

# Daoud Mohammed

Professeur de l'Enseignement Supérieur



Laboratoire de la Physique de la Matière et du Rayonnement.  
Département de Physique, Faculté des Sciences,  
Université Ibnou Zohr, Agadir.  
Téléphone: 06 68 06 43 93 / 05 28 22 09 57  
Fax: 05 28 22 01 00  
email: m\_daoud@hotmail.com

## CURRICULUM VITAE

### Daoud Mohammed

49 years, married, 1 daughter  
Professor at University Ibnou Zohr  
Department of Physics  
Faculty of Sciences  
Agadir, Morocco.  
email: m\_daoud@hotmail.com  
Phone number: 06 68 06 43 93.

### Degrees

**1988** *Licence és Sciences Physiques*, University Mohammed V, Rabat, Morocco.

**1989:** *Diplôme d'études approfondies* (DEA) in Theoretical Physics from University Claude Bernard Lyon 1, France.

**1992:** *Diplôme de Doctorat d'université* in Theoretical Physics from University Claude Bernard Lyon 1, France.  
*Processus d'absorption multiphotonique pour des ions de transition et méthodes d'adaptation à la symétrie.*

**1997:** *Diplôme de Doctorat d'état* in Mathematical Physics from University Mohammed V, Rabat, Morocco.  
*Rôle des symétries dans les processus multiphotoniques et les statistiques quantiques intermédiaires.*

### Academic positions

**1993-1995:** *Attaché temporaire à l'enseignement et la recherche* (ATER), University Claude Bernard Lyon 1, France.

**1995-1997:** *Maître assistant*, University Ibnou Zohr, Agadir, Morocco.

**1997-2001:** *Maître de Conférences*, University Ibnou Zohr, Agadir, Morocco.

**2001-2006:** *Professeur de L'enseignement Supérieur-Grade A*, University Ibnou Zohr, Agadir, Morocco.

**2006-Now:** *Professeur de L'enseignement Supérieur-Grade B*, University Ibnou Zohr, Agadir, Morocco.

## Main Research Areas

### Quantum Information Theory.

Quantum entanglement, Quantum discord, Decoherence of quantum systems, Quantum cryptography, Quantum teleportation, Quantum computing, Quantum codes.

### Quantum Mechanics and Quantum Optics.

Exactly solvable quantum models, Quantum coherence and decoherence theory, Light-Matter interaction, Multi-photon absorption processes of atoms and ions.

### Symmetry Methods in Quantum Physics

Finite and compact groups and representation theory applied to nuclear, atomic and molecular spectroscopy. Lie and super-Lie algebras and symmetries in quantum physics.

### Quantum Coherence Theory in Quantum Physics

Coherent states and Intelligent states for exactly solvable models. States minimizing the Robertson-Schrödinger relation. Analytical and algebraic realizations of coherent states. Quantum-classical transition

### Geometric Methods in Quantum Physics

Non commutative geometry in condensed matter physics. Quantum Hall effect in higher dimensions. Anyons, parastatistics and fractional spins emerging from the topological effects in quantum systems.

### Mathematical Physics

Symmetries in Physics. Groups and representations theory. Lie algebras and quantized Lie algebras for quantum physics.  $Z_2$ -graded algebras. Symplectic, Riemannian and Kählerian manifolds in quantum physics and quantum field theory.

### Supersymmetric Methods in Quantum Physics

Supersymmetric quantum mechanics. Supersymmetric quantum states. Fractional supersymmetric systems and generalized spin systems.

## Other Research Interests

Supersymmetry in particle physics.

Quantum gravity.

Topological effects in physics.

Cosmology.

String theory.

Quantum phase transitions and topological orders.

## Teaching and tutoring activities

### Teaching

Undergraduate (DEUG): Classical and Quantum mechanics, Electromagnetism, Thermodynamics.

Graduate of maitrise: Quantum mechanics, Nuclear physics, Atomic Physics, Quantum optics.

Graduate of Master: Group theory, Relativistic quantum mechanics, Quantum field theory, Introduction to Supersymmetry, Gauge theories. Mathematical methods for physics.

### Supervising Phd Thesis

Supervisor of the Phd thesis of M. Mansour "Star-Produits et déformations quantiques" (1999).

