


## Brief Biodata

**Name: Dr Ajay Kumar Shukla**

<b>Designation:</b>	Principal Scientist	
<b>DP No. and Name:</b>	DP 2.05, QHRS & 2D Physics	
<b>DU No. and Name:</b>	DU 2.0, Electrical & Electronics Metrology	
<b>Email:</b>	shuklaak@nplindia.org	
<b>Date of Joining CSIR-NPL:</b>	14 September 2011	
<b>Phone (office)</b>	011-45609329	
<b>Mobile (optional)</b>		

### Research Area/ Interest

Investigation of electronic structure using photoemission spectroscopy (PES), Growth of Epitaxial Graphene on SiC and its functional interfaces, Defect induced electronic structure engineering of oxides, Two-dimensional electron/gas at oxide heterostructures, Study of atomic structure of surfaces using LEED and STM, Quasicrystals, Design and development of high/ultra-high vacuum growth systems.

### Educational Qualifications

*(Please write latest qualification first)*

Degree	Subject	University/ Institute	Year
Ph.D.	Physics	UGC-DAE Consortium for Scientific Research, Indore, India / Devi Ahilya Bai Vishwavidyalay, Indore, India	2008
M.Sc.	Physics	Jiwaji University, Gwalior, India	1999

### Academic / Research Experience

Grade / Post	Institute	Duration		Research Field
		From	To	
Principal Scientist	CSIR-NPL	September 2019	Present	Growth of Epitaxial graphene and its interfaces with functional materials, Electronic structure tuning of oxides through defect engineering, 2DEG
Senior Scientist	CSIR-NPL	September 2015	September 2019	Electronic structure of oxide surfaces and heterostructures, 2DEG at oxide interfaces, III-Nitrides and oxides
Scientist	CSIR-NPL	September 2011	September 2015	Electronic structure of thermoelectric materials, III-Nitrides and oxides
Post-doctoral Fellow	University of Warwick, UK	February 2010	September 2011	Electronic structure of III-Nitrides and Oxides using PES
Post-doctoral Fellow	Institute Jean Lamur, CNRS, Nancy, France	December 2007	December 2009	Quantum size effects in thin metallic films on quasicrystalline and CMA surfaces using PES, LEED and STM

## No. of Publications

No. of Publications in SCI Journals	No. of Publications in non-SCI Journals	No. of Publications in Conference Proceedings	Books	Total
52		15	1	68

