

**PROIECT DE HOTARÂRE
din 17 Noiembrie 2015**

**privind acordarea Titlului de Cetățean de Onoare al orașului Luduș domnului
doctor Ioan Lucian Prejbean**

Consiliul local al orașului Luduș, întrunit în ședința ordinară de lucru,

Având în vedere adresa înregistrată sub nr. 36500 din 10.11.2015, precum și referatul cu numărul 36702 din 12.11.2015 înaintat de conducerea Casei de Cultură "Pompeiu Hărășteanu" Luduș, privind acordarea Titlului de Cetățean de Onoare al orașului Luduș domnului Ioan Lucian Prejbean,

Luând în considerare Rapoartele de avizare ale Comisiilor de specialitate ale Consiliului local "Învățământ.Cultură.Sport.Culte și Protecție Socială" și "Comisia Juridică Apărarea drepturilor omului, ordine publică și relația cu cetățenii"

În conformitate cu Hotărârea Consiliului Local Luduș nr.87 din 29 mai 2007 privind aprobarea Regulamentului propriu pentru conferirea Titlului de Cetățean de Onoare și a altor titluri și distincții personalităților cu merite deosebite ,

În temeiul prevederilor art. 36 (8) și ale art. 45 alin. (1) din Legea nr. 215/2001, privind administrația publică locală, republicată, cu modificările și completările ulterioare,

HOTĂRĂȘTE :

Art.1. Se conferă Titlul de Cetățean de Onoare al orașului Luduș domnului doctor Ioan Lucian Prejbean.

Art.2. Cu ducerea la îndeplinire a hotărârii se încredințează primarul orașului Luduș, dl. Moldovan Ioan Cristian .

Art.4. Prezenta hotărâre se comunică:

- Instituției Prefectului Județului MUREȘ;
- Primarului orașului Luduș;
- Casei de Cultură "Pompeiu Hărășteanu" Luduș;
- Domnului dr. Ioan Lucian Prejbean;
- Spre afișare.

**Inițiator,
Primar,
Moldovan Ioan Cristian**





PRIMĂRIA ORAȘULUI LUDUȘ
CASA DE CULTURĂ
„POMPEIU HĂRĂȘTEANU”



B-dul 1 Decembrie 1918, Nr. 26; Județul Mureș
Tel: 0265-411548, 0265-411716; 0265-412002; Fax: 0265-413402;
e-mail: ludus@cjmures.ro; web: www.ludus.ro

Nr. 36702/12.11.2015

APROB
PRIMAR
MOLDOVAN IOAN CRISTIAN

REFERAT

privind acordarea Titlului de Cetățean de Onoare al orașului Luduș domnului dr.

Ioan Lucian Prejbean

Având în vedere cererea înregistrată la noi sub nr. 36500 din 10.11.2015, precum și Raportul Comisiilor de specialitate ale Consiliului local Luduș, anexate alăturat,

În conformitate cu prevederile Regulamentului propriu pentru conferirea Titlului de „Cetățean de Onoare” și al altor titluri și distincții unor personalități cu merite deosebite, aprobat prin Hotărârea Consiliului local Luduș nr. 87/2007,

În temeiul art. 36 (8) din Legea nr. 215/2001, privind administrația publică locală, republicată, conform căruia: „*Consiliul local poate conferi persoanelor fizice române sau străine cu merite deosebite titlul de cetățean de onoare al comunei, orașului sau municipiului, în baza unui regulament propriu. Prin acest regulament se stabilesc și condițiile retragerii titlului conferit.*”,

Ținând cont de cele de mai sus propunem Consiliului local Luduș, spre dezbatere și aprobare, proiectul de hotărâre întocmit în acest sens.

Director
Dorin Grama



ORAȘUL LUDUȘ		
INTRARE Nr.	36500	
Ziua.....	10	luna..... 11
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CĂTRE CONSILIUL LOCAL LUDUȘ

Subsemnatul, Gheborean Mircea, profesor pensionar, istoric și cronicar al orașului Luduș, vă propun să-i acordați Titlul de Cetățean de Onoare al orașului Luduș domnului PREJBEANU IOAN LUCIAN, actualmente director adjunct al Institutului de Cercetări Nanotehnologice și Spintropice, director general al laboratorului comun Spintec- Crocus, al Comisariatului de Energie Atomică din orașul Grenoble, Franța, ludușean prin locul nașterii, prin anii copilăriei și ai tinereții, prin legăturile de suflet pe care le menține cu părinții săi și cu foștii săi concitadini.

În sprijinul propunerii mele aduc următoarele argumente:

- Ioan Lucian Prejbeanu s-a născut la Luduș în data de 21 mai 1975, din părinții Ioan-Petre și Lucia Prejbeanu;
- A fost elev al Școlii Generale Nr. 2 și al Grupului Școlar Industrial Luduș, clasându-se, din clasa I până în clasa a XII-a, pe locul I;
- A participat, sub îndrumarea profesorului Ioan Pop, la fazele județene și naționale ale Olimpiadei de Fizică;
- A absolvit, în anul 1997, Facultatea de fizică a Universității Babeș-Bolyai din Cluj-Napoca, clasându-se în fiecare an în top 5 al facultății;
- După 2 semestre de studii aprofundate a obținut Diploma de Specializare în Fizica Corpului Solid, diplomă echivalentă cu stadiul de masterat universitar;
- În anii 1997-1998 a funcționat ca cercetător al Institutului de Tehnologii Izotopice și Moleculare din Cluj-Napoca;
- În anul 2003 a obținut titlul de doctor al Universității „Louis Pasteur”, din Strasbourg, Franța;
- Între anii 2002 și 2006 a fost încadrat ca cercetător în cadrul laboratorului Spintec, din Grenoble, Franța, timp în care a elaborat brevete de invenție

