

Mohamed Akli BELKHIR  
University A. Mira of Bejaia  
*Theoretical Physics Laboratory*  
Physics Department  
Campus of Targa Ouzemour  
06000 Bejaia – Algeria –  
Mobile phone : +213 776084759  
E-mail : [muhend.belkhir@gmail.com](mailto:muhend.belkhir@gmail.com)



Born on 18th of April, 1959 in Algeria

## Curriculum Vitae

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### Education

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- 06 – 1979** : Baccalaureate C (speciality elementary mathematics) earned on completion of secondary school studies, Lycee Amirouche of Tizi-Ouzou (Algeria)
- 06 – 1984** : D.E.S. (Diploma of High Studies : 4 years after Baccalaureate) in solid state physics, University of Tizi-Ouzou (Algeria)
- 10 – 1985** : D.E.A. (Diploma of Advanced Studies) in Physical and Mechanical Engineering, University of Metz (France)
- 06 – 1988** : Doctorate in Physical and Mechanical Engineering, University of Metz (France)

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### Languages

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Arabic (can read, write, speak, understand spoken and peer review)  
English (can read, write, speak, understand spoken and peer review)  
French (can read, write, speak, understand spoken and peer review)  
Kabyle (mother tongue)

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## Employment

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- 09/1988 – 02/1989** : Assistant professor in physics, University of Bejaia (Algeria)  
**02/1989 – 01/1990** : military Service : School of reserve officers and national school of engineers and technicians of Algeria  
**02/1990 – 03/1996** : Assistant professor in physics, University of Bejaia (Algeria)  
**03/1996 – 07/2004** : Associate professor in physics, University of Bejaia (Algeria)  
**07/2004 – 09/2019** : Full professor in physics, University of Bejaia (Algeria)  
**10/2019 –** : Full professor in physics, University of Batna 2 (Algeria)

### Courses :

Undergraduate level : Newtonian mechanics, electricity, vibrations and waves, solid state physics, crystallography.

Graduate level : quantum theory of solids, group theory for solids, magnetic properties of solids, band theory of solids.

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## supervision of theses

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- 5 theses of magister  
5 theses of master  
10 PhD theses

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## Research stay

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- 1994** : Invited for 2 months as associate professor at University of Metz -France-  
**1999** : Post-doctoral fellowship of KOSEF foundation, “Chunbuk national University”, South Korea. Research program : electronic structures of threading dislocations in GaN.  
**2003-2016** : Short period trainings of 2 to 4 weeks in different countries : South Korea, France, Marocco, Canada.  
**2014-2017** : Short stays, University Humboldt of Berlin, Germany.  
**2018** : Stay of 3 months, University Humboldt of Berlin, Germany.

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## List of Research Publications

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h-index (**Hirsch index**) : 15, i10-index : 25.

Link to → *Google Scholar* database :

