznan, June 2011 (“PM'11”). Invited

108. S. Mamica, M. Krawczyk, and J. W. Kłos, “Spin-wave spectrum of 2D magnonic crystals with elliptically shaped scattering centres”, PM'11. Poster

109. S. Mamica, M. Krawczyk, M. Sokolovskyy, J. W. Kłos, W. Schwarzacher, J.-C. Eloi, and M. Okuda, “Magnonic band gaps in magnetoferritin-based nanocomposites”, PM'11. Poster

110. M. L. Sokolovskyy, J. W. Klos, and M. Krawczyk, “Influence of the demagnetizing field on spin wave spectra of planar two-dimensional magnonic crystals”, PM'11. Poster

111. F. Ogrin, V. Kruglyak, and A. Hibbins, “Tuneable magnetic metamaterials”, PM’2011. Poster

112. J. W. Kłos, M. Krawczyk, S. Tacchi, G. Gubbiotti, H. - T. Huang, M. - F. Lai, and Z. - H. Wei, “Spin-wave spectra of a series of ferromagnetic stripes coupled by a uniform ferromagnetic film”, International Conference on Materials for Advanced Technologies Singapore, June-July 2011 (“ICMAT’2011”). Poster

113. M. Mruczkiewicz, R. V. Mikhaylovskiy, J. Kłos, M. Krawczyk, and V. V. Kruglyak, “1D or 2D magnonic crystals as meta-materials with negative permeability”, ICMAT’2011. Poster

114. M. Okuda, J.-C. Eloi, S. E. Ward Jones, A. Sarua, and W. Schwarzacher, "Magnetic properties and versatile applications of Cobalt-ferrite nanoparticles in cage-shape protein and their three dimensional crystals", 10th International Conference on Materials Chemistry (MC10), Manchester, UK, July 2011. Poster

115. D. Berkov and N. L. Gorn, “Localized and propagating modes for spin-torque induced magnetic excitations in structures with different dimensionalities”, Moscow International Symposium on Magnetism, Moscow, Russia, August 2011 (“MISM’2011”). Invited

116. J. W. Klos, “Tamm and Shockley states in magnonic superlattices”, MISM’2011. Talk

117. M. L. Sokolovskyy, M. Krawczyk, and J. W. Klos, “Influence of interfaces on spin wave spectra of planar magnonic crystals”, MISM’2011. Poster

118. D. Grundler, "Spin wave propagation in magnonic crystals made from nanopatterned permalloy", 2nd International Workshop “Magnonics: From Fundamentals to Applications”, Recife, Brazil, August 2011 (“Magnonics’2011”). Invited

119. G. Gubbiotti, S. Tacchi, M. Madami, and G. Carlotti “Controlling Spin Wave Propagation in Planar Magnonic Crystals”, Magnonics’2011. Invited

120. V. Kruglyak, Y. Au, M. Dvornik, R. Mikhaylovskiy, T. Davison, E. Ahmad, V. Tkachenko, and A. Kuchko, “Magnonics beyond magnonic crystals: Magnonic meta-materials and devices”, Magnonics’2011. Invited

121. T. Schwarze, F. Brandl, R. Huber, G. Duerr, S. Neusser, and D. Grundler, “Low-temperature spectroscopy on magnonic devices in perpendicular fields”, Magnonics’2011. Poster

122. F. Brandl, R. Huber, S. Neusser, G. Dürr, and D. Grundler, “Spin waves in antidot lattices on suspended membranes”, Magnonics’2011. Poster

123. D. Grundler, "Ferromagnetic nanostructures for magnonic crystals and waveguides", SPIE Optics and Photonics Conference, Symposium Spintronics IV, San Diego, US, August 2011. Invited

124. S. Mamica and M. Krawczyk, “Tuning of the spin-wave band structure in 2D magnetic composites”, 18th International Conference on Composite Materials (ICCM18), Jeju Island, Korea, August 2011. Poster

125. G. Gubbiotti, M. Madami, S. Tacchi, and G. Carlotti, “Advances in spin waves detection in magnetic nanonstructures”, XCVII National Conference of the Italian physical Society, L’Aquila, Italy, September 2011. Invited

126. R. Zivieri, F. Montoncello, L. Giovannini, F. Nizzoli, S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, and A. O. Adeyeye, “Collective dynamics in chains of rectangular magnetic dots”, HMM 2011, Levico (Trento), Italy. Poster

