Department of Electronics and Telecommunication Engineering in association with IETE Students' Forum and IETE Bhopal Centre organized an

Expert Talk on Design and Simulation of Lead-Free Inorganic Solar Cells By Dr. Sachchidanand

(24 August 2025)

An Expert Talk on "**Design and Simulation of Lead-Free Inorganic Solar Cells**" organized by the IETE Bhopal Chapter in collaboration with the Department of Electronics Engineering, MITS Gwalior, **on 24 August 2025**.

The event began with a welcome address by **Student Coordinator Medhavi Agrawal**. Coordinator Medhavi Agrawal then introduced **Dr. Sachchidanand** to the audience and invited him to commence the session.

Dr. Sachchidanand is an **Assistant Professor** in the Department of Electronics and Communication Engineering, School of Engineering and Sciences, **SRM University, AP**. He earned his **Ph.D.** from **PDPM IIITDM Jabalpur** in the area of **lead-free inorganic perovskite solar cells (PSC)**, and holds a **B.Tech. in Electronics and Communication Engineering** and an **M.Tech. in VLSI Design**.

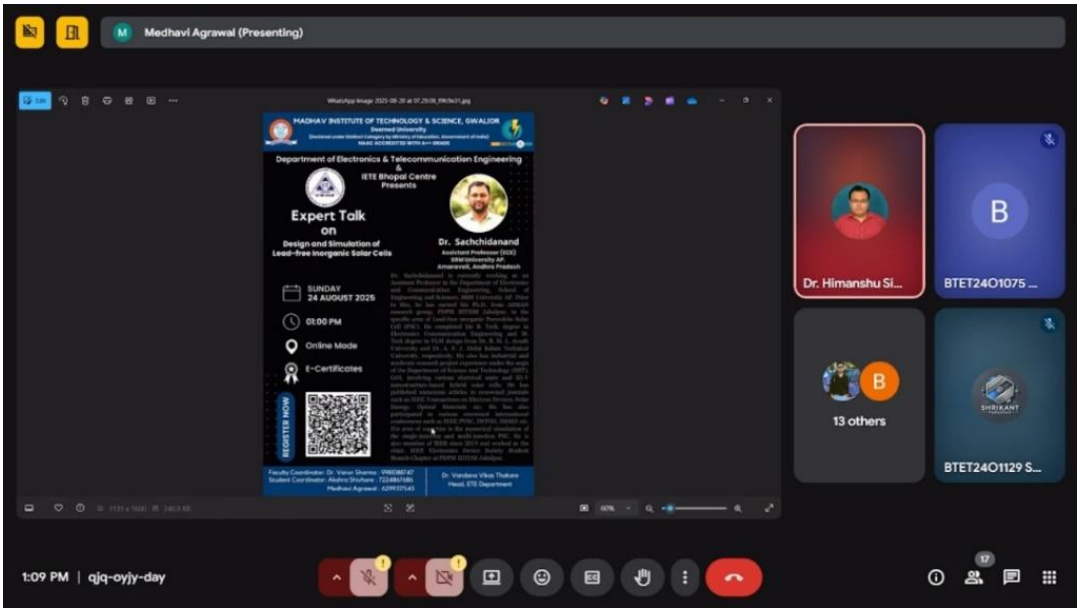
He has worked on **DST-funded research projects** involving electrical units and III–V nanostructure-based hybrid solar cells, and has published in reputed journals such as **IEEE Transactions on Electron Devices, Solar Energy,** and **Optical Materials**. His expertise lies in the **numerical simulation of single- and multi-junction PSCs**. He is a **member of IEEE since 2019** and has served as **Chair of the IEEE Electron Devices Society Student Branch Chapter** at PDPM IIITDM Jabalpur.

The session concluded with a **vote of thanks** delivered by **Dr.Varun Sharma.**

This activity was coordinated by **Dr. Varun Sharma** under the guidance of **Dr. Pramod Kumar Singhal** (Dean, Quality Assurance) and **Dr. Vandana Vikas Thakare** (Head of the Department, Electronics Engineering).