Supervisor of the Phd thesis of J. Douari concerning "Anyons, statistiques fractionnaire et groupes quantiques." (2001).

Supervisor of the Phd thesis of A. Jellal concerning "Effet Hall fractionnaire et Symétries quantiques" (2003).

Supervisor of the Phd thesis of A. H. El Kinani concerning "Etats cohérents et intelligents généralisés pour des systèmes quantiques exactement solubles" (2005).

Supervisor of the Phd thesis of A. Hamama concerning "Théories des champs non commutatives et effet Hall quantique fractionnaire" (2008).

Supervisor of the Phd thesis of A. Ouelguejdi concerning "Géometrie symplectique en physique quantique de l'information" (Expected for December 2015)

### Supervising Phd Thesis: in progress

Supervisor of the Phd thesis of R. Essaber

"Mesures quantiques de l'intrication en théorie quantique de l'information: Aspects algébriques et géométriques"

Supervisor of the Phd thesis of W. El Kaydi

"Intrication dans les systèmes d'états cohérents"

Supervisor of the Phd thesis of S. Seddik

"Codes correcteurs d'erreurs en théorie quantique de l'information"

Supervisor of the Phd thesis of Hanane El Hadfi

"Contrôle des processus de décohérence en physique quantique"

### Supervising DESA thesis

Supervisor of Diploma thesis (DESA) of N. Hassani

"Etats cohérents et intelligents for des algèbres de Lie " (2005).

Supervisor of Diploma thesis (DESA) of F. Oufedjikh  
"Mécanique quantique supersymétrique en dimensions supérieures" (2005).

Supervisor of Diploma thesis (DESA) of J. Maher  
"Géométrie des états cohérents et produit de Moyal" (2005).

### **Supervising Master thesis**

Supervisor of the Master thesis of R. Essaber  
"Corrélations quantiques en théorie quantique de l'information" (Rabat 2012)

Supervisor of the Master thesis of M. El Banany  
"Méthodes géométriques pour l'étude des corrélations quantiques" (Rabat 2012)

Supervisor of the Master thesis of T. Charki  
"Transitions de phase quantique et ordres topologiques" (Rabat 2012)

Supervisor of the Master thesis of W. El Kaydi  
"Champs quantiques sur des espaces non commutatifs" (Rabat 2012)

Supervisor of the Master thesis of H. El Oulji  
"Géométrie non commutative et applications en la physique du graphène" (Rabat 2012)

Supervisor of the Master thesis of Aouini Saloua  
"Intrication quantique des états cohérents et la géométrie symplectique" (Rabat 2013)

Supervisor of the Master thesis of Nadia Hadar  
"L'intrication Quantique et Mesure Géométrique de la Discorde Quantique" (Rabat 2013)

Supervisor of the Master thesis of Ahami Nizar  
"Intrication Quantique à basse dimension" (Rabat 2013)

Supervisor of the Master thesis of Martin Mihigo Byamungu "Communication et cryptographie quantiques avec des variables continues" (Rabat 2014)

Supervisor of the Master thesis of Bilal Benzimoune  
"Décohérence quantique en théorie quantique de l'information" (Rabat 2014)

### **Editor-Referee**

Member of editors advisory panel of Journal of Physics A: Mathematical and Theoretical.

Member of editorial board of Journal of African Journal of Mathematical Physics.

Referee for Journal of Physics A: Mathematical and Theoretical.

Referee for Journal of Physics B: Atomic, Molecular and Optical Physics.

Referee for Journal of Mathematical Physics.

Referee for Physica A.

Referee for Physics Letters A.

Referee for European Journal of Physics C.

Reviewer for Mathematical Reviews.

Reviewer for Fortschritte der Physik - Progress of Physics.

### **Positions**

Associate member of International centre for Theoretical Physics (ICTP), Trieste, Italy (2010-2014).

Invited Professor at Max Planck Institute for the Physics of Complex Systems (several times).

Invited Professor at University Claude Bernard Lyon 1, France (several times).

Associate researcher at Centre de recherches mathématiques, Montréal, Canada(2000).

### **Memberships**

Coordinator of GNDR-IQ (Groupement National De Recherches-Information Quantique).

Vice president of Moroccan Society of Mathematical Physics.