- prin care a demonstrat existența memoriei magnetice asistate termic, cu aplicații în domeniul memoriilor non-volatile (computere și smartphonuri);
- Este creatorul unui start-up pe memorii magnetice MRAM, dezvoltând astfel cea mai mare investiție (de 80 de milioane de euro) în nanotehnologii din regiunea Rhone – Alpes, din Franța ultimilor 20 de ani;
 - Între anii 2006 și 2013 a fost director R&D Crocus Technology și al unei filiale Crocus Nano-Electronics din Rusia;
 - Este cunoscut în lumea academică internațională prin cele 39 de brevete de invenție și prin cele 65 de lucrări științifice, unele dintre ele susținute în timpul conferințelor internaționale care au avut loc în SUA, Japonia, Taiwan, în Arabia Saudită și în state ale Uniunii Europene;
 - Pentru întreaga activitate de cercetare a primit, în 2012 premiul Brillouin al Societății Franceze de Electronică și Electrotehnică (SSE) al Institutului Internațional al inginerilor în electrică și electronică;
 - Din 2013 și până în prezent coordonează activitatea a peste 68 de cercetători științifici ai laboratoarelor Spintec și Crocus, de în Grenoble-Franța.

Anexez documente care atestă veridicitate celor afirmate mai sus.

Luduș, 10 noiembrie 2015

Mircea Gheborean
Strada Crinului 20B
Telefon: 0728.072.836



1. informații generale

Ioan Lucian Prejbeanu



- *40 ani*

- *casatorit cu Liliana Buda-Prejbeanu, conferentiar Institutul Politehnic Grenoble Franta*

- *2 copii: Vlad si Elisa*



Cateva repere ale carierei (in ordine cronologica):

- Premiul I din clasa I in clasa a XII-a (Scoala Gen nr 2 si Grupul Scolar Industrial Ludus)
- Clasat primul la toate treptele de admitere (treapta I, treapta II, bacalaureat)
- Premiul III la faza judeteana a Olimpiadei de Fizica in clasa a VIII-a (profesor Pop Ioan)
- Mentione la faza nationala a Olimpiadei de Fizica in clasa a XI-a (profesor Pop Ioan)
- Licenta Facultatea de Fizica / Universitatea Babes Bolyai din Cluj – 1997 (in top 5 al facultatii in fiecare an)
- Masterat Facultatea de Fizica / Universitatea Babes Bolyai din Cluj / Institutul National Politehnic din Grenoble – 1998
- Cercetator Institutul de Tehnologii Izotopice si Moleculare din Cluj-Napoca (1997-1998)
- Doctorat la Universitatea Louis Pasteur din Strasbourg (2001) si Institutul de Fizica si Chimie a Materialelor din Strasbourg
- Cercetator la laboratorul SPINTEC din Grenoble (2002-2006) – brevete de inventie si demonstrarea prototipului unei memorii magnetice asistate termic, cu aplicatii in domeniul memoriilor non-volatile (computere, smartphonuri)
- Creator al unui start-up pe memorii magnetice MRAM (Crocus Technology) – dezvoltarea memoriilor magnetice asistate termic, cu aplicatii in domeniul memoriilor non-volatile (computere, smartphonuri) cea mai mare investitie intr-un start-up in nanotehnologii in regiunea Rhone-Alpes in Franta in ultimii 20 de ani – peste 80 milioane € www.crocus-technology.com
- Director R&D Crocus Technology (2006-2013) – parteneriat strategic Crocus / IBM, lansarea unei filiale in Rusia Crocus Nano-Electronics, finantata de agentia rusa de nanotehnologii Rusnano
- Premiul Brillouin al societatii franceze de electronica si Electrotehnica (SEE) si al Institutului International al inginerilor in electrica si electronica (2012)
- Director adjunct SPINTEC (2013-prezent) – circa 100 angajati www.spintec.fr
- Director al laboratorului comun Spintec / Crocus (2013-prezent)
- Habilitation de Diriger les Recherches (septembrie 2015)
- Director SPINTEC (de la 1 ianuarie 2016)
- Propus pentru premiul Yves Rocard al Societatii Franceze de Fizica pe anul 2015

Director laborator SPINTEC (www.spintec.fr) /
 Comisariatul de Energie Atomica (www.cea.fr) / Grenoble / Franta (circa 100 de cercetatori)



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LATEST NEWS

Prix « Adrien Constantin de Magny » de l'Académie des Sciences pour Bernard Diery
 Bernard Diery a reçu lors d'une cérémonie annuelle de remise de prix de l'Académie des Sciences le prix « Adrien Constantin de Magny ». La cérémonie s'est déroulée le 13 octobre sous la Coupole de l'Institut de France. Ce prix biennal récompense « un savant dont les travaux pratiques auront paru remarquables à l'Académie ». Toutes nos félicitations à Bernard [...]

Master and PhD Thesis Projects for 2016
 With the objective to train tomorrow's researchers in an active and growing research field, SPINTEC proposes every year several (six) Master projects. The majority of the Master projects will lead over to a PhD thesis.

CALENDAR

novembre 2015

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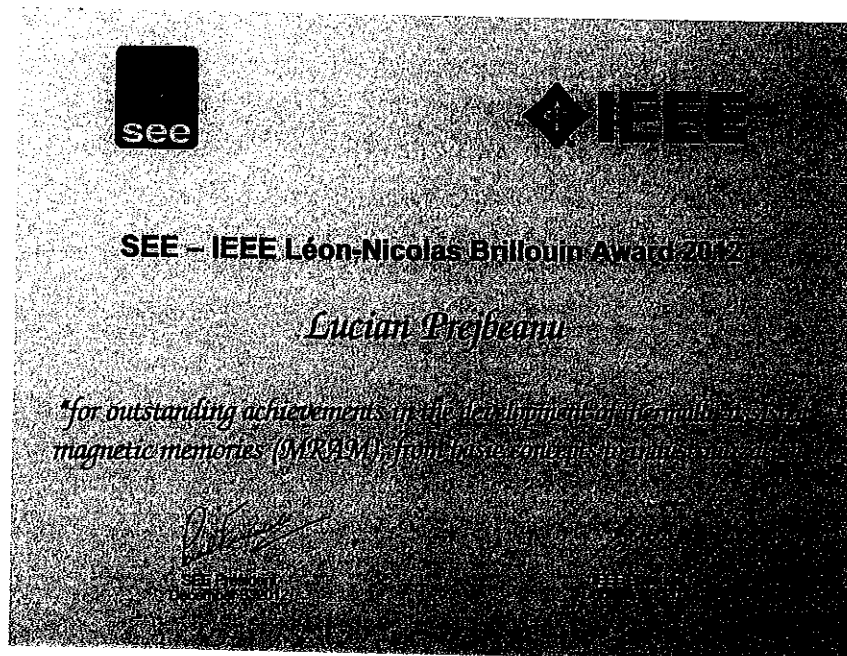
EVENTS