127. M. Madami, D. Bisero, G. Gubbiotti, S. Tacchi, G. Carlotti, and T. Ono ”Magnetization configurations and spin excitations in micrometric-sized NiFe slotted rings”, 20th Soft Magnetic Materials Conference, Kos Island, Greece, September 2011 (“SMM’2011”). Poster

128. S. Mamica, M. Krawczyk, M. Sokolovskyy, and J. W. Kłos, “Tailoring of the band gap width in the spin-wave spectrum of 2D magnonic crystal with elliptically shaped scattering centres”, SMM’2011. Poster

129. D. Bisero, P. Cremon, M. Madami, S. Tacchi, G. Gubbiotti, G. Carlotti, and A. O. Adeyeye, “Magnetization reversal of rectangular particles: closure states and effect of dipolar coupling”, SMM’2011. Poster

130. G. Gubbiotti, “Spin wave band structure in planar magnonic crystals”, 5th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics, Spain, Barcelona, October 2011 (“Metamaterials’2011”). Invited

131. M. Krawczyk, M. Mruczkiewicz, R. V. Mikhaylovskiy, J. W. Klos, S. Mamica, M. L. Sokolovskyy, and V. V. Kruglyak, “Magnonic crystals and their metamaterials properties - theoretical considerations”, Metamaterials’2011. Invited

132. S. Neusser, G. Duerr, F. Brandl, R. Huber, T. Schwarze, and D. Grundler, “Transmission of GHz spin waves through periodically nanopatterned ferromagnets”, Metamaterials’2011. Invited

133. R. Zivieri, F. Montoncello, L. Giovannini, F. Nizzoli, S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, and A. O. Adeyeye, “Metamaterial properties of arrays of rectangular magnetic dots”, Metamaterials’2011. Poster

134. T. Schwarze, M. Okuda, R. Huber, J.-C. Eloi, F. Brandl, L. Dreher, M. S. Brandt, D. Grundler, and W. Schwarzacher, “Fabrication and characterization of crystallized magnetoferritin as an artificial magnetic metamaterial”, Metamaterials’2011. Poster

135. T. Schwarze, R. Huber, G. Dürr, F. Brandl, S. Neusser, K. Thurner, and D. Grundler, “Microwave Antennas for Broadband Spectroscopy on Magnonic Metamaterials“, Metamaterials’2011. Poster

136. D. V. Berkov and N. L. Gorn, “Micromagnetic studies of quasistatic and dynamic properties of densely packed hexagonal nanodisk arrays”, Metamaterials’2011. Poster

137. R. Mikhaylovskiy, E. Hendry, and V. V. Kruglyak, “In-situ generation of THz electromagnetic waves for studies of effective continuous properties of magnonic metamaterials”, Metamaterials’2011. Poster

138. S. Mamica, M. Krawczyk, M. Sokolovskyy, J. W. Kłos, W. Schwarzacher, J.-C. Eloi, and M. Okuda, “Spin waves in magnetoferritin-based magnonic crystals”, International Conference "Functional Materials 2011", October 2011, Parthenit, Ukraine (“ICFM’2011”). Talk

139. M. Krawczyk, J. W. Kłos, S. Mamica, M. Sokolovskyy, J. Romero Vivas, and V. V. Kruglyak, “Magnonic Crystals: Mastering Magnons at the Nanoscale”, ICFM’2011. Invited

140. M.L. Sokolovskyy and M. Krawczyk, “Effect of boundaries on spin wave spectra of planar magnonic crystals”, ICFM’2011. Poster

141. S. Tacchi, M. Madami, G. Gubbiotti, G. Carlotti, B. Botters, S. Neusser, D. Grundler, J. W. Kłos, M. L. Sokolovsky, M. Krawczyk, and A. O. Adeyeye “Spin wave propagation in a two-dimensional magnonic crystal consisting of a rhombic antidot array with circular holes”, 56th Conference on Magnetism & Magnetic Materials, Scottsdale, Arizona, USA, October 2011 (“MMM’2011”). Poster

142. M. Madami, S. Bonetti, G. Consolo, S. Tacchi, G. Carlotti, G. Gubbiotti, F. B. Mancoff, M. A. Yar, and J. Åkerman, “Propagation of spin-torque excited spin waves revealed by micro-focused brillouin light scattering”, MMM’2011. Talk