Member of national steering committee of RHEMAP: Réseau National de Physique des Hautes Energies et Physique Mathématique.

Member of the International Association of Mathematical Physics.

Member of the editorial board of African Journal of Mathematical Physics.

Member of RENAPT: Réseau National de Physique Théorique,(1999-2004).

Member of GNPHE: Groupement national de Physique des Hautes Energies.

### Expertise

Expert for CNRST (Centre National de la Recherche Scientifique et Technique)-Morocco.

Expert for CONICYT, la Comisión Nacional de Investigación Científica y Tecnológica (Chile)

Expert for National Research Council (CNCS)- Roumania

### Organisation of National and International Meetings

Ecole Nationale de Physique quantique, (Rabat les 27-28-29 Octobre 1999):  
Etats cohérents: Aspects géométriques et algébriques.

Premier Workshop de Physique Théorique Organisé par le réseau national de physique théorique (RNPT);  
Faculté des sciences, Rabat, Maroc, 16-17/06/2000  
"la géométrie non commutative la théorie des supercordes la physique des particules"

Ecole Nationale "Symétries en physique", (Rabat les 01-03 Décembre 2002).

Rencontre Nationale de RENAPT ( Tanger, 24-26 May 2004).  
Etats Cohérents et Applications, Phénoménologie du MSSN et QCD, Géométrie Non-Commutative.  
Tanger 27 - 29 Mai 2004.

The International Conference on High Energy and Mathematical Physics (Marrakech, 04-07 April 2005 ).

International colloquium in Mathematical Physics: Non commutative geometry, Symmetries and String theory (Errachidia, 01-03 June 2006).

Rencontre National des Jeunes Chercheurs de Physique (Casablanca, 19-20 December 2006).

12th Workshop on High Energy and Mathematical Physics (Rabat, 17-18 April 2007).

13th Workshop on High Energy and Mathematical Physics (Rabat, 29-31 May 2008).

International Conference: Quantum information theory and related topics (first edition organized by Groupement National de Recherches-Information Quantique)(Agadir, 03-06 October 2010).

International Conference: Quantum information theory and related topics (second edition organized by Groupement National de Recherches-Information Quantique) (Rabat, 13-16 November 2011).

Ecole Nationale: Théorie Quantique de L'Information: Fondements et Applications (Rabat, 30 November and 01 December 2012).

Ecole Nationale: Théorie Quantique de L'Information: Fondements et Applications (Rabat, 31 January and 01 February 2014).

### Research visits (one month and more)

**Lyon**, Institut de physique nucléaire, December 1996.

**Lyon**, Institut de physique nucléaire, May-July 1997.

**Lyon**, Institut de physique nucléaire, December-April 1998.

**Trieste**, International centre for theoretical physics, August-September 1998.

**Lyon**, Institut de physique nucléaire, May-July 1999.

**Montréal**, Centre de recherches mathématiques, Mars-July 2000.

**Trieste**, International centre for theoretical physics, August 2000.

**Trieste**, International centre for theoretical physics, August 2001.

**Trieste**, International centre for theoretical physics, August 2002.

**Lyon**, Université Claude Bernard, May 2003.

**Dresden**, Max Planck institute (MPI-PKS), November-December 2003.

**Trieste**, International centre for theoretical physics, September 2004.

**Dresden**, Max Planck institute (MPI-PKS), October-November 2005.

**Lyon**, Institut de physique nucléaire, July 2006.

**Trieste**, International centre for theoretical physics, September 2006.

**Dresden**, Max Planck institute (MPI-PKS), December 2006.

**Trieste**, International centre for theoretical physics, November 2007.

**Dresden**, Max Planck institute (MPI-PKS), December 2007.

**Dresden**, Max Planck institute (MPI-PKS), December 2008.

**Lyon**, Institut de physique nucléaire, July 2009.

**Dresden**, Max Planck institute (MPI-PKS), November-December 2009.

**Lyon**, Institut de physique nucléaire, July 2010.



**Dresden**, Max Planck institute (MPI-PKS), November-December 2010.

**Lyon**, Institut de physique nucléaire, July 2011.

**Dresden**, Max Planck institute (MPI-PKS), November-December 2013.

**Trieste**, International centre for theoretical physics, July-September 2014.

**Trieste**, International centre for theoretical physics, July-September 2015.

## Chapter books

**1. M. Daoud** and M. Kibler

k-fermionic coherent states

Chapter book in Concise Encyclopedia of Supersymmetry And Noncommutative Structures in Mathematics and Physics,

Duplij S., Siegel W., Bagger J. (Eds.) (2004) 211.