In total, more than 50 participants attended the talk via Google Meet. The event successfully fostered curiosity and enthusiasm for AI/ML career paths in both academia and industry, making it a memorable and enriching experience.

Glimpse of the expert talk by Dr. Sachchidanand



Sachchidanand Arjun Prasad (Presenting)

SRM UNIVERSITY AP
Andhra Pradesh

ASMAN

An
Expert Talk
on

Design and Simulation of Lead-free Inorganic Solar Cells

Presented by:
Dr. Sachchidanand
Assistant Professor, ECE
SRM University AP

SEAS, Electronics and Communication Engineering, SRM University AP

Sachchidanand ...
Dr. Himanshu Si...
25 others
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1:14 PM | qjq-oyjy-day

Sachchidanand Arjun Prasad (Presenting)

Dr. Sachchidanand
PhD, ASMAN Research Group,
PDPM IIITDM Jabalpur, MP

5+ years of experience in research on ***Solar Cells*** with highly reputed publications.

Awards:
- Qualified GATE 2013, 2018 and 2024
- Fellowship for Training of Young Scientists from MPCST in 2021

Google Scholar Snipet:
- Citations: 163
- H-index: 5
- I10-index: 5

URL:
https://srmap.edu.in/faculty/sachchidanand/
6/24/2025

Contact

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+91 9718585318

Email Address:
sachchidanand.a@srmap.edu.in,
sachbade@gmail.com

Education

- **UG** B. Tech. (ECE) – 2009 – Dr. R. M. L. Avadh University Ayodhya, UP
- **PG** M. Tech. (VLSI Design) – 2018 – Dr. A. P. J. Abdul Kalam Technical University Lucknow, UP
- **PhD** Ph. D. (ECE) – 2024 – PDPM IIITDM Jabalpur, MP

Membership

- IEEE Graduate Student Member [93857851],
- IEEE Society Membership: EDS and NTC

Skills

Softwares:
Ansys Lumerical, COMSOL Multiphysics, MATLAB, SCAPS-1D, Sentaurus, OriginPro, etc.

Fabrication Techniques:
Co-precipitation, Hydrothermal, Solvothermal, Chemical Vapor Deposition (CVD), etc

Characterizations:
X-ray diffraction (XRD), Electrochemical Impedance Spectroscopy (EIS), Fourier Transform Infrared (FTIR) Spectroscopy etc.

Languages:
C, Embedded C, Verilog HDL, etc.

Experience

- **2024 - Present** Assistant Professor – SRM University AP – ECE
- **2018 - 2019** Junior Research Fellow – PDPM IIITDM Jabalpur – 01Y 01M – Research on HSC
- **2010 - 2011** Graduate Trainee – HAL Lucknow – 01Y – R&D in EE

ADVANCES MATERIALS FOR SUSTAINABLE ENERGIES - ECT - IIITDM JABALPUR 2

Sachchidanand ...
Dr. Himanshu Si...
24 others
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Sachchidanand Arjun Prasad (Presenting)

Generation of Solar Cells (SCs)

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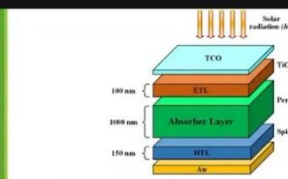
Sachchidanand Arjun Prasad (Presenting)

A novel lead-free absorber

- Solar Cell Capacitance Simulator in One Dimension (SCAPS-1D) involved equation given in (1) - (3).
- All simulations are performed under AM1.5G spectrum standard with incident light power of 100 mWcm^{-2} at 300 K.



The novel lead-free inorganic $Cs_3Sb_2Br_9$ based perovskite solar cells (PSCs): the proposed schematic[9].

