

Manipal University Jaipur

Department of Physics

Webinar On Blend of Physics & Materials

Report 1

Title of Talk: PHOTONIC CRYSTALS OSCILLATORS

Speaker



Eduardo Lugo PhD

Associate Researcher

Faubert Lab, School of Optometry, Quebec, Canada

Convener of the Event: Dr. Sushil Kumar Jain Date of the Event: 23/06/2021

Flyer of the event

MANIPAL UNIVERSITY JAIPUR

Decennial Year Celebration
Blend of Physics and Materials
 An Online Webinar Series Hosted
 by
Department of Physics
 (For UG/PG/Research Scholars & Faculty members)

Join us on 23rd June 2021
From 10:00 AM to 12:00 PM
(Online Platform: MS Team)


Speaker 1


 Eduardo Lugo
 Associate Researcher
 Faubert Lab, School of Optometry, Quebec, Canada

Topic: Photonic Crystals Oscillators
Time: 10:15 AM to 11:00 AM

Link for registration:
<https://forms.gle/KmaA2jXVVJ6aJ6ko8>

Speaker 2


 Dr. Dinesh Kumar Shukla, Scientist E
 Novel Materials Laboratory
 UGC-DAE Consortium for Scientific Research Indore

Topic: X-ray scattering studies of BaTiO₃ based ferroelectrics
Time: 11:00 AM to 11:45 AM

Convener of the Event
 Email: sushilkumar.jain@jaipur.manipal.edu
 Mob no. 8003599914, 9828034055

*e-certificate to all participants

For more information:
<https://jaipur.manipal.edu/os/schools-faculty/schools-list/s/obs/dept-of-physics.htm>

About the Speaker

J. Eduardo Lugo received his PhD degree in physics from Morelos State University, Cuernavaca, Mor., Mexico. His research involved experimental and theoretical studies of porous silicon nanostructures. He was a professor in the Department of Physics at Morelos State University, where his research focused on porous silicon multilayers and molecular dynamics simulations; and he was professor at the Center for Energy Research of the National Autonomous University of Mexico (UNAM), where his work entailed research on the electro-optical properties of nanostructures and multilayer filters. He was a postdoctoral fellow in the Electrical and Computer Engineering Department and the Center for Future Health at the University of Rochester, Rochester, NY, working with biosensors and photonic bandgap materials based on nanostructures of silicon; and at the Photonic Systems Group in the Electrical and Computer Engineering Department at McGill University, Montreal, QC, Canada, working with OE-VLSI systems. Currently, he is associated at the Faubert Lab, School of Optometry, Quebec, Canada, where he is looking for new photonic applications.