Co-fondator a unui start-up pe memorii magnetice si senzori magnetici (Crocus Technology)
www.crocus-technology.com, aproximativ 60 angajati in prezent

The screenshot shows a website with a dark background and white text. At the top, there is a navigation menu with links: Home, Products & services, Applications, The solution, About Crocus, and Contact. The main heading reads 'Discover Our Sensor Solutions FOR Power Distribution Unit'. Below this, there are five application categories with corresponding images: Industrial, Consumer electronics, Automotive, Solutions for Energy & Transport, and Embedded systems. On the right side, there is a section titled 'Find your product' with a list of product types: Magnetic sensors for current sensing, Magnetic sensors for position sensing, Magnetic field sensors, speed sensors, and Embedded memory.

Expert mondial in nanotehnologii, nanomagnetism, spintronica si memorii magnetice MRAM

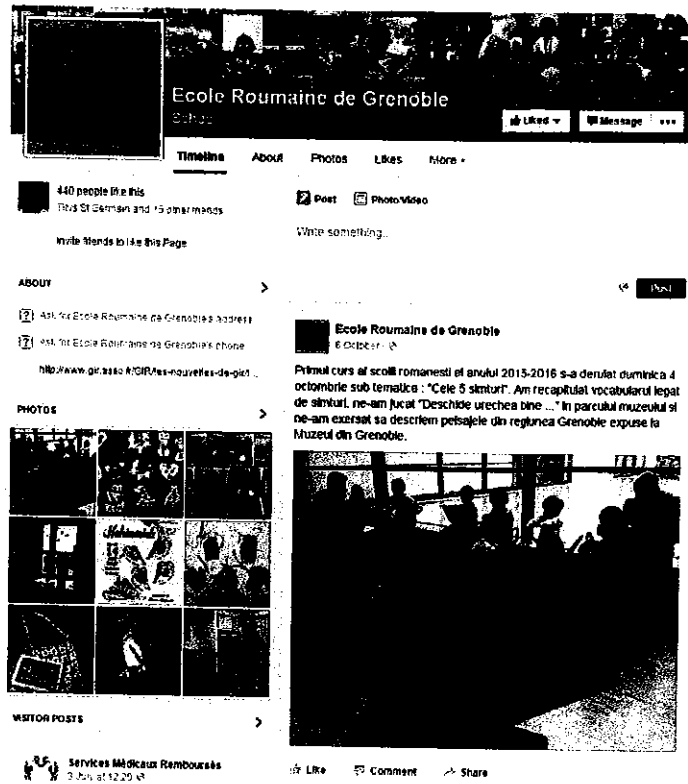
Premiul Brillouin al societatii franceze de electronica si electrotehnica SEE si al IEEE in 2012



<https://www.linkedin.com/pub/lucian-prejbeanu/26/8b8/a26>

- **Autor a 68 de lucrari in reviste internationale de prestigiu si a 39 brevete de inventie (h-index 17)**
- Numeroase conferinte invitate in SUA, Japonia, Taiwan, Arabia Saudita, Europa
- Coordinator a numeroase proiecte de cercetare finantate de Agentia Nationala de Cercetare din Franta si de Uniunea Europeana, a numeroase proiecte industriale

Vicepresedinte si membru fondator al asociatiei "Scoala Romaneasca din Grenoble" (din 2012)

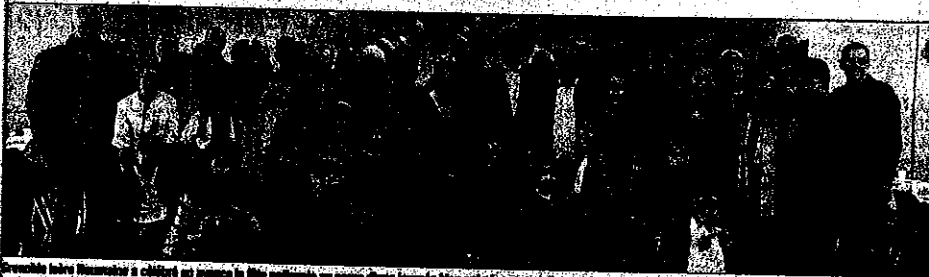


Vicepresedinte si membru fondator al Parohiei Romanesti din Grenoble (din 2002)
<http://toussaints.free.fr>



Membru al consiliului de administratie al asociatiei Grenoble-Isère-Roumanie (membra Operation Villages Roumains) din 2002

Grenoble Isère Roumanie à la fête



Grenoble Isère Roumanie a celebrat cu bucurie la fine restaurant un curs de trei zile bine amenajat, plin de mâncare, cântec și dansuri.

Grenoble Isère Roumanie (GIR) a fost, ce sâmbătă, cu un pic înainte, la fete nationale, la ferma Heurard, în prezența domnului de Seyssins, Fabrice Hugé. Asociația, care există de peste 20 ani, reunește în deosebit din comunitate cu deosebit din jumătate cu deosebit

comunitate românești. A la suite de la chute du régime totalitaire, une "opération villages roumains" a été créée, permettant des échanges humains et voyant des conseils humanitaires. Quatre-vingt-onze fédérations se sont associées pour donner le GIR et ses relations amicales, culturelles et

logistiques. La commune a ainsi un partenariat avec la ville de Bavi depuis 2007, avec comme objectif l'aide dans l'apprentissage du français par l'intermédiaire de la bibliothèque et des écoles. En janvier, une dizaine d'enfants seront accueillis dans des familles de 4^e du collège et parti-

ticiperont à la Fête blanche.