- **TCO**: Transparent Conducting Oxide
- **TiO_2**: Titanium Dioxide
- **Spiro-OMeTAD**: 2,2',7,7'-Tetrakis[N,N-di(4-methoxyphenyl) amino]-9,9'-spirobifluorene
- **Au**: Gold

$$\varepsilon_0\varepsilon(x)\frac{\partial}{\partial x}\left(\frac{\partial \Psi}{\partial x}\right) = q\left[n - p + N_A^- - N_D^+ - \frac{D_{defect}}{q}\right] \quad (1)$$

$$G_p - R_{net} = \frac{\partial p}{\partial t} + \frac{\partial J_p}{\partial x} \quad (2)$$

$$G_n - R_{net} = \frac{\partial n}{\partial t} + \frac{\partial J_n}{\partial x} \quad (3)$$

[9]Sachchidanand, V. Garg, A. Kumar, and P. Sharma, *Optical Materials*. Vol 122:111715, 2021.

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Dr. Himanshu Si...
30 others
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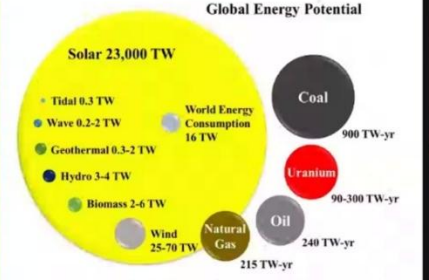
Sachchidanand Arjun Prasad (Presenting)

Why Solar Energy?

- Earth receives approximately 1366 W/m² of sunlight [1].
- Directly converted into electrical energy using photovoltaic (PV) cells.
- Solar energy – the very huge bunch for energy harvesting source for user applications.



The Global Energy Potential Worldwide[2].

[2] https://batteryconsult.ch/wp-content/uploads/2022/05/globalenergyrpotentialperez1.png

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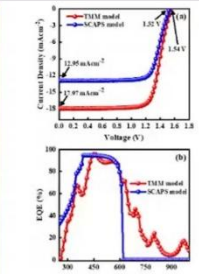
Electrical Simulation



Electrical simulation results of $Cs_3Sb_2Br_9$-based PSC (a) J-V, and (b) EQE characteristics.

Electrical performance of the lead-free $Cs_3Sb_2Br_9$-based PSC and a comparison among other lead-free PSCs

Structures	V_{OC} (V)	J_{SC} (mAcm^{-2})	FF (%)	PCE (%)	References
FTO/TiO_2/$MA_3Bi_2I_9$/Spiro-OMeTAD/Carbon	0.76	2.75	54.00	1.12	[10]
FTO/TiO_2/$Cs_2AgBiBr_6$/Spiro-OMeTAD/Au	0.98	3.93	63.00	2.43	[11]
FTO/TiO_2/$Cs_3Bi_2I_9$/CuI/Au	0.86	5.78	64.38	3.20	[12]
ITO/TiO_2/$MASnI_3$/Spiro-OMeTAD/Au	0.79	13.40	52.00	5.49	[6]
ITO/TiO_2/$CsSnBr_3$/Spiro-OMeTAD/Au	0.85	21.23	58.00	10.46	[7]
ITO/TiO_2/$MAPbI_3$/Spiro-OMeTAD/Au	1.09	20.61	66.80	15.60	[13]
ITO/TiO_2/$Cs_3Sb_2Br_9$/Spiro-OMeTAD/Au (SCAPS Model)	**1.52**	**12.95**	**74.96**	**14.84**	**[Our work][a]**
ITO/TiO_2/$Cs_3Sb_2Br_9$/Spiro-OMeTAD/Au (TMM Model)	**1.54**	**17.97**	**74.61**	**20.67**	**[Our work][a]**

[a]Sachchidanand, A. Kumar, and P. Sharma, ***Solar Energy***, Vol 259, 63-71, 2023.