<https://scholar.google.com/citations?user=-JsvlFEAAAAJ&hl=en>

- 1- **M. Belkhir**, J. Hugel; Origin of the separation for the transition metal monoxides, Solid state communications, Vol. 70, p. 471, (1989).
- 2- J. Hugel, **M. Belkhir**; Nature of the NiO absorption edge within a spin polarized band scheme, Solid State Communications, Volume 73, Issue 2, January 1990, Pages 159-162. Plus de 5 citations dans SCOPUS.
- 3- J. Hugel, **M. Belkhir**; Calculated optical curve for the spin polarized MnO, Condensed matter, Z. PHYSIK B, Vol. 79, p. 57, (1990).
- 4- Seung Mi Lee, **Mohamed Akli Belkhir**, Xiao Yan Zhu, Young Hee Lee, Yong Gyo Hwang and Thomas Frauenheim; Electronic structures of GaN edge dislocations, Phys. Rev. B, Vol. 61, n° 23, p. 16033, (2000) → DOI : 10.1103/PhysRevB.61.16033.
- 5- **M. A. Belkhir**, W. Tazibt and N. Akroune; Fonctions d'ondes symétrisées pour le groupe d'espace dans la méthode des liaisons fortes. Application à NiO dans sa phase antiferromagnétique. Sciences & Technologie, Université de Constantine, n° 19, pp. 20-27, (2003).
- 6- S. Mahtout, **M. A. Belkhir** and M. Samah; Fabrication and characterization of semiconductor CuCl nanocrystals Acta Physica polonica A, Vol. 105, No. 3, p. 279 (2004)
- 7- M. Samah, S. Mahtout, M. Bouguerra, and **M. A. Belkhir**; CuCl nanocrystals in monocrystalline NaCl matrix Physica Scripta, Vol. 69, p. 351, (2004).
- 8- Madani Samah , Hocine Khelfane, Madjid Bouguerra, Abdelhamid Chergui, **Mohamed Akli Belkhir** and Sofiane Mahtout; Optical responses of alkali-halide matrix (NaCl)-doped silver Physica E, Vol. 23, Issues 1-2, p. 217 (2004)
- 9- S. Mahtout, **M. A. Belkhir** and M. Samah; Fabrication and characterization of semiconductor CuCl nanocrystals Semiconductor physics. Quantum electronics & Optoelectronics, Vol. 7, n°2, p. 185-189, (2004)
- 10- I. Belabbas , **M. Akli Belkhir**, Y. H. Lee, A. Béré, P. Ruterana, J. Chen, and G. Nouet; Atomic structure and energy of threading screw dislocations in wurtzite GaN, Physica Status Solidi (c), Vol. 2, No. 7, p. 2492-2495 (2005)
- 11- M. Samah, **M. A. Belkhir**; Electronic and magnetic properties of ring-like Fe6 and Fe6@Si12 clusters, Physics letters A, Vol. 341 256-260 (2005).
- 12- W. Tazib, N. Toufik, C. Salame, P. Mialhe, **M.A. Belkhir** Reliability of microelectronic devices from emitter-base junction characterisation, AMSE Modelling, Measurement and Control, Vol. 78, n°5, p.65 (2005).
- 13- **Mohamed Akli Belkhir**, Sofiane Mahtout, Imad Belabbas and Madani Samah; Structure and electronic properties of medium-sized silicon clusters, Physica E, Vol. 31, Issue 1, p. 86-92 (2006).
- 14- I. Belabbas, **M. A. Belkhir**, Y. H. Lee, J. Chen, A. Béré, P. Ruterana, and G. Nouet, Title : Local electronic structure of threading screw dislocations in Wurtzite GaN, Computational Materials Science, Vol. 37, p. 410 (2006).
- 15- I. Belabbas, J. Chen, **M.A. Belkhir**, P. Ruterana, and G. Nouet; New core configurations of the c-edge dislocation in wurtzite GaN Physica status solidi (c), 3 No. 6, pp. 1733-1737 (2006)
- 16- I. Belabbas, J. Chen, **M.A. Belkhir**, P. Ruterana, and G. Nouet; Ab-initio tight binding study of the core structures of the c-edge dislocation in wurtzite GaN, Physica status solidi a, Vol. 203, p. 2167 (2006)

