C.V.

Name : *Alaa Ahmed Saad Akl* ***Nationality:*** *Egyptian*
Perth Day: *9-11-1960* ***Religion:*** *Muslim*
Marital Status: *Married and reliable*

Scientific Grade:

1-*BSc. of Physics May 1982, Faculty of Science*
2-*MSc. of Solid State Physics June 1988,Physics Dept. Faculty of Science*
3-*Ph.D. of Solid State Physics June 1997, Physics Dept. Faculty of Science*

Granting University: *El-Minia University*
Major Specialization: ***Solid State Physics***
Specific Specialization: ***Experimental of Solid State Physics***

Experience:

1-Doctoral of solid state physics from 22/12/1998 to 24/9/2006
2-Associated professor of Experimental of Solid State Physics from 25/9/2006 to 18/11/2013 in Faculty of Science -Physics Department – El-Minia University.
3-Professor of Experimental of Solid State Physics 19/11/2013 Until now, in Faculty of Science -Physics Department – El-Minia University.
4-Director of central laboratory for physio-chemical analysis in El-Minia University from 6/7/1997 to 26/8/2003.
5- I have good experience in the supervision of Masters and PhDs
6- I have good experience in the interpretation and the surface morphology reading of images by scanning electron microscope (SEM) and transmission electron microscope (TEM).
7- I have good experience in choosing the best and better research instrumentation that serves different specialties and that order to establish central laboratories.
8-I'm a member in the project of Electrochromic application research for cars refer to Academic Scientific Research in Egypt from 2003 to 2005
9- I 'be an experience of crystal study of solid state physics such as qualitative and quantitative analysis of inorganic and organic materials by using X-ray diffraction analysis from 1984 to now.
*10-I've published **60** papers in an international journal, eight of them were single author in the field material characteristics, solar cells and its application in Electrochromic behavior..*
11-Member of the National Society for Crystallography since from Feb 2014 until now.
12-I'm a referee of Journal Applied Surface Science and Journal of Chemistry and Physics.
13-I'm a member of Egyptian Society of Solid State Physics from 1984 to NOW
14-I'm referring to more papers for multi International Journals.

Information of the website Scopus

Prof. Dr. Alaa Ahmed Saad Akl

El-Minia University, Faculty of Science
Physics Department

Alaa A. Akl obtained a B.S. Degree in physics from the Faculty of Science, Minia University, May, 1982, an M.S. Degree of solid state physics from the Physics Department, Faculty of Science, Minia University, June, 1988, and a Ph.D. degree of solid state physics from the Physics Department, Faculty of Science, Minia University, June, 1997. Akl's major specialization is in solid state physics and specific specialization in materials science in the form of thin films and surface science. Akl was a Doctoral of solid state physics from 22/12/1998 to 24/9/2006, has been an Associated professor of solid state physics since 25/9/2006 at the Physics Department, Faculty of Science, Minia University, and was the Director of the Central Laboratory for Microphysio-Chemical Analysis in Minia University from 6/7/1997 to 26/8/2003. Akl's area of interest is growth and characterization (nanostructure, optical, and electrical properties) of metal oxide thin films for thin film device applications such as Electrochromic properties and smart windows. Akl trained to grow metal transition oxide thin films (Fe_2O_3, NiO_2, WO_3 , V_2O_5, TiO_2, IrO_2 and chalcogniet materials as a thin film form) using spray pyrolysis, thermal evaporation, and sputtering (RF) techniques. In parallel, Akl learned to characterize, analyzing, and interpret the obtained results from XRD, SEM, AFM, and UV-VIS-NIR spectrophotometer and optical dispersion analysis of metal transition oxides and other thin films.

Personal knowledge of Prof. Dr. *Alaa Ahmed Saad Akl*

I obtained my PhD. in experimental solid state physics and I worked as a teacher from 22/12/1998 to 24/9/2006 and then I got the degree of associate professor of experimental of solid state physics since 25/9/2006 to 18/11/2013 at the Physics Department, Faculty of Science, Minia University. Since 19/11/2013 I have worked as a professor in experimental solid state physics at the Department of Physics, Faculty of Science, Minia University until now.