## Selected Publications

1. Metal-to-insulator transition in  $\text{LaAl}_{1-x}\text{Cr}_x\text{O}_3/\text{SrTiO}_3$  oxide heterostructures guided by electronic reconstruction, Pramod Kumar, Prabir Pal, A. K. Shukla, J. J. Pulikkotil, and Anjana Dogra, *Phys. Rev. B* 91, 115127 (2015).
2.  $\text{LaScO}_3/\text{SrTiO}_3$ : A conducting polar heterointerface of two 3d band insulating perovskites, Sumit Kumar, Jyoti Kaswan, Biswarup Satpati, A. K. Shukla, Bhasker Gahtori, J. J. Pulikkotil and Anjana Dogra, *Appl. Phys. Lett.* 116, 051603 (2020).
3. Structure, magnetism, and electronic properties in 3d–5d based double perovskite  $(\text{Sr}_{1-x}\text{Ca}_x)_2\text{FeIrO}_6$  ( $0 \leq x \leq 1$ ), K. C. Kharkwal, Roumita Roy, Harish Kumar, A. K. Bera, S. M. Yusuf, A. K. Shukla, Kranti Kumar, Sudipta Kanungo, and A. K. Pramanik *Phys. Rev. B* 102, 174401 (2020).
4. ZnO-rGO nanocomposite based bioelectrode for sensitive and ultrafast detection of dopamine in human serum, Shilpi Verma, Priyanshu Arya, Anu Singh, Jyoti Kaswana, Ajay Shukla, Hemant R. Kushwaha, Shalini Gupta, Surinder P. Singh, *Biosensors and Bioelectronics* 165, 112347 (2020).
5. Graphene boosts thermoelectric performance of a Zintl phase compound, A. Bhardwaj, A. K. Shukla, S. R. Dhakate and D. K. Misra, *RSC Adv.* 5, 11058 (2015).
6. Structural, optical and electronic properties of homoepitaxial GaN nanowalls grown on GaN template by laser molecular beam epitaxy S. S. Kushvaha, M. Senthil Kumar, A. K. Shukla, B. S. Yadav, Dilip K. Singh, M. Jewariya, S. R. Ragama and K. K. Maurya, *RSC Adv.* 5, 87818 (2015).
7. Direct growth of self-aligned single-crystalline GaN nanorod array on flexible Ta foil for photocatalytic solar water-splitting, Prashant Tyagi, Ch Ramesh, Jyoti Kaswan, Swati Dhua, Subish John, Ajay Kumar Shukla, Somnath C. Roy, Sunil Singh Kushvaha, Senthil Kumar Muthusamy, *Journal of Alloys and Compounds* 805, 97 (2019).
8. Quasiperiodic ordering in thick Sn layer on i-Al-Pd-Mn: A possible quasicrystalline clathrate, Vipin Kumar Singh, Marek Mihalkovic, Marian Krajčí, Shuvam Sarkar, Pampa Sadhukhan, M. Maniraj, Abhishek Rai, Katariina Pussi, Deborah L. Schlagel, Thomas A. Lograsso, Ajay Kumar Shukla, and Sudipta Roy Barman, *Phys. Rev. Research* 2, 013023 (2020).
9. Quantum size effects in Ag thin films grown on the fivefold surface of the icosahedral Al-Cu-Fe quasicrystal: Influence of the growth temperature, A. K. Shukla, J. Ledieu, E. Gaudry, D. M. Wu, T. A. Lograsso and V. Fournée, *Journal of Vacuum Science & Technology A* 40, 013212 (2022).
10. Structural investigation of the (110) surface of  $\gamma\text{-Al}_4\text{Cu}_9$ , É. Gaudry, A. K. Shukla, T. Duguet, J. Ledieu, M.-C. deWeerd, J.-M. Dubois, and V. Fournée, *Phys. Rev. B* 82, 085411 (2010).
11. Quasiperiodic layers of free-electron metals studied using electron diffraction, A. K. Shukla, R. S. Dhaka, S. W. D'Souza, Sanjay Singh, D. Wu, T. A. Lograsso, M. Krajčí, J. Hafner, K. Horn, and S. R. Barman.
12. Influence of sp-d hybridization on the electronic structure of Al-Mn alloys, A. K. Shukla, C. Biswas, R. S. Dhaka, S. C. Das, P. Krüger, and S. R. Barman, *Phys. Rev. B* 77, 195103 (2008).
13. Understanding the 2p core-level spectra of manganese: Photoelectron spectroscopy experiments and Anderson impurity model calculations, A. K. Shukla, P. Krüger, R. S. Dhaka, D. I. Sayago, K. Horn, and S. R. Barman, *Phys. Rev. B* 75, 235419 (2007).
14. Growth and electronic structure of alkali-metal adlayers on icosahedral  $\text{Al}_{70.5}\text{Pd}_{21}\text{Mn}_{8.5}$ , A. K. Shukla, R. S. Dhaka, C. Biswas, S. Banik, S. R. Barman, K. Horn, Ph. Ebert, and K. Urban, *Phys. Rev. B* 73, 054432 (2006).
15. Argon Nanobubbles in Al(111): A Photoemission Study, C. Biswas, A. K. Shukla, S. Banik, S. R. Barman, and Aparna Chakrabarti, *Phys. Rev. Lett.* 92, 115506 (2004).

## Patents

--

### **Current Activities**

*(Not more than 100 words)*

Currently, I am involved in two main activities: (1) Growth of Epitaxial Graphene on SiC for realization of indigenous Quantum Hall Resistance Standard (2) Tuning of electronic structure of oxide surfaces and interfaces. My group has designed and developed a state-of-the-art growth system for epitaxial graphene growth on SiC. We are also exploring to integrate epitaxial graphene with Oxides, III-Nitrides and other 2D materials with an aim to tune electronic structure of these functional interfaces and to create quantum devices. We are also working on defect and band gap engineering of oxide surfaces and heterostructures.

### **Honour(s)/Award(s)/ Fellowship(s)**

Visiting Scientist Fellowship awarded by Max-Planck Institute for Chemical Physics of Solids (MPI-CpFS), Dresden, Germany in 2015 and 2016.

### **Contributions to AcSIR**

1. Associate Professor, AcSIR
2. Supervision/co-supervision of AcSIR PhD students

### **Membership of Professional Societies/ Institutions**

### **Any other Information**

*(Not more than 100 words)*

#### **Experience in experimental techniques and instrumentation:**

- More than 19 years of experience of designing, installing and handling of Ultra-high vacuum systems.
- Experience of handling sophisticated multi-technique (ARPES, XPS, UPS, STM, LEED) surface science experimental stations as main responsible. Experience of working with large scale facilities like Synchrotron sources.
- A versatile Knudsen type effusion cell has been fabricated for growing nanostructures and epitaxial layers of metals and semiconductors (Rev. Sci. Instrum. **75**, 4467 (2004).)
- A k-resolved inverse photoemission spectrometer had been fabricated to study the unoccupied band structure of solids. (Rev. Sci. Instrum., **76**, 066102 (2005) and Current Science, **90**, 490 (2006))