Une école a été créée par le GIR (11 enfants de 4 à 8 ans) et propose, 2 h tous les deux samedis, des cours de parole, traditions, culture et coutumes.

La structure a profité de cette journée pour présenter peintures, céramiques, figurines

avec motifs traditionnels, costumes et masques, et entraîner les autres enfants dans des danses, comptines, chansons avec instruments musicaux roumains, l'atelier "jeux d'autrefois".

Un repas traditionnel inspiré de la cuisine roumaine a été servi.

LD 2006118

Vizita teatrului Nottara din Bucuresti la Grenoble



2. date administrative: foto, copii pașapoarte





ROUMANIE

ROMANIA

ROMANIA

CERTIFICAT DE NAȘTERE

CERTIFICAT DE NAISSANCE / BIRTH CERTIFICATE

Seria NL Nr. 265284
Série/Series No./Nmb.

DATE PRIVIND COPILUL

Dates concernant l'enfant
Data concerning the child

Cod Numeric Personal

1750517260021

Code personnel/Personal number

S A A L L Z Z N N N N C

Numele de familie Nom/Surname		PREȚBEANU			
Prenumele Prénom/First name		IOAN - LUCIAN			
Sexul Sexe/Sex	BĂIEȚEȘ	Data nașterii Date de naissance/Date of birth	Anul /Année/Year	Luna /Mois/Month	Ziua /Jour/Day
		1975	Mai	17	
Locul nașterii Lieu de naissance/ Place of birth		Localitatea /Localité/Place		Județul /Département/County	
		LUDUȘ		MUREȘ	

DATE PRIVIND PĂRINȚII / Dates concernant les parents / Data concerning the parents

TATĂL Père/Father	Numele de familie Nom/Surname	PREȚBEANU
	Prenumele Prénom/First name	ION-PETRE
MAMA Mère/Mother	Numele de familie Nom/Surname	PREȚBEANU
	Prenumele Prénom/First name	LUCIA

Act de naștere nr.
Acte de naissance no /
Birth document nmb.

403

din
de/from

21 Mai 1975

(ziua, luna, anul / jour, mois, année / day, month, year)

înregistrat la
enregistré à/
registered at

LUDUȘ

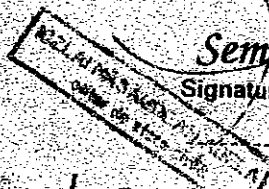
(Localitatea/Ambasada/Consulatul)
(Localité/Ambassade/Consulat / Place/Embassy/Consulate)

MUREȘ

(Județul / Département / County)

Mențiuni

Mentions/Mentions



Semnătură

Signature/Signature

Eliberat de

PRIMĂRIA

LUDUȘ

LUDUȘ

Delivré par/Issued by

Data

2003/05/03

Date/Date

A A A L L Z Z

CURRICULUM VITÆ

Lucian PREJBEANUDeputy Director
SPINTEC

UMR8191 CEA/DSM/INAC-CNRS-UJF-G-INP

Expert spin electronics / fundamentals & devices / nanomagnetism,**SHORT BIO**

I have been conducting research on nanomagnetism and spintronics for more than 15 years. I hold a Physics degree from Babes Bolyai University in Cluj (Romania) and a PhD in Physics from Louis Pasteur University in Strasbourg where he pioneered the work on magnetic nanostructures.

After my PhD, I have joined SPINTEC research laboratory in Grenoble, where I pioneered scientific work on thermally assisted MRAM, tackling the key long-standing problem of bits stable enough for long-term storage, yet still easy to write with small magnetic fields. With my co-workers at SPINTEC, we took advantage of the temperature dependence of the magnetic properties to resolve this fundamental conflict: at operating temperature the bits would be stable, and at high temperature they would be easy to write. We pioneered experimental work in this field, establishing the basics scientific concepts and providing the first experimental proof that the thermally-assisted scheme worked. This work was reported in the well-cited paper, 'Thermally assisted switching in exchange-biased storage layer magnetic tunnel junctions'. Based on this proof-of-principle of the scientific concepts, a start-up company was founded to develop and commercialize thermally assisted MRAM technology. Crocus was founded in Grenoble in 2006, and I was hired as the Research and Development Manager. In this capacity I led the research and development of this new technology, going beyond the scientific work he had done earlier in his career to now focus on solving the fundamental engineering challenges in order to make MRAM a viable product. The early success he achieved in this regard was reported in 'Thermally assisted MRAM'. These two publications established both the basic science and technology of thermally assisted MRAM, and are by far the most highly cited publications in this field, with a total of more than 140 citations so far. The success achieved at this stage was enough to secure several rounds of venture capital funding for Crocus, which enabled it to grow into the successful company it is today, culminating in a \$300 million financing deal in 2011 with RUSNANO to build an advanced MRAM manufacturing facility in Russia. For the work on TAS-MRAM and its successful transfer to Crocus, I have received in 2012 the SEE-IEEE Nicolas Brillouin award.

In 2013, I have returned to Spintec as deputy director, working on sub-20nm scalable MRAMs, hybrid logical circuits and magnetic sensors.

Professional experience

✦ **February 2013 – Present: Deputy Director, CEA/DSM/INAC/SPINTEC**

- ⇒ Daily management of the laboratory (HR, finances, HCERES evaluation)
- ⇒ Management of the sensors team
- ⇒ Management of the R&D Crocus – Spintec research program (MRAMs & magnetic sensors)
- ⇒ Setup and managed several R&D projects: ANR Excalyb, joint spintronic line SPINTEC / LETI
- ⇒ Engineering of high sensitivity 3D magnetic sensors
- ⇒ Engineering of magnetic tunnel junctions for industrial MRAMs and MLU (magnetic logic unit) - Led material development for advanced MRAM – thermally assisted with field or spin polarized current writing, self-reference concept for magnetic logic unit applications




✦ **August 2006 – January 2013: R&D Manager, Crocus Technology**

Management and expertise of magnetic materials for thermally assisted or STT-MRAMs