Practical experiences

1- **I have experience in preparing thin films in different ways such as thermal evaporation, sputtering and chemical spray pyrolysis**
2- **I have experience in studying the surface morphology, crystallography, crystal defects, microstructure, optical and electrical properties of alloys and thin films**
3- **I have long experience in crystalline materials using XRD and I have experience in the qualitative and quantitative analysis of inorganic compounds**
4- **I worked as Director of the Central Laboratory for Microphysio-Chemical Analysis in Minia University from 6/7/1997 to 26/8/2003. I also managed the Applied Scientific Research Unit, Faculty of Science, Minia University, from 12/10/2012 until 22/9/2014**

Research Interest

My major specialization is in Experimental of solid-state physics and specific specialization in materials science in the form of thin films, alloys and surface morphology. My research interests also in the growth and characterization (crystallography, nanostructure, optical, and electrical properties) of metal oxide thin films for thin film device applications such as Electrochromic properties and smart windows. I was trained to grow metal transition oxide thin films (Fe_2O_3, NiO_2, WO_3 , V_2O_5, TiO_2, IrO_2 and ternary composite (Chalcogniet) materials as a thin film form and bulk forms) using spray pyrolysis, thermal evaporation, and sputtering (RF) techniques. In parallel, I was experience to characterize, analyzing, and interpret the obtained results from XRD, SEM, AFM, FTIR and UV-VIS-NIR spectrophotometer and optical dispersion analysis of metal transition oxides and other thin films.

This link is in my google scholar:

https://scholar.google.com/citations?user=aXJ7hjMAAAAJ&hl=en

List of publications for Dr . Alaa Ahmed Saad Akl

1- ***Title:*** ***"Study of source errors of x-ray diffraction profile analysis"***
Authors: **A.A.S. Akl,** and A. A.Ramadan
Journal**: *Solid State Sciences, vol. 14, no. 2, (1994) 221–226.***

2- ***Title:*** ***"Carrier transport mechanisms of a-GaAs/n-Si heterojunctions"***
Authors: N.I.Aly**,** ***A.A.Akl,*** A.A.Ibrahim and A.S.Riad
Journal: ***Egypt. J. Sol.,*** *Volume 24, No.(2)* ***(2001)*** 245-254*.*

3-*Title :* **"** ***Structural study of flash evaporation $CuInSe_2$ thin films*****"**
Authors : ***A.A.Akl***, A.Ashour, A.A.Ramadan and K.Abd El -Hady
Journal : ***Vacuum,*** *Volume 61,* ***(2001)*** *75-84****.***

4- ***Title:*** **"Opto-structural, electrical and electrochromic properties of crystalline nickel oxide thin films prepared by spray pyrolysis"**
Authors: S. A. Mahmoud, ***A. A. Akl***, H. Kamal and K. Abdel-Hady
Journal: ***PHYSICA B: Condensed Matter***, *Volume 311,issue (3-4)****(2002)*** *366-375.*

5- ***Title :*** **"** ***Characterization of tungsten oxide films of different crystallinity prepared by RF sputtering*****"**
Authors: ***A.A.Akl***, H.Kamal and K.Abdel-Hady
Journal : ***PHYSICA B: Condensed Matter,*** *Volume 325* ***(2003)*** *65-75*

6- ***Title :*** **"** ***Influence of proton insertion on the conductivity, structural and optical properties of amorphous and crystalline electrochromic WO_3 films*****"**
Authors: H.Kamal, ***A.A.Akl*** and K.Abdel-Hady
Journal : ***PHYSICA B: Condensed Matter,*** *Volume 349* ***(2004)****192-205*

7- ***Title :*** **"** ***Study of polycrystalline $CuInSe_2$ thin film formation*****"**
Authors: *A. Ashour,* ***A. A. S. Akl****, A. A. Ramadan and K. Abd EL-Hady*
Journal : ***Thin Solid Films,*** *Volume 467* ***(2004)*** *300-307*

8- ***Title:*** **"** ***Microstructure and electrical properties of iron oxide thin films deposited by spray pyrolysis*****"**
Authors : ***Alaa A. Akl***
Journal : ***Applied Surface Science,*** *Volume 221* ***(2004)*** *319-329.*

9-*Title:* **"** ***Optical properties of crystalline and non-crystalline iron oxide thin films deposited by spray pyrolysis*****"**
Authors: ***Alaa A. Akl***
Journal : ***Applied Surface Science****, Volume 233* ***(2004)*** *307-319.*