**2. M. Kibler** and **M. Daoud**

On supersymmetric quantum mechanics

Chapter book in Fundamental World of Quantum Chemistry, A Tribute to the Memory of Per-Olov Lowdin, Volume 3, E. Brandas and E.S. Kryachko (Eds.), Springer-Verlag, Berlin, 2004.

**3. M. Daoud** and M. Kibler

Phase states and coherent states for generalized Weyl-Heisenberg algebras.

Nankai Series in Pure, Applied Mathematics and Theoretical Physics: Symmetries and Groups in Contemporary Physics, Volume **11** (2013) 289.

**4. M. Daoud**

Les corrélations quantiques en théorie quantique de l'information.

Actes de la session plénière solennelle de l'académie Hassan II des sciences et techniques, Rabat, 20 - 22 février 2013.

## List of Publications

1. J. Sztucki, **M. Daoud** and M. Kibler  
Intensity of two photon spectroscopy transitions for  $Ni^{2+} : Mgo$   
Phys. Rev. B. **45** (1992) 2023.
2. **M. Daoud** and M. Kibler  
Two-photon spectroscopy of transitions metal ions in cubical symmetry  
J. Alloys and Compounds **188** (1992) 255.
3. **M. Daoud** and M. Kibler  
Symmetry adaptation and two photon spectroscopy of ions in molecular or solid-state finite symmetry  
Symmetry methods in Physics, **1** (1992) 37.
4. **M. Daoud** and M. Kibler  
Two photon laser spectroscopy of ions transitions: Interconfigurational transitions  
Laser Physics **2** (1992) 704.
5. **M. Daoud** and M. Kibler  
Sum rules for multi-photon spectroscopy of ions in finite symmetry  
Lett. Math. Phys. **28** (1993) 269.
6. **M. Daoud** and M. Kibler  
Symmetry adaptation techniques in n-photon absorption spectroscopy  
J. Alloys and Compounds **193** (1993) 219.
7. **M. Daoud** and M. Kibler  
Two photon spectroscopy between states of opposite parities  
Phys. Rev. B. **52** (1995) 12677.
8. **M. Daoud** and Y. Hassouni  
On the generalized statistics through the deformation of the exterior algebra  
Mod. Phys. Lett. A. **12** (1997) 457.
9. **M. Daoud**, Y. Hassouni and E.H. Tahri  
Deformation of the exterior algebra and the Yang Baxter equation  
Inter. J. Theor. Phys. **6** (1997) 1413.
10. **M. Daoud** and M. Kibler  
Statistical mechanics of qp-bosons in D-dimensions  
Phys. Lett. A **206** (1995) 13.
11. **M. Daoud**, J. Meyer M. Kibler  
Statistical mechanics of qp-bosons in D-dimensions  
Symmetry and Structural Properties of Condensed Matter, Eds. T.Lulek, B.Lulek and W. Florek (World Scientific).