143. G. Consolo, G. Gubbiotti, L. Giovannini, and R. Zivieri, “ Linear and autonomous magnetization dynamics in spin-torque auto-oscillators: a Lagrangian approach” , MMM’2011. Talk

144. G. Duerr, M. Madami, S. Neusser, S. Tacchi, G. Gubbiotti, G. Carlotti, and D. Grundler, “Interchanging extended modes in permalloy antidot arrays by incorporation of Co nanodisks”, MMM’2011. Poster

145. M. L. Sokolovskyy, M. Mruczkiewicz, S. Mamica, J. W. Klos, and M. Krawczyk, “Tailoring of the spin wave spectra of planar magnonic crystals using metallic overlayers”, MMM’2011. Poster

146. D. Rüffer, R. Huber, E. Russo, M. Heiss, J. Arbiol, D. Grundler, and A. Fontcuberta i Morral, “Magnetotransport on single GaAs-Ni Core-Shell Ni/GaAs hybrid magnetic nanotubes”, Workshop GDR Nanofils, Porquerolles, Corsica, France, October 2011. Poster

147. G. Duerr and D. Grundler, “Spin-wave modes in bicomponent ferromagnetic antidot lattices“, VI Young researchers’ conference on nanoelectronics, nanophotonics, and nonlinear physics, Saratov, Russia, October 2011. Talk

148. M. Madami, S. Bonetti, G. Consolo, S. Tacchi, G. Carlotti, G. Gubbiotti, F. B. Manconff, M. A. Yar, and J. Åkerman, “Propagation of spin-toruqe excited spin waves revealed by micro-focused Brillouin light scattering”, Spin Master Voice Workshop - Challenges and opportunities of Spin-Transfer Nano-Oscillators, France, Chateau de Villiers-Mahieu, December 2011 (“Master’2011”). Poster

149. D. V. Berkov, “Micromagnetic simulations of STNO synchronization for point contacts on a quasi-1D nanowire”, Master’2011. Talk

150. D. Rueffer, R. Huber, P. Berberich, E. Russo-Averchi, M. Heiss, J. Arbiol, D. Grundler, and A. Fontcuberta i Morral, “Magnetotransport on single Ni/GaAs magnetic nanotubes”, QSIT Meeting, Zürich, Switzerland, December 2011. Poster

151. S. Mamica, M. Krawczyk, J. W. Kłos, W. Schwarzacher, J.-C. Eloi, and M. Okuda, “Size- and structure-induced properties of spin waves in magnetic nanoparticle crystals”, 2nd Nano Today Conference, Waikoloa, Hawaii, USA, December 2011. Poster

152. M. Madami, “Spin-torque excited spin waves revealed by micro-focused Brillouin light scattering”, APS March Meeting 2012, Boston (MA), USA, February 2012. Invited

153. D. Rueffer, R. Huber, E. Russo-Averchi, M. Heiss, J. Arbiol, D. Grundler, and A. Fontcuberta i Morral, “Magnetotransport on single Ni/GaAs magnetic nanotubes”, QSIT Student School, Arosa, Switzerland, February 2012. Poster

154. R. Huber and D. Grundler, “Phase resolved measurements on permalloy 1D magnonic crystals”, TRR 80 Integrated Graduate School Seminar, Garching, Germany, February 2012. Talk

155. D. Grundler, “Artificial Crystals and Meta-Materials for Spin Waves made of Nanopatterned Ferromagnets”, Colloquium of Chalmers and Gothenburg Universities, Gothenburg, Sweden, February 2012. Invited

156. R. Huber, T. Schwarze, G. Duerr, H. Yu, S. Albert, and D. Grundler, “Large relaxation times in permalloy reprogrammable magnonic crystals”, DPG-Spring Meeting, Berlin, Germany, March 2012. Talk

157. M. Okuda, J.-C. Eloi, S. E. Ward Jones, A. Sarua, R. Richardson, and W. Schwarzacher, "Synthesis and 3D self-assembly of magnetite and Co-ferrite nanoparticles using protein templates", 3rd European workshop on self-organized nanomagnetics, Guadarrama, Madrid, Spain, April 2012. Talk

158. M. Madami, “Spin-torque excited spin waves revealed by micro-focused Brillouin light scattering”, Third Nordic Workshop on Spintronics and Nanomagnetism (Nordicspin12), Varberg, Sweden, April 2012. Invited