- ⇒ Engineering of magnetic tunnel junctions for industrial MRAMs and MLU (magnetic logic unit) - Led material development for advanced MRAM – thermally assisted with field or spin polarized current writing, self-reference concept for magnetic logic unit applications
- ⇒ Management of the R&D Crocus – Spintec research program
- ⇒ Management of the installation of a back-end magnetic processing line 200mm: deposition / magnetic anneal / characterization
- ⇒ Established the initial company wafer level test-chip design
- ⇒ Participated in company's early stage of strategic business development & planning
- ⇒ Built up intelligent monitoring scheme to diagnosis wafer processing defects at early stages, enabling high yields for product environment
- ⇒ Setup and managed several R&D projects: TIMI, R&D Crocus – INESC, ANR RAMAC, CRYSTO, CILOMAG, SPIN, PATHOS
- ⇒ Demonstrated the TA-STT concept
- ⇒ Demonstrated the self-reference cell writing adapted for logic applications and improved performances MRAM




- ✦ **December 2004 – July 2006 : CEA/INAC engineer, SPINTEC, Grenoble**
MRAM technology advisor for the fund raising and the creation of Crocus Technology
Magnetic logic : based on extraordinary Hall effect & using domain wall movement in magnetic structures with perpendicular magnetization
Magnetic storage : STT based writing based from a near field nanometric tip

 - ⇒ expert OMNT in nanomagnetism & spin electronics
 - ⇒ editor of a special edition of J. Phys. C : Cond. Mat, dedicated to the spintronics
 - ⇒ Setup an EU RTN project: SPINSWITCH


- ✦ **April 2003 – November 2004 : Postdoc CEA/INAC, SPINTEC, Grenoble**
Thermally assisted MRAMs: first demonstration of the thermally assisted MRAMs with an exchange biased storage layer

 - ⇒ Design and engineering of magnetic tunnel junctions, characterisation, optimisation of structural, electrical & magnetic properties
 - ⇒ Management of a R&D contract with CYPRESS SEMICONDUCTEUR
 - ⇒ Management of the ANR contract ECRIN (thermally inhibited memories with ferrimagnetic storage layers)


- ✦ **March 2002 – March 2003 : Postdoc CNRS, Louis Néel laboratory & SPINTEC Grenoble**
Magnetic storage: patterned media and writing by heating the dots by a near field nanometric AFM tip

 - ⇒ Conception and development of the experimental setup : injection of spin polarized current
 - ⇒ Fabrication of submicronic dots by e-beam and UV lithography and dry etching
 - ⇒ Macroscopic magnetic characterization (Kerr, VSM), magnetic microscopy (MFM)


- ✦ **November 1998 – February 2002 : PhD**
IPCMS (Institut de Physique et Chimie des Matériaux de Strasbourg)
Nanomagnetism, spin electronics: domain wall magnetoresistance in nanowires & effect of dipolar interactions on the reversal of the magnetization

 - ⇒ Fabrication of nano-objects by e-beam lithography
 - ⇒ Magnetotransport measurements magnetic microscopy MFM, micromagnetic simulations;
 - ⇒ Local coordinator of the european contract MAGNOISE


- ✦ **October 1997 – November 1998 : R&D engineer**
INCDTIM (National institut for research & development of the isotopic and molecular technologies, Cluj-Napoca, Romania)
Molecular Physics : multi-fotonic dissociation of molecules in laser radiation field






- ✦ **March 1997 – July 1997 : Master of Science**
LMGP (Laboratoire de Matériaux et de Génie Physique) - INPG Grenoble
Refractory materials : low temperature preparation of ultra-refractory nanocompounds

 - ⇒ Structural characterization : X-ray & electronic microscopy

- ✦ **March 1996 – June 1996: Bachelor of Science**
Institut de recherche en physique de l'Université Babes Bolyai, Cluj Napoca, Roumanie
NdFeB permanent magnets : preparation & magnetic caracterisation



Education

- ✦ **2001 : PhD in physics – condensed matter & materials**
 Louis Pasteur University & Institut de Physique et Chimie des Matériaux de Strasbourg
 - ✦ **1998 : Master of Science - condensed matter & materials**
 Babes-Bolyai University, Cluj-Napoca, Romania & INPG Grenoble
 - ✦ **1997 : Bachelor in physics - condensed matter & materials**
 Babes-Bolyai University, Cluj-Napoca, Romania
- 
- 
- 

Publications & patents

- ✦ Published over 65 papers in scientific journals & chapters in scientific books (Springer Verlag, NATO Science Series) - H-index : 17
- ✦ Holds 38 patents filed, at different stages (granted, published, provisional pending)

Scientific reputation

- ✦ **Member of the organizing committee of several conferences and summer schools**
 - ⇒ Mesomagnetism spin dynamics and spin electronics, 11-17 september 1999, Rhodes, Greece
 - ⇒ From Nanoscopic to mesoscopic magnetic systems, 28-31 august 2000, Spetses, Greece
 - ⇒ « Magnétisme des systèmes nanoscopiques et structures hybrides », 1-10 september 2003, Brasov, Romania

- ⇒ French-American symposium on spin electronics, May 2006, St. Pierre en Chartreuse
- ✦ **Expert OMNT in nanomagnetism and spin electronics**
- ✦ **Reviewer for several scientific journals (APL, IEEE Trans Magn, JMMM, JAP)**
- ✦ **Editor of a special edition of J. Phys. C : Cond. Mat, dedicated to the spintronics**

Skills

- ⇒ Extensive experiences in engineering of materials, interfaces: deposition of thin films & multilayers : sputtering, molecular beam epitaxy, thermal treatments, vacuum techniques
- ⇒ Deep physics understanding / knowledge of critical antiferromagnetic materials, crystalline structure, annealing and processing
- ⇒ Pioneered in spin-transfer material exploration, MRAM switching
- ⇒ Nanofabrication : e-beam & UV lithography, nanoimprint, IBE etching
- ⇒ Physical characterisation : AGFM, VSM, SQUID, Kerr, magnetotransport, X-ray diffraction, SEM, TEM, AFM, conducting AFM, TUNA, MFM
- ⇒ Languages: French (fluent), English (fluent), Italian (basics), Russian (basics), Romanian (native)