- 12. M. Daoud** and Y. Hassouni  
q-deformed Fock space and statistical properties of quons  
Helv. Phys. Acta **71** (1998) 599.
- 13. M. Daoud** and Y. Hassouni  
On the generalization of the supersymmetric quantum mechanics  
Inter. J. Theo. Phys. **37** (1998) 2021.
- 14. M. Daoud** and Y. Hassouni  
A new realization of the fractional supersymmetry  
Prog. Theo. Phys. **6** (1997) 1033.
- 15. M. Daoud**, J. Douari and Y. Hassouni  
Quonic realization of the deformed H-W algebra  
Inter. J. Theo. Phys. **12** (1997) 3071.
- 16. M. Daoud**, Y. Hassouni and M. Kibler  
The k-fermions as objects interpolating bosons and fermions  
In Symmetries in Science X , eds. B.Gruber and M.Ramek (Plenum Press, New York) 1998.
- 17. M. Daoud**, Y. Hassouni and M. Kibler  
On the generalized coherent states  
Phys. At. Nuclei **61** (1998) 1821
- 18. M. Daoud** and M. Kibler  
Variations on a theme of quons: A non standard basis for Wigner-Racah algebra of the group  $SU(2)$   
Recent Res. Devel. Quantum Chem., **2** (2001) 91.
- 19. M. Daoud** and M. Kibler  
Variations on a theme of quons: A fractional supersymmetric oscillator  
Recent Res. Devel. Quantum Chem., **2** (2001) 101.
- 20. A.Jellal, M. Daoud** and Y. Hassouni  
Supersymmetric sine algebra and degeneracy of Landau levels  
Phys. Lett. B **474** (2000) 122.
- 21. M. Daoud**, J. Douari and Y. Hassouni  
Yang-Baxter equation on two-dimensionnal lattice and some infinite dimensionnal algebras  
Acta. Phys. Slovaca **49** (1999) 945.
- 22. M.Mansour, M. Daoud** and Y. Hassouni  
fractionnal spin through Q-deformed Lie and super-Lie algebras  
Phys. Lett. B **454** (1999) 281.
- 23. M.Mansour, M. Daoud** and Y. Hassouni  
fractionnal spin through some quantum algebras  
Rep. Math. Phys. **44** (1999) 435.
- 24. M. Daoud** and M. Kibler  
A fractional supersymmetric oscillator and its coherent states  
In Procceding of the Sixth Wigner Symposium. math-ph/ 9912024.

- 25. M. Daoud** and M. Kibler  
On the fractional supersymmetric quantum mechanics: the fractional supersymmetric oscillator  
In Symmetry and Structural Properties of Condensed Matter, Eds. T.Lulek, B.Lulek and W. Florek  
(World Scientific). math-ph/ 0101009.
- 26. A.H. El Kinani** and **M. Daoud**  
Generalized intelligent states for an arbitrary quantum mechanical system  
J.Phys. A: math and general **34** (2001) 5373.
- 27. A.H. El Kinani** and **M. Daoud**  
Coherent states à la Klauder-Perelomov for the Pöshl-Teller potentials  
Phys. Lett. A **283** (2001) 291.
- 28. A.H. El Kinani** and **M. Daoud**  
Generalized intelligent states for nonlinear oscillator  
Inter. J. Modern. Phys. B **15**(2001) 2465.
- 29. A.H. El Kinani** and **M. Daoud**  
Generalized coherent states and intelligent states for exact solvable quantum systems  
J.Math. Phys **43**(2002) 714.
- 30. A.H. El Kinani** and **M. Daoud**  
Coherent and generalized intelligent states for infinite square well potential and nonlinear oscillators  
Inter. J. Modern. Phys. B **16** (2002) 3915
- 31. M. Daoud** and E.H El Kinani  
The Moyal bracket in the coherent states framework  
J.Phys. A: math and general **358** (2002) 2639.
- 32. M. Daoud** and V. Hussin  
General sets of coherent states and Yanes-Cummings model  
J.Phys. A: math and general **35** (2002)7381.
- 33. M. Daoud** and M. Kibler  
On two approaches of fractional supersymmetric quantum mechanics  
Inter. J. Quantum. Chem **91** (2003) 551.
- 34. M. Daoud** and M. Kibler  
fractional supersymmetric quantum mechanics  
Phys. Part. Nucl. (Suppl. 1) **33** (2002) 543.
- 35. M. Daoud**  
Robertson Schrödinger intelligent states for two-body Calogero model  
Mod. Phys. Lett.A **17** (2002) 1805.
- 36. M. Daoud**  
Photon-added coherent states for exactly solvable Hamiltonians  
Phys. Lett.A **305** (2002) 135.
- 37. M. Daoud** and J. Douari  
Extended Weyl-Heisenberg Algebra and Rubakov-Spiridonov Superalgebra Anyonic Realizations

Mod. Phys. Lett. A **18** (2003) 913.

**38. M. Daoud** and J. Douari

A Generalized Jaynes-Cummings Model Nonlinear Dynamical Superalgebra  $u(1/1)$  and Supercoherent States

Inter. J. Mod. Phys. B **17** (2003) 2473.

**39. A. Jellal** and **M. Daoud**

D-dimensional ideal quantum gases in a  $Ar^n + Br^{-n}$  potential

Mod. Phys. Lett. B **17** (2003) 1321.