10-Title: Electrical properties of stacked $CuInSe_2$ thin films

Authors: *A. Ashour, A.A. Akl, A.A. Ramadan, K. Abd El-Hady*
Journal: *J. Materials Science: Materials in Electronics; Vol.(16); issue 9 (2005)599-603*

11-Title: *"PREPARATION AND CHARACTERIZATION OF THE JUNCTION n-CuInSe$_2$/p-CdTe SOLAR CELL BY THE STACKED ELEMENTAL LAYER (SEL) TECHNIQUE"*
Authors: *A. Ashour , A. A.Ramadan , K. Abd EL-Hady, A. A. S. Akl*
Journal*: J. Optoelectronics and Advanced Materials Vol.7, No.3(2005)1493 -1498*

12-*Title:* *" Effect of solution molarity on the characteristics of vanadium pentoxide thin film"*
Authors : *Alaa A. Akl*
Journal: *Applied Surface Science, Volume 252 (2006) 8745-8750*

13- *Title :* *"Fabrication and characterization of sputtered titanium dioxide"*
Authors : *A.A.Akl*, H.Kamal and K.Abdel-Hady
Journal : *Applied Surface Science: Volume 252 (2006) 8651-8656.*

14-*Title:* *" Optical manipulation of temperature formation of CuInSe$_2$ thin films"*
Authors : A.Ashour, *A.A.Akl*, A.A.Ramadan, N.A.El-Kadry and K.Abd El-Hady
Journal : *Materials Science and Engineering : B, Volume 134 (2006) 63-67.*

15-*Title:* *"Crystallization and electrical of V_2O_5 thin films prepared by RF sputtering"*
Authors : *Alaa A. Akl*
Journal : *Applied Surface Science; Volume 253, (2007) 7094-7099.*

16-*Title:* *"Growth, microstructure, optical and electrical properties of sprayed CuInSe$_2$ polycrystalline films "*
Authors : *Alaa A. Akl* **and** H.H.Afify
Journal : *Bulletin Materials Research, Volume* 43 *(2008)* 1539–1548

17-*Title:* *" Effect of some preparative parameters on optical properties of spray deposited iridium oxide thin films"*
Authors : *S.A. Mahmoud, A.A. Akl and S.M. Al-Shomar*
Journal : **PHYSICA B:** *Condensed Matter, Volume* 404 *(2009)* 2151–2158**.**

18-*Title:* *" Nanocrystalline formation and optical properties of germanium thin films prepared by physical vapor deposition "*
Authors : *A. A .Akl and H. Howari*
Journal : *J. Physics and Chemistry of Solids, Volume 70 (2009) 1337–1343*

19-Title: *" Thermal annealing effect on the crystallization and optical dispersion of sprayed V_2O_5 thin films"*
Authors : *Alaa A. Akl*

Journal : ***J. Physics and Chemistry of Solids, Volume 71 (2010) 223–229.***

20-Title: ***"Electrical Characteristics and Nanocrystalline Formation of Sprayed Iridium Oxide Thin Films"***
Authors : ***S. A.Mahmoud, S. M. Al-Shomar and A. A. Akl***
Journal : ***Hindawi Publ. Corporation, Adv. Cond. Matter Physics, Volume 2010***

21- Title: ***" "Influence of preparation conditions on the dispersion parameters of sprayed iron oxide thin films"***
Authors : ***Alaa A. Akl***
Journal : ***Applied Surface Science, Volume 256 (2010) 7496–7503.***

22-Title: ***"Electrochromic properties and energy gap dependent on preparative condition of sprayed iridium oxide thin films".***
Authors : ***Alaa A. Akl***
Journal :Bul.of the Cat. Soc. of Ind., Volume 10, iss. (3-4) (2011)50-60.