159. D. Grundler, “Artificial Crystals and Meta-Materials for Spin Waves made of Nanostructured Magnetic Antidot Lattices”, Spring Meeting of the Materials Research Society 2012, San Francisco, USA, April 2012. Talk

160. F. Spizzo, L. Patrignani, D. Bisero, P. Vavassori, and V. Metlushko, “Vortex state suppression in an hexagonal array of interacting Py triangular rings”, 2nd International Conference Advances in Applied Physics & Materials Science, Antalya, Turkey, April 2012. Poster

161. G. Duerr, D. Grundler, G. Gubbiotti, S. Tacchi, M. Madami, G. Carlotti, J. W. Klos, and M. Krawczyk "Magnonic band gap in periodic cobalt/permalloy binary component lattices", Advanced Electromagnetics Symposium, April 2012, Paris, France ("AES'2012"). Invited

162. M. L. Sokolovskyy, "Influence of coating planar magnonic crystals on its spin wave spectra", AES'2012. Talk

163. Y. Au and V. V. Kruglyak, "Nanoscale magnonic valve and phase shifter", AES'2012. Talk

164. S. Neusser, G. Duerr, R. Huber, F. Brandl, T. Schwarze, and D. Grundler, "Tunable Artificial Crystals and Meta-Materials in Nanomagnonics", 3rd Initernational Conference on Superconductivity and Magnetism, Istanbul, Turkey, April – May 2012 ("ICSM'2012"). Invited

165. V. V. Kruglyak, Y. Au, M. Dvornik, R. V. Mikhaylovskiy, E. Ahmad, and T. Davison, "Magnonics: Current Status and Perspectives", ICSM'2012. Invited

166. J. W. Kłos, M. Krawczyk, and J. Romero-Vivas, "Spin Wave Spectra for Periodic Slab of Finite Thickness", ICSM'2012. Talk

167. E. Ahmad, Y. Au, T. Davison, M. Dvornik, and V. V. Kruglyak, "Arrays of Co Antidots on Continuous NiFe Films: Towards Perfect Magnonic Crystals", ICSM'2012. Poster

168. F. Y. Ogrin and A. Hibbins, "Investigation of the magnetodynamic modes of a patch resonator loaded with magnetic metamaterial", International Magnetics Conference, Vancouver, Canada, May 2012 ("Intermag'2012"). Talk

169. E. Ahmad, Y. Au, T. Davison, F. Y. Ogrin, and V. V. Kruglyak, "Time resolved characterization of a Co antidots / NiFe thin film 2D magnonic metamaterial", Intermag'2012. Talk

170. R. Zivieri, S. Tacchi, F. Montoncello, L. Giovannini, F. Nizzoli, M. Madami, G. Gubbiotti, G. Carlotti, S. Neusser, G. Duerr, and D. Grundler, "Spin wave band structure of a two-dimensional ferromagnetic antidot array", Intermag'2012. Talk

171. S. Tacchi, F. Montoncello, M. Madami, G. Gubbiotti, G. Carlotti, L. Giovannini, R. Zivieri, F.Nizzoli, S. Jain, A.O. Adeyeye, and N. Singh, "Complete wave vector mapping of a two-dimensional Magnonic Crystal consisting of square array of NiFe disks", Intermag'2012. Poster

172. Y. Au and V. V. Kruglyak, "Nanoscale spin wave valve and phase shifter", Intermag'2012. Poster

173. V. V. Kruglyak, "Magnonics: Mastering Magnons in Magnetic Meta-Materials", Industrial Technologies 2012, Aarhus, Denmark, June 2012. Poster

174. M. Krawczyk, "Theory of Magnonic Metamaterials: From Band Gap to Effectively Continuous", International Conference on Metamaterials and Dissemination Workshop 2012, Jena, Germany, July 2012 ("Jena'2012"). Invited

175. D. V. Berkov, "Numerical micromagnetics: a non-missing link between theory and experiment on a mesoscopic scale", Jena'2012. Invited

176. W. Schwarzacher, "Electrodeposition and Protein Crystallisation as Tools for Metamaterial Manufacturing", Jena'2012. Invited

177. V. V. Kruglyak, "Dynamical Characterisation of Magnonic Metamaterials", Jena'2012. Invited

178. M. Krawczk, Yu. S. Dadoenkova, N. N. Dadoenkova, I. L. Lyubchanskii, M. Sokolovskyy, J. W. Klos, and J. Romero-Vivas, "Goos-Hänchen effect for spin waves in an exchange limit", Jena'2012. Talk