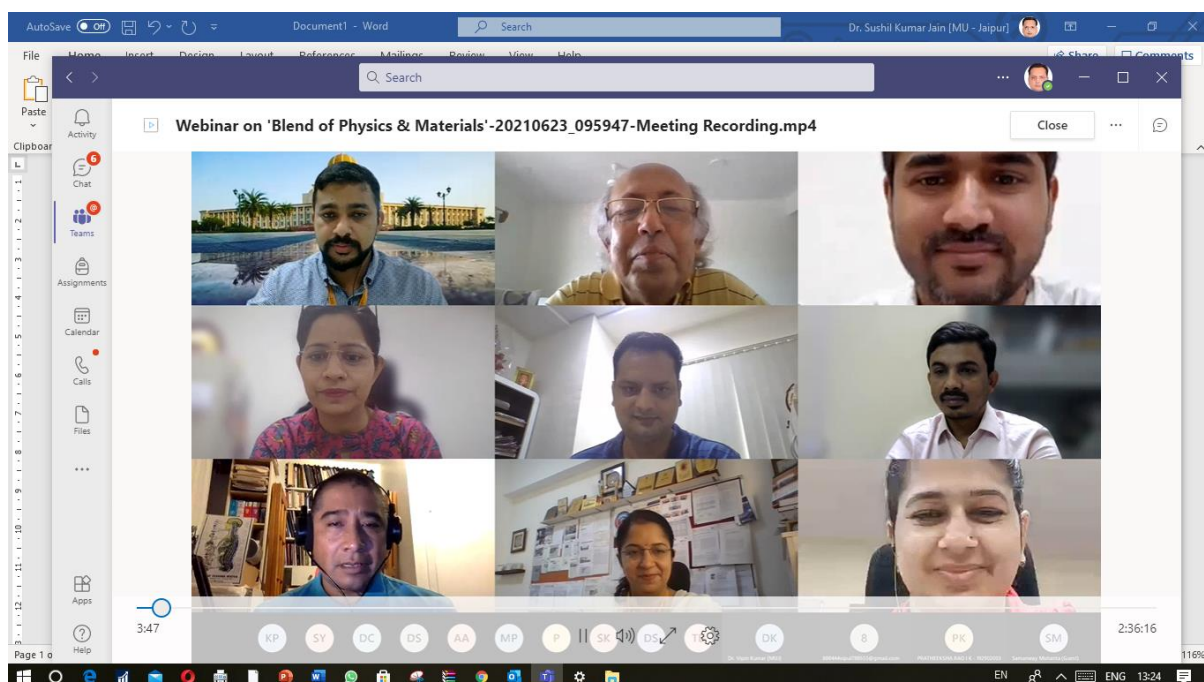
Abstract of the talk

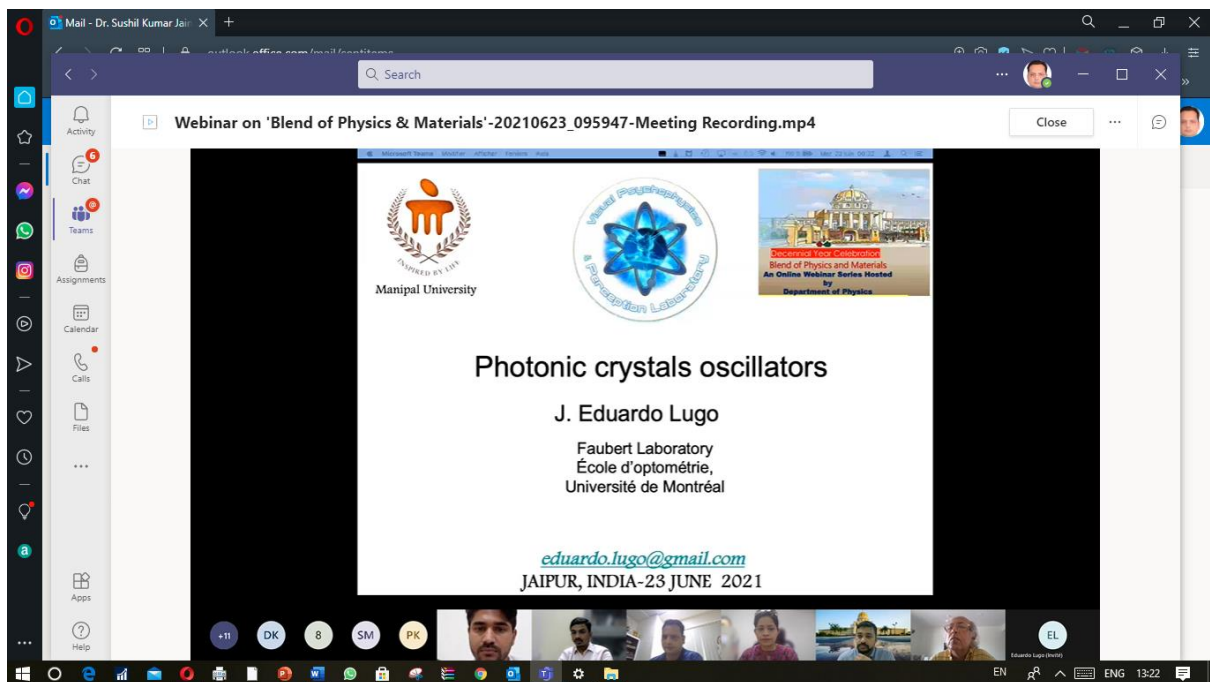
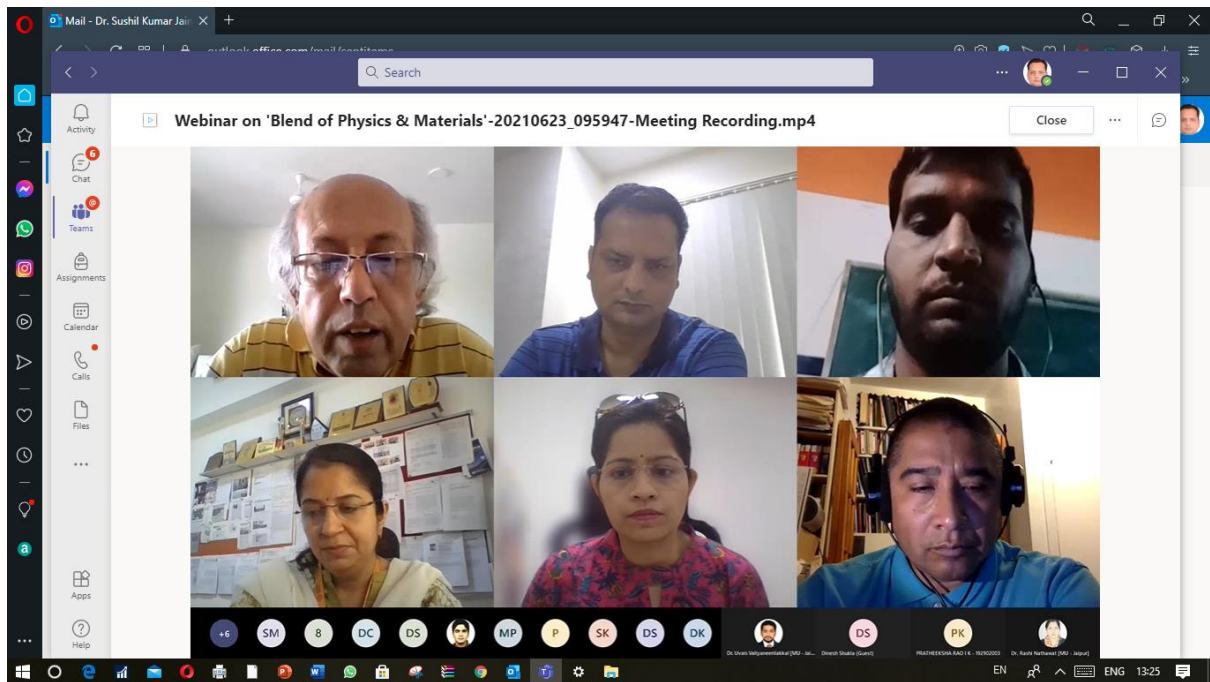
Photonic crystals have been an object of interest because of their properties to inhibit specific wavelengths and allow the transmission of others. Using these properties, we have designed a microcavity of Porous Silicon using two one-dimensional photonic crystals with an air defect between them. When we illuminate the microcavity with the appropriate light wavelength an electromagnetic force within the structure is generated. These electromagnetic forces allow the microcavity to oscillate mechanically and we have named such a device Photodyne. Experimentally, we have characterized the maximum displacement of several photodynes by using different driven frequencies and light powers. The displacements were put in evidence using a commercial vibrometer and by interferometry. From these measurements, it is

possible to estimate the generated forces. Finally, we induced mechanical self-oscillations. The electromagnetic force generated within the whole photonic structure, by light is enough to overcome energy losses and sustain self- oscillations at two different frequencies. From these mechano-optical measurements, we estimated the stiffness and Young's modulus of porous silicon and compared the results with values reported elsewhere and with values estimated herein by a mechanical method.

A possible application of these oscillators also discussed.