23-Title: ***"Nanostructure, optical and electrical properties of thermally evaporated $CdS_{0.1}Se_{0.9}$ thin films with different thickness".***
Authors : ***Alaa A. Akl***
Journal :Int. J. of Mat. Eng. and Tech. Vol. 8,No 8, (2012) 105-122

24-Title:"Estimation of grain size of a deformed 5251 Al alloy using plat and XRD techniques"
Authors : *M. A.Abdel-Rahman, Ahmed.G. Attallah, M. El.sayed, A. A. Ibrahim,* ***A.A. Akl*** *, Atef E. Ali and Emad. A. Badawi*
Journal: Defects and Diffusion Forum; Vols. 337-338 (2013) 11-18

25-Title:" Microstructure characterization of Al-Mg alloys by X-ray diffraction line profile analysis"
Authors: A.A.Akl and A.S.Hassanien
Journal: International Journal of Advanced Research, V.2 (2014) 1-9

26-Title:"Influence of composition on optical and dispersion parameters of thermally evaporated non-crystalline $Cd_{50}S_{50-x}Se_x$ thin films"
Authors : ***A.S. Hassanien and Alaa A. Akl***
Journal: Journal of Alloys and Compounds 648 (2015) 280-290

27-Title:" Estimation of some physical characteristics of chalcogenide bulk $Cd_{50}S_{50-x}Se_x$ glassy systems"
Authors : ***A.S. Hassanien and Alaa A. Akl***
Journal: Journal of Non-Crystalline Solids 428 (2015) 112–120

28-Title: ***" Crystal imperfection sand Mott parameters of sprayed nanostructure IrO_2 thin films"***
Authors : ***A.S. Hassanien and Alaa A. Akl***

***Journal**: Physica B 473(2015)11–19*

***29-Title**:"Microstructure and crystal imperfections of nanosized CdS_xSe_{1-x} thermally evaporated thin films"*
***Authors :** Alaa A. Akl and A.S. Hassanien*
***Journal**: Superlattices and Microstructures 85 (2015) 67–81*

***30-Title:**" Electrical transport properties and Mott's parameters of chalcogenide cadmium sulphoselenide bulk glasses"*
***Authors :** A.S. Hassanien and Alaa A. Akl*
***Journal**: Journal of Non-Crystalline Solids 432 (2016) 471–479*

***31-Title:** " Study of optical properties of thermally evaporated ZnSe thin films annealed at different pulsed laser powers"*
Authors: AS Hassanien, KA Aly, ***Alaa A Akl***
Journal: **Journal of Alloys and Compounds; Volume 685 (2016) 733-742**

***32-Title**:" Effect of Se addition on optical and electrical properties of chalcogenide CdSSe thin films"*
***Authors :** A.S. Hassanien and Alaa A. Akl*
***Journal**: Superlattices and Microstructures 89 (2016) 153-169*

***33-Title:**"Influnce of film thickness on optical absorption and energy gap of thermally evaporated $CdS_{0.1}Se_{0.9}$ thin films"*
***Authors:** S. A. Aly and Alaa A. Akl*
***Journal:** Chalcogenide Letters, Vol. 12, No. 10, October (2015) 489 - 496*

***34-Title:**" Effect of Pulsed Laser Power Annealing on Structural and Optical Characteristics of ZnSe Thin Films"*
***Authors:** S.A. Aly, Alaa A. Akl, H. Howari*
***Journal:** Acta Physica Polonica A, Vol. 128, No.(3) (2015)414-418*

***35-Title**:"Microstructural and electrical characteristics of sprayed Tungsten oxide thin films"*
***Authors :** S. A. Aly, A. A. Akl, and D. H. Mahmoud*
***Journal**: International Journal of New Horizons in Physics 2, No. 2, (2015) 47-52*

***36-Title:**" Structure characterization and optical properties of annealed ZnSSe thin films"*
***Authors :** Alaa A.Akl , S. A. Aly, and H. Hawari*
***Journal**:Chalcogenide Letters, Volume 13, Number 5, May 2016*

***37-Title:**" Microstructural and Electrical Properties of $(WO_3)_{1-x}(MoO_3)_x$ Thin Films Synthesized by Spray Pyrolysis Technique"*
***Authors :** Alaa A.Akl , S. A. Aly, and M.A.Kaid*
***Journal**: Res. & Rev.: J. Material Sciences, Published date: 07/11/2016*

38- Title: *" Thermal Annealing Effect on the Single Oscillator Energy and Dispersion Energy of Epitaxial Growth Bilyers of ZnS/ZnSe thin Films"*
Authors : *Alaa A. Akl* **,Salah M.M. Salman**
Journal: **IJSRSET | Volume 3 | Issue 8** ***(2017) 489-494***