Major scientific publications

1. **MRAM: status and roadmap**
I.L. Prejbeanu & B. Dieny
J. Phys D: Applied Physics (2014),
2. **Heating asymmetry induced by tunneling current flow in magnetic tunnel junctions**
E. Gapihan, J. Héroult, R. C. Sousa, Y. Dahmane, B. Dieny, L. Vila, I. L. Prejbeanu, C. Ducruet, C. Portemont, K. Mackay, and J. P. Nozières
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1. **Yann Conraux (co-supervising 75%) – R&D engineer Crocus Technology**
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Directeur de thèse : Jean-Pierre Nozières
2. **Marta Kerekes (co-supervising 25%) – passed away**

Développement de nouvelles méthodes d'étude du comportement dynamique des systèmes de type vanne de spin à très hautes fréquences

Université Joseph-Fourier, Grenoble, 2006 – not defended, student died before defense

Directrice de thèse : Ursula Ebels

3. **Lucien Lombard (co-supervising 33%) - R&D engineer Crocus Technology**

Etude et extension de la gamme de température de fonctionnement des Mémoires Magnétiques à Accès Aléatoire Assistées Thermiquement

Université Joseph-Fourier, Grenoble, Dec. 1 2010

Directeur de thèse : Alain Schuhl

4. **Erwan Gapihan (co-supervising 25%) - R&D engineer Crocus Technology**

Mémoire magnétique à écriture assistée thermiquement à base de FeMn

Université Joseph-Fourier, Grenoble, Jan. 11 2011

Directeur de thèse : Bernard Dieny

5. **Jérémy Herault (co-supervising 33%) - R&D engineer Crocus Technology**

Mémoire magnétique à écriture par courant polarisé en spin assistée thermiquement

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6. **Maria Souza (co-supervising 25%) – Professor Brasil**

Commutation précessionnelle de mémoire magnétique MRAM avec polariseur à anisotropie perpendiculaire

Université Joseph-Fourier, Grenoble, Sep. 27 2011

Directrice de thèse : Ursula Ebels

7. **Sebastien Bandiera (co-supervising 33%) - R&D engineer Crocus Technology**

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Directeur de thèse : Bernard Dieny

8. **Giovanni Vinai (co-supervising 75%) – postdoc Trieste**

Scalabilité et amélioration des propriétés d'échange des TA-MRAM

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Directeur de thèse : Jean-Pierre Nozières

9. **Kamil Akmalidinov (co-supervising 25%) –**

Ferromagnetic/antiferromagnetic exchange bias nanostructures for ultimate spintronic devices

Université Joseph-Fourier, Grenoble, February, 06, 2015

Directeur de these: Bernard Dieny

10. **Quentin Stainer (co-supervising 25%) - R&D engineer Crocus Technology**

Development of self-referenced thermally assisted magnetic random access memory cells (MRAM)

Université Joseph-Fourier, Grenoble, defended December 19, 2014

Directeur de these: Bernard Dieny

11. **Antoine Chavent (co-supervising 33%) – PhD ongoing**

Bipolar TAS

Université Joseph-Fourier, Grenoble, to be defended 2015

Directeur de these: Bernard Dieny

12. **Myckael Mouchel (co-supervising 50%) – PhD ongoing**

Noise in MLU magnetic sensors

Université Joseph-Fourier, Grenoble, to be defended 2016

Directeur de these: Claire Baraduc

LIST OF PUBLICATIONS

Ioan - Lucian Prejbeanu

69 articles & review chapters (H-Index 17)

39 patents

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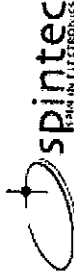
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Development of thermally assisted MRAMs: from basic concepts

présentée par

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Influence of cooling rate in planar thermally assisted magnetic random memory: Improved writeability due to spin-transfer-torque influence

A. Craven, C. Duenet, C. Portemont, C. Creuzet, L. Vila, J. Alvarez-Héaut, R. C. Sousa, B. Dieny

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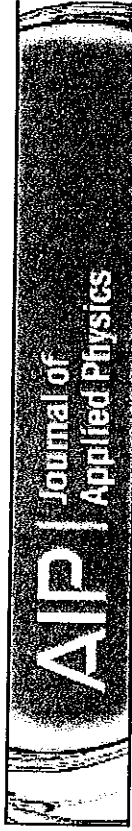
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Perpendicular magnetic tunnel junctions with double barrier and single or synthetic antiferromagnetic storage layer

Léa Cuchet, Bernard Rodmacq, Stéphane Auffret, Ricardo C. Sousa, Ioan L. Prejbeanu, and Bern

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Modulating spin transfer torque switching dynamics with two orthogonal spin by varying the cell aspect ratio

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We study in-plane magnetic tunnel junctions with additional perpendicular polarizer for subnanosecond current-induced switching memories. The spin-transfer-torque switching dynamics was studied as a function of the cell aspect ratio both experimentally and by numerical simulations using the macrospin model. It is shown that the anisotropy field plays a significant role in the dynamics, along with the relative amplitude of spin-torque contributions. This was confirmed by micro-magnetic simulations. Real-time measurement of the magnetization reversal were performed with samples of low and high aspect ratio. For low aspect ratios, a precession reversal was observed with samples of low and high aspect ratio. For high aspect ratios, a precession reversal was observed with samples of low and high aspect ratio. For low aspect ratios, a precession reversal was observed with samples of low and high aspect ratio. For high aspect ratios, a precession reversal was observed with samples of low and high aspect ratio.