17. S. Belkhiri, D. Mezaoui, H. Rebbah, S. Ouhenia, and **M. A. Belkhir** ; X-Ray Powder Diffraction Analysis of Tungsto-Niobio- Monoarsenate  $K_3Nb_3WO_9(AsO_4)_2$ , Powder diffraction, Vol. 21, p. 236 (2006)
18. S. Belkhiri, S. Ouhenia, D. Mezaoui, **M. A. Belkhir**, and H. Rebbah ; X-Ray Powder Diffraction Analysis of Tungsto-Niobio- Monoarsenate  $K_3Nb_3WO_9(AsO_4)_2$ , ICDD n° A08046, (2006)
19. S. Ouhenia, **M. A. Belkhir**, and M. Samah ; “Formula  $BaTiO_3$ ” ICSD n° 171670, (2006)
20. I. Belabbas, G. Nouet, A. Béré, J. Chen, S. Petit, **M.A. Belkhir**, P. Ruterana and Ph. Komninou ; What does (a+c)-dislocation core look like in wurtzitz GaN ? MRS Proceedings, Vol. 892, FF26-10.1 (2006)
21. S. Mahtout and **M. A. Belkhir** ; Structure and relative stability of  $Sin$  (n=10-16) clusters, Acta Physica polonica A, Vol. 109, p. 685 (2006)
- 22- Madjid Bouguerra, Madani Samah, **Mohamed Akli Belkhir**, Abdelhamid Chergui, Lakhdar Gerbous, Gérard Nouet, Daniel Chateigner and Roger Madelon ; Intense Photoluminescence of slightly doped ZnO-SiO<sub>2</sub> matrix, Chemical Physics Letters, Vol. 425, pp. 77-81 (2006).
- 23- S. Mahtout and **M. A. Belkhir** ; Structural, magnetic and electronic properties of Fe encapsulated by silicon Clusters, Physics Letters A, Vol. 360, p. 384 (2006).
- 24- M. Samah, M. Bouguerra, A. Chergui, **M.A. Belkhir**, M. Kerkar, and N. Maloufi, Optical properties of ZnO Aggregates in a KBr Matrix, JKPS, Vol. 49, p. 2015 (2006).
- 25- A. Houari, S.F. Matar and **M.A. Belkhir** ; Ab initio investigation of the electronic structure and the magnetic trends within equiatomic FeN, JMMM, Vol. 312, p. 298 (2007)
- 26- Abdesalem Houari, Samir F. Matar, **Mohamed Akli Belkhir** ; and Michel Nakhl ; Structural stability and magnetism of FeN from first principles, Phys. Rev. B, Vol. B75, p. 064420, (2007) → DOI : 10.1103/PhysRevB.75.064420.
- 27- I. Belabbas, A. Béré, J. Chen, S. Petit, **M. Akli Belkhir**, P. Ruterana, and G. Nouet ; Atomistic modeling of the (a+c)-mixed dislocation core in wurtzite GaN, Phys. Rev. B, Vol. B75, p. 115201 (2007)
- 28- A. Houari, S.F. Matar, **M.A. Belkhir**, and M. Zakhour ; Covalent magnetism and invar-like behaviour within ternary nitrides, Z. Naturforschung B - Chemical science, Vol. 62b, p. 881 (2007)
- 29- Samir F. Matar, A. Houari, **M.A. Belkhir** ; Ab initio studies of magnetic properties of cobalt and tetracobalt nitride  $Co_4N$ , PHYSICAL REVIEW B Volume : 75 Issue : 24 Article Number : 245109 DOI : 10.1103/PhysRevB.75.245109 Published : JUN 2007.
- 30- W. Tazibt, P. Mialhe, J.P. Charles, **M.A. Belkhir** ; A junction characterization for microelectronic devices quality and reliability, Microelectronic reliability, Vol. 48, p. 348-353 (2008).
- 31- A. Houari, S.F. Matar, **M.A. Belkhir** ; Stability and magnetic properties of Mn-substituted ScN semiconductor from first principles, Comput. Mater. Sci., Volume 43, Issue 2, August 2008, Pages 392-398.
- 32- K. Rezouali and **M.A. Belkhir** ; An ab initio study of a model of single wall GaN nanotubes with oxygen and zinc as impurities : structural and electronic properties, Acta Phys. Pol. A, Vol. 113, p. 713, (2008).
- 33- Salim Ouhenia, Daniel Chateigner, **Mohamed Akli Belkhir**, Emmanuel Guilmeau

and Christopher Krauss; Synthesis of calcium carbonate polymorphs in the presence of polyacrylic acid *Journal of Crystal Growth*, Volume 310, Issue 11, 15 May 2008, pp. 2832-2841.

34- S. Mahtout and **M.A. Belkhir**; Novel structure and electronic property of  $\text{Sin}$  ( $21 \leq n \leq 30$ ) clusters, *Physica E*, Volume 40, Issue 9, August 2008, Pages 2884-2889.

35- Salim Ouhenia, Daniel Chateigner, **Mohamed Akli Belkhir**, Emmanuel Guilmeau, Microstructure and Crystallographic Texture of *Charonia lampas lampas* Shell, *Journal of Structural Biology*, Volume 163, Issue 2, August 2008, pp. 175-184.

36- M. Bouguerra, **M.A. Belkhir**, D. Chateigner, M. Samah, L. Gerbous, G. Nouet; Blue and yellow luminescence of GaN nanocrystals-doped  $\text{SiO}_2$  matrix, *Low-dimensional Systems and Nanostructures*, Volume 41, Issue 2, December 2008, Pages 292-298.

37- Karim Rezouali, **Mohamed Akli Belkhir**, JinBo Bai, Thickness-dependent electronic and optical properties of faceted hexagonal aluminum nitride nanotubes, *Physica E : Low-dimensional Systems and Nanostructures*, Volume 41, Issue 2, December 2008, Pages 254-257.

38- Karim Rezouali, **Mohamed Akli Belkhir**, Abdeslam Houari, JinBo Bai, Ab initio study of confinement and surface effects in hexagonal AlN nanotubes, *Computational Materials Science*, Volume 45, Issue 2, April 2009, Pages 305-309.

39- D. Chateigner, S. Ouhenia, C. Krauss, **M. Belkhir**, M. Morales; Structural distortion of biogenic aragonite in strongly textured mollusc shell layers, *Nuclear Instruments and Methods in Physics Research Section B : Beam Interactions with Materials and Atoms*, Volume 268, Issues 3-4, February 2010, Pages 341-345.

40- Abdesalem Houari, Samir F. Matar, **Mohamed Akli Belkhir**; DFT study of magneto-volume effects in iron and cobalt nitrides *Journal of Magnetism and Magnetic Materials*, Volume 322, Issue 6, March 2010, Pages 658-660.