39-Title: ***INFLUENCE OF GROWTH CONDITIONS ON THE ELECTROCHROMIC EFFICIENCY AND THE ENERGY BAND GAP OF IRIDIUM OXIDE THIN FILMS".***
Authors : *Alaa A. Akl*, **Salah M.M. Salman and Eman Kashit**
Journal: ***Int. J. Adv. Res. 5(12) (2017) 1695-1706***

40-Title: ***"INFLUENCE OF CU/IN RATIOS AND THE GROWTH TEMPERATURE ON THE MICROSTRUCTURAL PARAMETERS OF SPRAYED CUINSE2 THIN FILMS"***
Authors: *Alaa A. Akl* and Salah M.M. Salman
Journal: ***Int. J. Adv. Res. 6(2) (2018)1450-1461***

41-Title: ***" Influence of thermal and compositional variations on conduction mechanisms and localized state density of amorphous $Cd_{50}S_{50-x}Se_x$ thin films"***
Authors: ***Ahmed Saeed Hassaniena,*** *Alaa Ahmed Akl*
Journal: **Journal of Non-Crystalline Solids 487 (2018) 28–36**

42-Title: ***"Improving microstructural properties and minimizing crystal imperfections of nanocrystalline Cu_2O thin films of different solution molarities for solar cell applications"***
Authors : *Alaa A. Akl*, ***Safwat A. Mahmoud, S.M. AL-Shomar, A.S. Hassanien***
Journal : ***Materials Science in Semiconductor Processing 74 (2018) 183-192***

43-Title: ***"Surface Morphology, Optical Conductivity, Localized States and Dielectric Constants of Sprayed Nickel Oxide Films at Different Substrate Temperatures"***
Authors: *Alaa A. Akl*, **Safwat A. Mahmoud, Salah M. M. Salman**
Journal: **IJSR*; volume (7), issue (4) (2018)935-943***

44-Title: ***" Synthesis, crystallography, microstructure, crystal defects, and morphology of $Bi_xZn_{1-x}O$ nanoparticles prepared by sol-gel technique "***
Authors: ***A.S. Hassaniena,*** *Alaa A. Akl*, ***A.H. Sa'aedie***
Journal: ***CrystEngComm, Volume 20, Issue 12 (2018)1716-1730***

45-Title: ***" Effect of growth temperatures on the surface morphology, optical analysis, dielectric constants, electric susceptibility, Urbach and bandgap energy of sprayed NiO thin films"***
Authors: *Alaa A. Akl*, ***Safwat A. Mahmoud***
Journal: ***Optik – Int. J. for Light and Electron Optics 172 (2018) 783–793***

46-Title:" ***MICROSTRUCTURE, CRYSTAL IMPERFECTIONS AND ULTRASONIC STUDIESOF SPRAYED NANOSIZED Cu $_{2-x}$ S $_x$ OAND Cu$_{2-y}$Cr$_y$OTHIN FILMS***"
Authors: ***SM Al-Shomar, MAY Barakat, SA Mahmoud, A.A. Akl***
Journal: ***DIGEST J. OF NANOMATERIALS AND BIOSTRUCTURES* 13.3 (2018): 885-901.**

47-Title:" ***Optical characteristics of iron oxide thin films prepared by spray pyrolysis technique at different substrate temperatures***"
Authors: ***Ahmed Saeed Hassanien, Alaa A. Akl***
Journal: **Applied Physics A** ;Materials Science & Processing***; Volume 124, (11) (2018) 1-16***

48-Title: ***X-Ray Studies: CO_2 pulsed laser annealing effects on crystallography, microstructure and crystal defects of vacuum deposited nanocrystalline ZnSe thin films"***
Authors: ***Ahmed Saeed Hassanien, Alaa A. Akl***
Journal: **CrystEngComm*; Volume 20 (2018) 7120.***

49-Title:" ***Optical charctrrizations and refractive index dispersion parameters of annealed TiO_2 thin films synthesized by RF-sputtering technique at different flow rates of the reactive oxygen gas"***
Authors: ***Ahmed Saeed Hassanien, Alaa A.Akl***
Journal: ***Physica B: Condensed Matter;Volume 576, (2020) 411718***

50-Title: ***" Physical and optical properties of a-Ge-Sb-Se-Te bulk and thin film samples: Refractive index and its association with electronic polarizability of thermally evaporated a-$Ge_{15-x}Sb_xSe_{50}Te_{35}$ thin- films***"
Authors: ***Ahmed Saeed Hassanien, Ishu Sharma, Alaa A. Akl***
Journal: ***Journal of Non-Crystalline Solids, Volume 531, (2020) 119853***