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Spin transfer torque (STT) magnetic random-access memory (MRAM) are very promising nonvolatile memories envisioned to provide devices of smaller sizes and faster dynamics. A conventional STT-MRAM consists of a reference layer, whose magnetization is fixed either in-plane or out-of-plane, separated by an MgO barrier from the storage layer (SL), whose magnetization is free. The SL magnetization has two stable configurations, parallel (P) and antiparallel (AP) to the reference layer. To write the memory cell, a voltage pulse is applied to the magnetic tunnel junction (MTJ) that can reverse the SL magnetization, thanks to the STT of the polarized current due to the reference layer. However the STT is proportional to the vectorial product of the reference-layer magnetization and the SL magnetization, so that, in the equilibrium configuration (P or AP), the STT vanishes. The reversal of the MTJ is only possible thanks to thermal fluctuations that misalign the two layer magnetizations, resulting in a stochastic switching dynamics in conventional STT-MRAM. In fact, even if the switching itself lasts less than a nanosecond, the switching occurs after a random incubation time. This is detrimental to the switching time, as it is difficult to switch an MTJ with a bit error rate lower than 10^{-4} in less than 10 ns [1,2], which is necessary for application as a fast RAM.

In order to eliminate the incubation time, it was proposed to add another polarizing layer with a magnetization fixed and orthogonal to the equilibrium directions of the SL magnetization in order to maximize the STT action on the SL

whose magnetization is out-of-plane. SL by a nonmagnetic spacer. Although observed that the presence of the PP or the magnetization dynamics with two not completely understood, especially of the two polarizers. Here we propose confirmed experimentally, to describe precessional motion of the SL magnetization with two polarizers, due to a change in netization is submitted to two STT contributions different effects on the SL magnetization. This analysis can be applied to the macrospin equation is similar [9], or if saturation magnetization of the SL, M_{sat} , perpendicular anisotropy, for instance, the Gilbert damping constant, and the STT efficiency of the reference respectively.

On the one hand, the STT contribution to the SL magnetization out-of-plane [Fig. 1(a)] around the out-of-plane axis at a higher free-layer magnetization is in out-of-plane

Effects of the Heating Current Polarity on the Write Thermally Assisted Switching-MRAM

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In thermally assisted switching-magnetic random access memory (TAS-MRAM), a storage layer is pinned by an antiferromagnet, and is unpinning during writing because of a heating pulse of current injected through the junction. The current densities at which spin-transfer torque (STT) assisted switching occurs are of the order of magnitude of the current densities at which spin-transfer torque (TAS-MRAM) statistical writing tests were performed on 1-kb test devices. The phase diagrams with the pinning regions were obtained. A reduction of the writing field in the unpinning region was evidenced by changing the asymmetrical with respect to the direction of writing. This is consistent with STT influence. The order of magnetization reversal with previous work on writing field dependence with the current and compares well with the Néel-Brown-modified model to consider the STT effect. The writing field can be reduced by 15% by the current direction for a current density of 2 MA/cm².

Index Terms—Spin-transfer torque, thermally assisted magnetic random access memory (MRAM), configurations. To use advantageously the driven magnetization reversal, a writing scheme proposed [4] to combine the field direction and the spin-transfer torque, such that STT assists the magnetization reversal, and the same final magnetization configuration, as a result. Depending on the heating current direction, the STT effect associated with the help or hinder the switching of the storage layer.

I. INTRODUCTION

THERMAL assistance has been proposed in field-induced written magnetic tunnel junctions (MTJ) to enhance the reliability and the scalability of magnetic random access memory (MRAM) [1], [2]. In thermally assisted switching-MRAM (TAS-MRAM), the write selectivity is achieved by a combination of heating produced by the tunneling current flowing through the cell and of a magnetic field. Besides, TAS-MRAM with a soft reference allows introducing new functionalities such as the Match in Place particularly promising for security and router applications [3]. In the standard MTJ cell of TAS-MRAM, both the reference layer and the storage layer are pinned by antiferromagnetic (AF) layers of different blocking temperature (T_b). Generally, PtMn is used to pin the reference layer ($T_b \sim 350$ °C) and Fe(r)Mn is used for the storage layer ($T_b \sim 150$ °C-220 °C). Heating the junction above the write temperature is achieved directly by the tunnel current flowing through the CoFeB/MgO/CoFeB junction, the power dissipated in the junction resulting in a corresponding temperature increase. The write selectivity based on the combination of field and heating offers a number of advantages: 1) perfect write selectivity based on transistor selection; 2) lower write fields compared with toggle MRAM; and 3) reduced power consumption thanks to the possibility of field sharing between all bits of a given word. Typical current density required for heating are in the range of 10⁶ A/cm², which are in the range where spin-transfer torque (STT) effects can be observed in a standard MTJ cell [1].

II. METHOD

In this paper, we investigated statistical heating current polarity on the write field of TAS-MRAM cells connected to bipolar STT. The magnetic tunnel junction stack has a reference layer, a MgO tunnel barrier and a CoFeB exchange-biased storage layer. The CoFeB thickness is 3 nm and its saturation magnetization is 1.2 MA/cm.

The 2014 Magnetism Roadmap

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Andrii V Chumak⁵, Yoshichika Otani^{6,7}, Gerrit E W Bauer^{8,9},
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Abstract

Magnetism is a very fascinating and dynamic field. Especially in the last 30 years, there

Focused Kerr measurements on patterned arrays of exchange square dots

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Abstract. Microstructural effects on the antiferromagnetic layer were investigated on *h* biased square dots. IrMn grain size and distributions were tuned by changing Co buffer thicknesses. Lateral dimensions from 200 to 50nm were varied. Exchange bias (H_{ex}) varied through focussed Kerr measurements on small groups of dots. Patterned samples presented bias values following the trends and values of full sheet samples. Concerning the dot to dot resulted that IrMn microstructure variations have minor effects on H_{ex} variability, because no observed as a function of grain size and distribution. The variability is attributed to geometric intrinsic variability.

1 Introduction

For more than twenty years, the interfacial exchange coupling between a ferromagnetic (F) and an antiferromagnetic (AF) layer, known as exchange bias [1], has been exploited in various technological applications like spin valves [2] or Magnetic Random Access Memories (MRAM) [3].

Among the possible technologies for MRAM systems, Thermally Assisted MRAM (TA-MRAM) exploits exchange bias in both reference and storage layer [4]. In order to guarantee reproducibility and reliability, the variability of exchange bias properties from one memory point to another has to be minimized.