**40. M. Daoud**

Extended Voros product in the coherent states framework

Phys. Lett.A **309** (2003) 167.

**41. M. Daoud**

Covariance of the Grassman star product

Rep. Math. Phys. **52** (2003) 281.

**42. M. Daoud** and M. Kibler

k-fermionic coherent states

Chapter book in Concise Encyclopedia of Supersymmetry And Noncommutative Structures in Mathematics and Physics,

Duplij S., Siegel W., Bagger J. (Eds.) (2003) 211.

**43. M. Kibler** and **M. Daoud**

On supersymmetric quantum mechanics

Chapter book in Fundamental World of Quantum Chemistry, A Tribute to the Memory of Per-Olov Lowdin, Volume 3, E. Brandas and E.S. Kryachko (Eds.), Springer-Verlag, Berlin, 2004.

**44. M. Daoud** and D. Popov

Statistical properties of Klauder-Perelomov coherent states for the Morse potential

Inter. J. Mod. Phys. B **18** (2004) 325

**45. M. Daoud** and M. Kibler

Fractional supersymmetric quantum mechanics as a set of replicas of ordinary supersymmetric quantum mechanics

Phys. Lett. A **321** (2004) 147.

**46. M. Daoud**

Generalized intelligent states of the  $su(N)$  algebra

Phys. Lett. A **329** (2004) 318.

**47. M. Daoud**

Analytic representations based on  $su(3)$  coherent states and Robertson intelligent states

J. Math. Phys. **45** (2004) 3435.

**48. M. Daoud** and M.Kibler

Fractional supersymmetric quantum mechanics as superposition of ordinary supersymmetry

Physics of Atomic Nuclei **68** (2005) 1654.

**49. M. Daoud**

Representations of generalized  $A_r$  statistics and eigenstates of Jacobson generators.  
Modern. Phys. Lett. A **21** (2006) 1691.

**50. M. Daoud**

Representations and properties of generalized  $A_r$  statistics.  
Inter. J. Modern. Phys. A **21** (2006)

**51. M. Daoud**

Representations and properties of generalized  $A_r$  statistics, coherent states and Robertson uncertainty relations .  
J. phys. A: mathematical and general **39** (2006) 889.

**52. M. Daoud** and A. Jellal

Quantum Hall droplets on disc and effective WZW action for edge states  
Inter. Jour. of Geometric Methods in Modern Physics **4**(2007) 1187.

**53. M. Daoud** and M. Kibler

Fractional supersymmetry and hierarchy of shape invariant potentials  
Journal of Mathematical Physics **47** (2006) 122108

**54. M. Daoud** and A. Jellal

Effective WZW action for edge states of quantum Hall systems on Bargman ball  
Nuclear Physics **B 764** (2007) 109

**55. M. Daoud** and A. Jellal

Quantum Hall effect on Flag manifold  
Int. J. Mod. Phys. A **23** (2008) 3129.

**56. M. Daoud** and A. Hamama

Noncommutative scalar fields from symplectic deformation  
Journal of Mathematical Physics **49**(2008) 023508.

**57. M. Daoud** and A. Hamama

Symplectic deformations, Noncommutative scalar fields and Fractional quantum Hall effect  
Int. J. Mod. Phys. A **23** (2008) 2591 .

**58. M. Daoud** and A. Hamama

Chiral bosons on Bargmann space associated with  $A_r$  statistics  
Journal of Physics A: Mathematical and Theoretical **41** (2008) 205205.

**59. M. Daoud** and M. Kibler

Phase operators, temporally stable phase states, mutually unbiased bases and exactly solvable quantum systems  
J. Phys. A: Math. Theor. **43** (2010) 115303 .

**60. M. Daoud**, M. El Bouziani, R. Houca and A. Jellal

Magnetism of two coupled harmonic oscillators  
Journal of Statistical Mechanics: Theory and Experiment. P01012 (2010)

**61. M. Daoud**, A. Jellal and A. Oued Guejdi

Symplectic Fluctuations for Electromagnetic Excitations of Hall Droplets  
Journal of Statistical Mechanics: Theory and Experiment (2010) P07017.