41- Karim Rezouali, **Mohamed Akli Belkhir**, and Jin Bo Bai, Ab Initio Study of Confinement and Surface Effects in AlN Nanowires, *J. Phys. Chem. C* 11352, 114, 11352–11357 (2010) → DOI : <http://dx.doi.org/10.1021/jp100024m>.

42- W. Aggoune, K. Rezouali and **M. A. Belkhir**; Strong excitonic effects in hydrogen-graphene-fluorine janus graphene, *Phys. Status Solidi B*, volume 253, issue 4, 712-717 (2016). → DOI : <http://dx.doi.org/10.1002/pssb.201552431>

43- S. Safer, S. Mahtout, K. Rezouali, **M. A. Belkhir**, F. Rabilloud, Properties of neutral and charged cobalt-doped arsenic  $\text{CoAsn}(0 \pm 1)$  ( $n = 1-15$ ) clusters by density functional theory, *Computational and Theoretical Chemistry*, 1090, 23 (2016).

44- Wahib Aggoune, Caterina Cocchi, Dmitrii Nabok, Karim Rezouali, **Mohamed Akli Belkhir**, and Claudia Draxl; Enhanced Light-Matter Interaction in Graphene/h-BN van der Waals Heterostructures, *J. Phys. Chem. Lett.*, 8, pp 1464-1471 (2017). DOI : [10.1021/acs.jpcclett.7b00357](https://doi.org/10.1021/acs.jpcclett.7b00357).

45- Wahib Aggoune, Caterina Cocchi, Dmitrii Nabok, Karim Rezouali, **Mohamed Akli Belkhir**, and Claudia Draxl; Dimensionality of excitons in stacked van der Waals materials : The example of hexagonal boron nitride, *Phys. Rev. B* 97, 241114(R) (2018). DOI : <https://doi.org/10.1103/PhysRevB.97.241114>.

46- Wahib Aggoune, Caterina Cocchi, Dmitrii Nabok, Karim Rezouali, **Mohamed Akli Belkhir**, and Claudia Draxl; Structural, electronic, and optical properties of periodic graphene/h-BN van der Waals heterostructures, submitted to *Physical Review Materials*.

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## Participation to administrative responsibilities

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**1996-1997** President of the council of the Institute of Exact Sciences  
**1997-1999** Head of Physics graduation level  
**2008-2014** President of the scientific committee of the Physics Department  
**2010-2014** Director of Theoretical Physics Laboratory  
**2013-2016** President of the Scientific Council of the Faculty of Exact Sciences

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## Research interests

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My research work consists in quantum description of solids by doing simulation and modeling in collaboration, where appropriate, with experimentalists. A particular focus is the description of light-matter interaction. The underlying methodology is density functional theory and many-body perturbation theory. Currently I am working on 2D materials and their heterostructures. One example concerns graphene/hexagonal boron nitride (h-BN) heterostructures obtained by stacking of h-BN layers on graphene or inversely. We are interested in their physical properties, especially their optoelectronic ones. We are simulating Bernal (or ABA) stacking and the more realistic one consisting of turbostratic stacking where the layers are slightly rotated with respect to each other.

### Graphene

Graphene, a single sheet of carbon atoms arranged in a honeycomb pattern, has a lot of special properties likely to be used as a building block for future applications.

### Heterostructures obtained by stacking of hexagonal atomic monolayers : case of graphene-hexagonal boron nitride

Because of the lack of electronic bandgap, one can not use graphene as electronic device. In order to open an energy gap, we seek to combine it with other 2D structures. Hexagonal boron nitride (h-BN) stands as the material of choice for several reasons : i) 2D h-BN has a wide bandgap, ii) Its lattice parameter  $a$  is almost equal to that of graphene, iii) Synthesis of graphene—h-BN heterostructures is possible.

It should be noted that a collaboration is underway with Prof. Dr. C. Draxl and Prof. Dr. C. Cocchi from Humboldt University of Berlin. We are working on hétérostructures Graphene—h-BN. One of my PhD students is largely involved in the project.

### Aluminium nitride (AlN) nanostructures

AlN nanostructures are now the subject of numerous studies because of remarkable optoelectronic and piezoelectric properties. Other properties such as design flexibility or field effect make AlN an even interesting material. Nanostructures made of AlN offer novel properties that are not present in the bulk AlN. A lot of work was carried out on the synthesis and characterization of these systems. Despite these advances, knowledge of the properties of nanostructures remains limited, especially from the theoretical side.

### **Magnetic anisotropy**

Another topic I am interested in is the study of the magnetic anisotropy Fe-Pt particles on a graphene sheet.