Photographs of the event



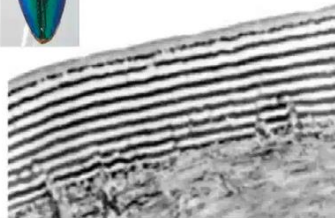




1-D photonic crystals

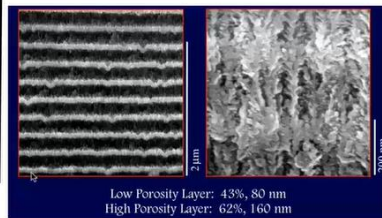


Golden Bugs
Cicindela scutellaris



Ainsley E. Seago et al. (2008)

Porous silicon



Low Porosity Layer: 43%, 80 nm
High Porosity Layer: 62%, 160 nm

S. Chan (2000)

+22

8

PK

DS

DK

Take home message

Oscillations are ubiquitous

Gravitational oscillations

Gravitational waves
The technology that will detect gravitational waves and the results are expected to prove that Einstein's theory is correct

Electron oscillations

Electromagnetic oscillations

Electric Field
Magnetic Field
Direction

Plasma oscillations-magnetosphere

00:28:04

8

PK

DS

DK

DM

02:08:12

EN

ENG

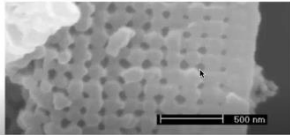
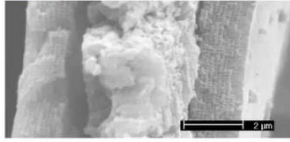
14:48



2-D photonic crystals

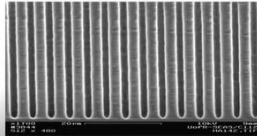
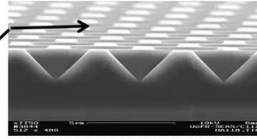


Pavo muticus
Peacock feather



Jin Zi et al. (2003)

Macro-Porous silicon



H. Lopez (2000)

00:33:33

8 PK SM DK

Dr. Rishi Nathawat [M2 - Jigar] Dr. Sushil Kumar Jain [M2 - Jigar]

Dr. Dhruv Vaidyanathan [M2 - Jigar] Dr. Arshita Bagaria [M2 - Jigar] Dr. Shikha (Guest)

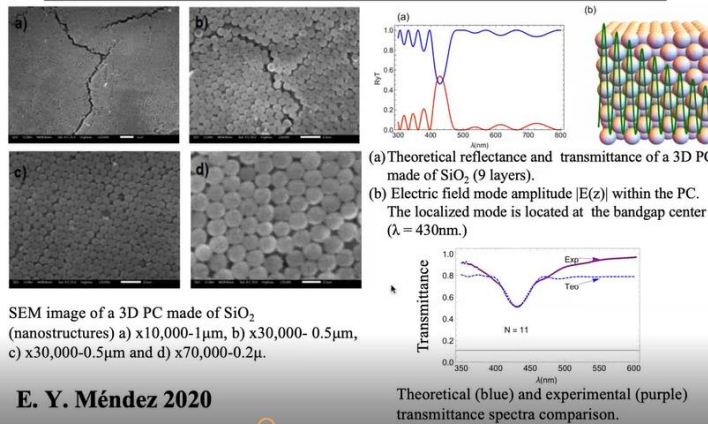
Arshita Sharma [M2 - Jigar]

EN ENG 14:48



3D Photonic crystal oscillator

Current work



E. Y. Méndez 2020

01:06:01

8 PK SM DK Dr. Rishi Nathaniel [M2 - Jaipur] Dr. Sushil Kumar Jain [M2 - Jaipur] Dr. Urvash Vaidyanathan [M2 - Jaipur] Dr. Anshu Bagaria [M2 - Jaipur] Dr. Shreshth Shukla [Guest] Anshu Sharma [M2 - 2020]

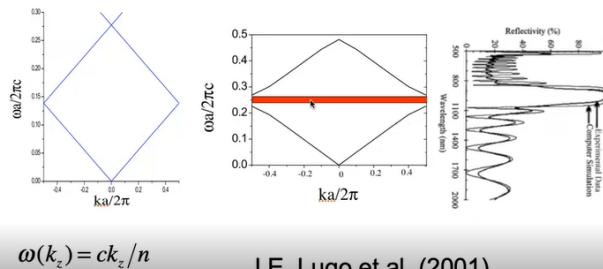
←



Photonic crystals

1D

Normal incidence $\vec{k}_{\parallel} = 0$



01:12:52

8 SM DK Dr. Rishi Nathaniel [M2 - Jaipur] Dr. Sushil Kumar Jain [M2 - Jaipur] Dr. Urvash Vaidyanathan [M2 - Jaipur] Dr. Anshu Bagaria [M2 - Jaipur] Dr. Shreshth Shukla [Guest] Anshu Sharma [M2 - 2020]