179. R. Zivieri and L. Giovannini, "Effective Properties of a Two-Dimensional Magnonic Metamaterial", Jena'2012. Talk

180. J. Romero-Vivas, S. Mamica, M. Krawczyk, and V. V. Kruglyak, "Tailoring intrinsic damping of spin-waves in 3D magnonic crystals", Jena'2012. Poster

181. G. Gubbiotti, "Spin wave band structure in planar magnonic crystals", Jena'2012. Poster

182. T. Schwarze, M. Okuda, J.-C. Eloi, D. Grundler, and W. Schwarzacher, "Fabrication and dynamic characterization of crystallized magnetoferritin as a magnonic metamaterial", Jena'2012. Poster

183. R. Zivieri, S. Tacchi, F. Montoncello, L. Giovannini, F. Nizzoli, M. Madami, G. Gubbiotti, G. Carlotti, S. Neusser, G. Duerr, and D. Grundler, "Spin wave bands and band gaps in a two-dimensional ferromagnetic antidot array", International Conference on Magnetism, Busan, South Korea, July 2012 (ICM'2012). Talk

184. Y. Au and V. V. Kruglyak, "Nanoscale spin wave switches and phase shifters", ICM'2012. Talk

185. M. Mruczkiewicz, M. Krawczyk, R. V. Mikhaylovskiy, and V. V. Kruglyak, "Magnonic Meta- and Meta-Meta-Materials", ICM'2012. Poster

186. R. V. Mikhaylovskiy, E. Hendry, F. Y. Ogrin, and V. V. Kruglyak, "Low Temperature Time Domain THz Spectroscopy of Terbium Gallium Garnet Crystals", ICM'2012. Poster

187. E. Ahmad, Y. Au, T. Davison, M. Dvornik, and V. V. Kruglyak, "Arrays of Co Antidots on Continuous NiFe Films: Towards Perfect Magnonic Crystals", ICM'2012. Poster

188. D. Grundler, "Spin waves in magnonic crystals and meta-materials prepared from nanopatterned permalloy", Workshop on Spin dynamics in Nanomagnets (WSDN'2012), Seoul, Korea, July 2012. Invited

189. V. V. Kruglyak, Y. Au, E. Ahmad, O. Dmytriiev, M. Dvornik, R. V. Mikhaylovskiy, and T. Davison, "Magnetic Resonance Phenomena in Magnonics", WSDN'2012. Invited

190. Y. Au, T. Davison, E. Ahmad, M. Dvornik, R. V. Mikhaylovskiy, P. S. Keatley, and V. V. Kruglyak, "Time Resolved Optical Pumped Scanning Optical Microscopy (TROPSOM) of thin magnetic films and 2D Magnonic Metamaterials", WSDN'2012. Poster

191. D. Rueffer, R. Huber, P. Berberich, E. Russo-Averchi, M. Heiss, J. Arbiol, A. Fontcuberta i Morral, and D. Grundler, "Semiconductor nanowire-based ferromagnet/semiconductor hybrid structures", ICPS-2012, Zürich, Switzerland, July 2012. Poster

192. G. Carlotti, "Spatial profile of spin waves excited by a spin-torque oscillator and by coplanar waveguides", International Conference on Microwave Magnetics 2012 ("ICMM'2012"), Germany, Kaiserslautern, August 2012. Invited

193. Y. Au, E. Ahmad, M. Dvornik, O. Dmytriiev, T. Davison, and V. Kruglyak, "Magnonic logic architectures driven by microwaves", ICMM'2012. Invited

194. S. Foteinopoulou, “Metamaterial characterization: Composite structures with effectively continuous electromagnetic properties”, International Advanced School on Magnonics, St. Margherita, Italy, September 2012 (“Magnonics School’2012”). Lecture

195. M. Krawczyk, “Plane wave method: Calculations of the magnonic band structure in periodically structured ferromagnetic materials”, Magnonics School’2012. Lecture

196. D. Berkov, “Micromagnetic modelling of quasistatic remagnetization processes and magnetization dynamics in magnonic nanomagnets”, Magnonics School’2012. Lecture

197. D. Grundler, “2D and 3D periodically patterned devices: from direct writing to atomic layer deposition on nanotemplates”, Magnonics School’2012. Lecture

198. W. Schwarzacher, “Bottom-up nanofabrication, protein based colloidal crystallisation and electrodeposition”, Magnonics School’2012. Lecture