51-Title:" ***Estimation of The Lattice Parameters, Crystallite Size and Internal Micro Strain of $Cu_{1-x}In_xSe_2$ Thin Films by Williamson-Hall Method***"
Authors: ***Alaa Ahmed Saad Akl***
Journal: ***Determinations in Nanomedicine & Nanotechnology; Volume 1, issue 5 (2020)1-9***

52-Title:"Intensive comparative study using X-Ray diffraction for investigating microstructural parameters and crystal defects of the Novel nanostructural $ZnGa_2S_4$ thin films"
Authors: *Alaa Ahmed Akl, IM El Radaf, Ahmed Saeed Hassanien*
Journal: ***Superlattices and Microstructures, Volume143(2020)106544.***

53-Title:" Physical and optical studies of the novel non-crystalline $Cu_xGe_{20-x}Se_{40}Te_{40}$ bulk glasses and thin films"
Authors: *Ahmed Saeed Hassanien, IM El Radaf, Alaa Ahmed Akl*
Journal: ***Journal of Alloys and Compounds; (2020) 156718***

54-Title: *" ESTIMATION OF CRYSTALLITE SIZE, LATTICE PARAMETER, INTERNAL STRAIN AND CRYSTAL IMPURIFICATION OF NANOCRYSTALLINE Al3Ni20Bx ALLOY BY WILLIAMSON-HALL METHOD"*

Authors: A. A. SAAD AKL, M. ELHADI

Journal: ***Journal of Ovonic Research; Vol. 16, No. 5 (2020)323 - 335***

55-Title:" An extensive comparative study for microstructural properties and crystal imperfections of Novel sprayed Cu_3SbSe_3 Nanoparticle-thin films of different thicknesses"

Authors: Alaa Ahmed Akl, *Ahmed Saeed Hassanien, IM El Radaf,*

Journal: ***Optik – Int. J. for Light and Electron Optics,*** *Available* ***online 24 October (2020) 165837***

56-Title:" *Investigation of thermal annealing effect on the microstructure, morphology, linear and non-linear optical properties of spray deposited nanosized V2O5 thin films"*

Authors: *H. Khmissi, Safwat A. Mahmoud and Alaa Ahmed Akl*

Journal: ***Optik – Int. J. for Light and Electron Optics Volume 227, February 2021, 165979***

57-Title: "Comparative study of microstructure parameters and–crystalline defects of quaternary nanoparticles $La_{0.8-x}Ce_x$ $Ag_{0.2}$ MnO_3 alloys"

Authors: Nejeh Hamdaoui, Yashar Azizian-Kalandaragh, Boubaker Zaidi, Alaa Ahmed Akl

Journal: ***Applied Physics A: Materials Science & Processing ,127 (5)377) (2021)1-18***

58-Title:" Comparative microstructural studies using different methods: Effect of Cd-addition on crystallography, microstructural properties, and crystal imperfections of nano-structural thin $Cd_xZn_{1-x}Se$ films"

Authors: ***Alaa Ahmed Akl and Ahmed Saeed Hassanien***

Journal: ***Physica B: Condensed Matter;*** **620 (2021) 413267**

59-Title: "Effect of Ni-doping on the structural, magnetic, and electronic properties of $La_{0.2}Sr_{0.8}MnO_3$ perovskite"

Authors: ***Nejeh Hamdaoui, Dhahbi Tlili, Yashar Azizian-Kalandaragh, Boubaker Zaidi, Sadok Zemni, Alaa Ahmed Akl, and Lotfi Beji***

Journal: ***Mater Sci: Mater Electron; 21 June 2021; : 19 September 2021***

60-Title:" Comparative Studies for Determining the Optical Band-gap Energy of the Novel Polycrystalline Thin $ZnGa_2S_4$ Films Sprayed at Different Film Thicknesses"

Authors: ***Ahmed Saeed Hassanien, Alaa A Akl, IM El Radaf***

Journal: ***March 2021- DOI:10.21203/rs.3.rs-325892/v1***

Prof. Dr. Alaa Ahmed Saad Akl
Experimental of Solid State Physics

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