In this article, a microstructural study of the IrMn grain size distribution is presented for different buffer layer conditions and IrMn thicknesses through Atomic Force Microscopy (AFM) measurements. Samples were then patterned on square dots of different lateral sizes to analyse the effects of scalability and IrMn grain populations. It resulted that the effects of IrMn grain microstructure are secondary because covered by the intrinsic variability of the Co layer.

AF layer is important on sputter observed [5, 6] that on polyc exchange bias intensity is proper uncompensated AF spins at compensated AF spin structure is is the case of IrMn [7]), uncon mainly at the grain boundaries. δ is inversely proportional to the influence of the AF grain dimension in combination with the thermal s which directly depends on its volume.

In IrMn polycrystalline thin the AF thickness causes an enhanced lateral size and a broadening it is also possible to tailor AF changing the sputtering rate [10] [11], the annealing temperature [layer [12-15]. In this study, IrM thicknesses were varied, without parameters.

Concerning the grain micro techniques are possible, including diffraction measurements [12, 15] Microscopy grid scans [11] and δ

Thermally assisted MRAMs: ultimate scalability and logic functionalities

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Abstract

This paper is focused on thermally assisted magnetic random access memories (TA-MRAMs). It explains how the heating produced by Joule dissipation around the tunnel barrier of magnetic tunnel junctions (MTJs) can be used advantageously to assist writing in MRAMs. The main idea is to apply a heating pulse to the junction simultaneously with a magnetic field (field-induced thermally assisted (TA) switching). Since the heating current also provides a spin-transfer torque (current-induced TA switching), the magnetic field lines can be removed to increase the storage density of TA-MRAMs. Ultimately, thermally induced anisotropy reorientation (TIAR)-assisted spin-transfer torque switching can be used in MTJs with perpendicular magnetic anisotropy to obtain ultimate downsize scalability with reduced power consumption. TA writing allows extending the downsize scalability of MRAMs as it does in hard disk drive technology, but it also allows introducing new functionalities particularly useful for security applications (Match-in-Place™ technology).

(Some figures may appear in colour only in the online journal)

1. Introduction

Spin electronics is a rapidly and continuously expanding area of research and development, which merges magnetism and electronics. It aims at taking advantage of the quantum characteristics of the electrons, i.e. its spin, to create new functionalities and new devices. Since the discovery of giant magnetoresistance in 1988, several breakthroughs have further boosted this field (spin-valves 1990, tunnel magnetoresistance (TMR) 1995 [1, 2], spin-transfer torque (STT) 1996 [3, 4], voltage-controlled magnetic properties 2004). Spintronics has found applications in hard disk drives (HDDs) (1988) and more recently in a new class of magnetic non-volatile memories (MRAM) for magnetic random access memory). MRAM technology combines a magnetoresistive device with

switch allowing the current to flow or in MTJ. MTJs consist of a stack of two ferromagnetic layers separated by a thin insulating layer, which is 1 and 2 nm thick. The interest for MRAMs after the first successful attempts in fabricating tunnel junctions using amorphous AlO_x lies between 20% and 50% were first observed in junctions [1, 2]. More recent studies using barriers have shown that it is possible to increase the magnetoresistive signal over 200% resistance at room temperature [5–7]. This large increase is due to the crystalline nature of the barrier, which results in a quasi-perfect spin-filtering of the tunneling electrons, leading to very large TMR. The resistance of the memory bit is either low

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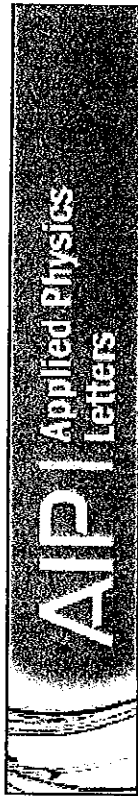
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Thermally assisted MRAMs: ultimate scalability and logic functionalities

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Abstract

This paper is focused on thermally assisted magnetic random access memories (TA-MRAMs). It explains how the heating produced by Joule dissipation around the tunnel barrier of magnetic tunnel junctions (MTJs) can be used advantageously to assist writing in MRAMs. The main idea is to apply a heating pulse to the junction simultaneously with a magnetic field (field-induced thermally assisted (TA) switching). Since the heating current also provides a spin-transfer torque (current-induced TA switching), the magnetic field lines can be removed to increase the storage density of TA-MRAMs. Ultimately, thermally induced anisotropy reorientation (TIAR)-assisted spin-transfer torque switching can be used in MTJs with perpendicular magnetic anisotropy to obtain ultimate downsize scalability with reduced power consumption. TA writing allows extending the downsize scalability of MRAMs as it does in hard disk drive technology, but it also allows introducing new functionalities particularly useful for security applications (Match-in-Place™ technology).

(Some figures may appear in colour only in the online journal)

1. Introduction

Spin electronics is a rapidly and continuously expanding area of research and development, which merges magnetism and electronics. It aims at taking advantage of the quantum characteristic of the electrons, i.e. its spin, to create new functionalities and new devices. Since the discovery of giant magnetoresistance in 1988, several breakthroughs have further boosted this field (spin-valves [990], tunnel magnetoresistance (TMR) 1995 [1, 2], spin-transfer torque (STT) 1996 [3, 4], voltage-controlled magnetic properties 2004). Spintronics has found applications in hard disk drives (HDDs) (1998) and more recently in a new class of magnetic non-volatile memories (MRAM for magnetic random access memory). MRAM technology combines a magnetoresistive device with

switch allowing the current to flow or not. MTJs consist of a stack of two ferromagnetic layers separated by a thin insulating layer, which is typically 1 and 2 nm thick. The interest for MRAMs after the first successful attempts in fabricating tunnel junctions using amorphous AlO_x barriers between 20% and 50% were first observed in junctions [1, 2]. More recent studies using high-quality barriers have shown that it is possible to obtain magnetoresistive signal over 200% resistivity at room temperature [5–7]. This large increase in magnetoresistance is due to the crystalline nature of the MTJ, which results in a quasi-perfect spin-filtering of the MTJ, leading to very large TMR. The resistance of the memory bit is either low



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