199. F. Ogrin, “Mixed nano-lithography: Self-assembled etched nanosphere lithography”, Magnonics School’2012. Lecture

200. W. Schwarzacher, “Structural, chemical, and static magnetic characterization”, Magnonics School’2012. Lecture

201. D. Grundler, “Broadband spectroscopy of standing and propagating spin waves with all-electrical means”, Magnonics School’2012. Lecture

202. G. Carlotti, “Brillouin Light Scattering”, Magnonics School’2012. Lecture

203. R. J. Hicken, “Time resolved magneto-optical imaging”, Magnonics School’2012. Lecture

204. E. Hendry, “THz spectroscopy”, Magnonics School’2012. Lecture

205. J. W. Kłos, S. Mamica, M. Mruczkiewicz, J. Romero Vivas, M. L. Sokolovskyy, and M. Krawczyk, “Frequency domain calculations of the spin-wave band structure in magnonic crystals”, Magnonics School’2012. Poster

206. D. V. Berkov, E. K. Semenova, S. G. Erokhin, and N. L. Gorn, “Numerical simulations of magnonic metamaterials: methodical progress and physical results”, Magnonics School’2012. Poster

207. M. Mruczkiewicz, M. Krawczyk, V.K. Sakharov, Yu. V. Khivintsev, Yu. A. Filimonov, and S. A. Nikitov, “Investigation of the FMR spectra in 1D Co/Py magnonic crystals”, Magnonics School’2012. Poster

208. R. Zivieri, L. Giovannini, and F. Nizzoli, “Dynamical Matrix Method applied to magnons in magnetic metamaterials”, Magnonics School’2012. Poster

209. M. Okuda, J.-C. Eloi, S. E. Ward Jones, and W. Schwarzacher, “Novel fabrication routes to magnonic meta-materials”, Magnonics School’2012. Poster

210. Y. Au, E. Ahmad, T. Davison, M. Dvornik, R. V. Mikhaylovskiy, O. Dmytriiev, F. Y. Ogrin, and V. V. Kruglyak, “Fabrication, dynamic characterisation and modelling of magnonic metamaterials and devices at Exeter”, Magnonics School’2012. Poster

211. T. Schwarze, R. Huber, G. Duerr, F. Brandl, F. della Coletta, T. Stückler, S. Neusser, P. Berberich, and D. Grundler, “Fabrication and dynamic characterization of one-, two-, and three-dimensionally nanopatterned magnonic crystals and metamaterials”, Magnonics School’2012. Poster

212. G. Gubbiotti, S. Tacchi, M. Madami, and G. Carlotti, “Brillouin light scattering investigation of collective spin waves in 2D magnonic crystals”, Magnonics School’2012. Poster

213. D. Grundler, “Spin waves in magnonic crystals from nanopatterned permalloy”, Joint European Magnetic Symposia, Parma, Italy, September 2012 (“JEMS’2012”). Invited

214. D. Rueffer, R. Huber, P. Berberich, E. Russo-Averchi, M. Heiss, J. Arbiol, D. Grundler, and A. Fontcuberta i Morral, “Magnetic states of individual ferromagnetic nanotubes probed by anisotropic magnetoresistance”, JEMS’2012. Talk

215. A. Francis, C. Davies, M. Dvornik, Y. Au, and V. V. Kruglyak, “Scattering of spin waves in curved magnonic waveguides”, JEMS’2012. Poster

216. C. Davies, A. Francis, and V. V. Kruglyak, “Interplay between magnonics and spintronics in spin-motive force generation devices”, JEMS’2012. Poster

217. D. Rueffer, D. Weber, R. Huber, P. Berberich, A.Buchter, F. Xue, E. Russo-Averchi, M. Heiss, J. Arbiol, M. Poggio, D. Grundler, and A. Fontcuberta i Morral, “Magnetic states of individual ferromagnetic nanotube probed by anisotropic magnetoresistance”, QSIT Lunch Seminar 2012, ETH Zürich , Switzerland, September 2012. Talk

218. H. Yu, G. Duerr, R. Huber, M. Bahr, T. Schwarze, F. Brandl, and D. Grundler, “Bragg reflection in a CoFeB/Ni80Fe20 bicomponent two-dimensional magnonic crystal”, TRR 80 Summer School 2012 "Functionality of Correlated Materials”, Chiemsee, Germany, September 2012. Poster