62. **M. Daoud**, A. Jellal and A. Oueld Guejdi  
Electromagnetic Excitations of  $A_r$  Quantum Hall Droplets  
International Journal of Physics A **25**(2010) 3675.
63. **M. Daoud**, A. Jellal and A. Oueld Guejdi  
Electromagnetic Excitations of Hall Systems on Four Dimensional Space.  
Inter. Jour. of Geometric Methods in Modern Physics 8 (2011) 1465.
64. **M. Daoud** and H. Ez-zahraouy  
Three dimensional quantum key distribution in the presence of several eavesdroppers  
Physica Scripta **84** 045018 (2011).
65. **M. Daoud** and E. B. Choubabi  
Entangled phase states via quantum beam splitter  
Optics Communications 284 (2011) 4535.
66. **M. Daoud** and E. H. El Kinani  
Extended Weyl–Heisenberg algebra, phase operator, unitary depolarizers and generalized Bell states  
Physics Letters A **375** (2011) 2492.
67. **M. Daoud**, A. Jellal, E. B. Choubabi and E. H. El Kinani  
Bipartite and tripartite entanglement of truncated harmonic oscillator coherent states via beam splitters  
J. Phys. A: Math. Theor. **44** (2011) 325301.
68. **M. Daoud** and M. Kibler  
Phase operators, phase states and vector phase states for  $SU_3$  and  $SU_{2,1}$   
J. Math. Phys. **52** (2011) 082101
69. **M. Daoud** and H. Ez-zahraouy  
Quantum encoding based on optical phase states and mutually unbiased bases in the presence of several eavesdroppers  
Journal of Russian Laser Research **33** (2012) 20.
70. **M. Daoud** and E. B. Choubabi  
Bipartite entanglement of multipartite coherent states using quantum network of beam splitters  
International Journal of Quantum Information **10** (2012) 1250009.
71. A. Jellal, A. El Mouhafid and **M. Daoud**  
Massless Dirac Fermions in Electromagnetic Field  
Journal of Statistical Mechanics: Theory and Experiment (2012) P01021.
72. **M. Daoud** and M. Kibler  
Bosonic and  $k$ -fermionic coherent states for a class of polynomial Weyl-Heisenberg algebras  
J. Phys. A: Math. Theor. **45** (2012) 244036.
73. **M. Daoud** and M. Kibler  
Generalized coherent states for polynomial Weyl-Heisenberg algebras.  
AIP Conference Proceedings 1472 (2012) 60 .
74. **M. Daoud** and R. Ahl Laamara  
Quantum discord of Bell cat-states under amplitude damping



J. Phys. A: Math. Theor. **45** (2012) 325302.

**75. M. Daoud** and R. Ahl Laamara Quantum discord for multipartite coherent states interpolating between Werner and Greenberger-Horne-Zeilinger states  
International Journal of Quantum Information **10** (2012) 1250060.

**76. M. Daoud** and R. Ahl Laamara  
Geometric Measure of Pairwise Quantum Discord for Superpositions of Multipartite Generalized Coherent States  
Phys. Lett. A **376** (2012) 2361.

**77. M. Daoud**, R. Essaber and R. Ahl Laamara  
Geometric quantum discord for multi-mode even and odd Glauber states.  
African Journal of Mathematical Physics **11** (2012) 11.

**78. M. Daoud**, W. Kaydi and R. Ahl Laamara  
Entanglement in  $n$ -partite coherent states interpolating between  $W_n$  and  $GHZ_n$  states.  
African Journal of Mathematical Physics **11** (2012) 1.

**79. M. Daoud** and H. Ez-zahraouy  
Higher dimensional quantum key distribution encoded in optical states and mutually unbiased bases.  
African Journal of Mathematical Physics **11** (2012) 19.

**80. M. Daoud** and M. Kibler  
Phase states and coherent states for generalized Weyl-Heisenberg algebras.  
Nankai Series in Pure, Applied Mathematics and Theoretical Physics: Symmetries and Groups in Contemporary Physics, Volume **11** (2013) 289.

**81. M. Daoud**, R. Ahl Laamara and R. Essaber  
Quantum correlations dynamics of quasi-Bell states  
Int. J. Quantum Inform. **11** (2013) 1350057

**82. M. Daoud**, R. Ahl Laamara and W. Kaydi  
Multipartite quantum correlations in even and odd spin coherent states  
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