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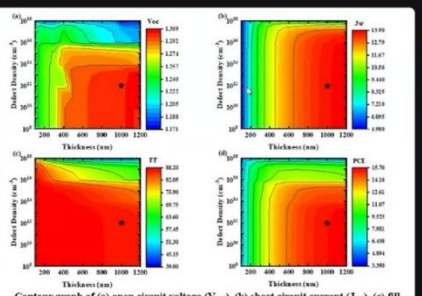
Sachchidanand Arjun Prasad (Presenting)

Thickness and defect density optimization

- Optimal value for thickness and defect density concluded as 1000 nm and 1×10^{12} cm^{-3} with maximum PCE of 15.69%.
- Star symbol shows the optimum absorber thickness and defect density



Contour graph of (a) open circuit voltage (V_{OC}), (b) short circuit current (J_{SC}), (c) fill factor (FF), and (d) power conversion efficiency (PCE) dependency on absorber thickness and defect density.[6]

[6]Sachchidanand, V. Garg, A. Kumar, and P. Sharma, ***Optical Materials***, Vol 122:111715, 2021.

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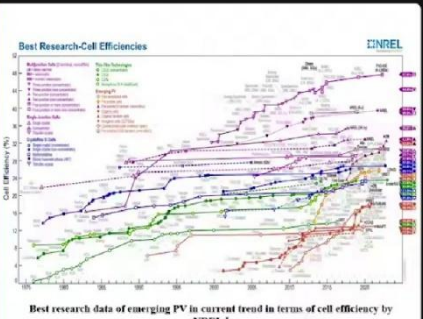
Sachchidanand Arjun Prasad (Presenting)

Current trends in SCs

- Since 1976, National Renewable Energy Laboratory (NREL) maintain the best cell efficiency for different types of SCs.[5]
- 3rd Generation emerging SCs show remarkable cell efficiency.
- Perovskite-based SCs (PSCs) show excellent performance in the last decades.



Best research data of emerging PV in current trend in terms of cell efficiency by NREL.[5]

[5] E. Alta. "Best Research-Cell Efficiencies." *Nrel*, p. 1. 2025.

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List of Attendees

1	PRIYANSHU PATEL	27	Arshad Khan
2	Harsh Arya	28	Rishiraj Sharma
3	Ajay Dhakad	29	Hariom Vishwakarma
4	Harsh Rajak	30	Naman kumar Mishra
5	Shubham patel	31	MR INDRESH DHAKAD
6	Shubham patel	32	Golu
7	KAJAL TYAGI	33	Prabhat Patel
8	Sachin Sharma	34	NITIN JATAV
9	Dhruv Tiwari	35	Vansh Kirar
10	Ankit Sahu	36	Prabhat Patel
11	Neelkant Rathour	37	Shruti Vishwakarma
12	Mradul Garg	38	HARSH YADAV
13	RATNESH INCHURKAR	39	Krishna Agrawal
14	Rishiraj Sharma	40	Mohd Rehan Qureshi
15	Aditya Raj Sahu	41	Khushi Dhakad
16	Kush bagora	42	Lavkush Prajapati
17	Aradhya Dixit	43	Anish Malaiya
18	KSHITIJ KANUNGO	44	LOVEKUSH SHARMA
19	Anshika Gupta	45	Kartik Kushwah
20	Devdatt Singh	46	ARYAN CHOUHAN
21	Priyanshu Soni	47	Harsh Thapak
22	Riya Malik	48	Daya Sagar Mudgal
23	Pramod Kushwaha	49	Krishnjeet Yadav
24	Satyam dubey	50	Om Pratap Singh
25	Nidheesh Prajapati	51	Nagendra Singh Sikarwar
26	ADITYA PRATAP SINGH BHADORIYA	52	Ankit Sahu

54	Shrikant Parashar	56	Aditya
54	RATNESH INCHURKAR	57	Heeral Verma
55	Aman Dangi		

Dr. Himanshu Singh
(Faculty Coordinator)

Dr. Vandana Vikas Thakare
(Head of the Department)