Webinar on 'Blend of Physics & Materials'-20210623_095947-Meeting Recording.mp4

Current work

R. Jimenez, 2020

Attendance list

Full Name	User Action	Timestamp
Dr. Sushil Kumar Jain [MU - Jaipur]	Joined	6/23/2021, 9:39:47 AM
Sandhya Kattayat	Joined before	6/23/2021, 9:39:47 AM
Sandhya Kattayat	Left	6/23/2021, 11:23:44 AM
Dr. Anoop Kumar Mukhopadhyay [MU - Jaipur]	Joined	6/23/2021, 9:41:57 AM
Dr. Anoop Kumar Mukhopadhyay [MU - Jaipur]	Left	6/23/2021, 10:31:12 AM
Dr. Ashima Bagaria [MU - Jaipur]	Joined	6/23/2021, 9:43:50 AM
eduardo.lugo (Guest)	Joined	6/23/2021, 9:45:57 AM
eduardo.lugo (Guest)	Left	6/23/2021, 9:46:00 AM
eduardo.lugo (Guest)	Joined	6/23/2021, 9:47:16 AM
eduardo.lugo (Guest)	Left	6/23/2021, 9:47:18 AM
eduardo.lugo (Guest)	Joined	6/23/2021, 9:47:38 AM
eduardo.lugo (Guest)	Left	6/23/2021, 9:47:39 AM
Samriddh Kumar Singh [ECE - 2020]	Joined	6/23/2021, 9:47:17 AM
Samriddh Kumar Singh [ECE - 2020]	Left	6/23/2021, 9:47:21 AM

palaktarachandani (Guest)	Joined	6/23/2021, 9:48:39 AM
palaktarachandani (Guest)	Left	6/23/2021, 10:34:37 AM
palaktarachandani (Guest)	Joined	6/23/2021, 10:34:58 AM
Eduardo Lugo (Invité) (Guest)	Joined	6/23/2021, 9:53:16 AM
Eduardo Lugo (Invité) (Guest)	Left	6/23/2021, 11:21:09 AM
Dr. Uvais Valiyaneerilakkal [MU - Jaipur]	Joined	6/23/2021, 9:53:36 AM
mpatel1439 (Guest)	Joined	6/23/2021, 9:53:45 AM
Dr. Vipin Kumar [MUJ]	Joined	6/23/2021, 9:54:16 AM
Dr. Anupam Sharma [MU - Jaipur]	Joined	6/23/2021, 9:54:32 AM
Dr. Anupam Sharma [MU - Jaipur]	Left	6/23/2021, 11:39:00 AM
Dr. Rashi Nathawat [MU - Jaipur]	Joined	6/23/2021, 9:54:41 AM
888444vipul788555@gmail.com (Guest)	Joined	6/23/2021, 9:54:44 AM
Samanway Mohanta (Guest)	Joined	6/23/2021, 9:55:22 AM
Dr. Lalita Ledwani [MU - Jaipur]	Joined	6/23/2021, 9:57:05 AM
Dr. Lalita Ledwani [MU - Jaipur]	Left	6/23/2021, 10:31:40 AM
pratibha singla (Guest)	Joined	6/23/2021, 9:57:06 AM
pratibha singla (Guest)	Left	6/23/2021, 9:59:08 AM
Dr. Satyapal Singh Rathore [MU - Jaipur]	Joined	6/23/2021, 9:57:21 AM
Dr. Satyapal Singh Rathore [MU - Jaipur]	Left	6/23/2021, 11:30:08 AM
pratheeksha.k2 (Guest)	Joined	6/23/2021, 9:58:47 AM
pratheeksha.k2 (Guest)	Left	6/23/2021, 11:07:56 AM
Dinesh Shukla (Guest)	Joined	6/23/2021, 10:00:26 AM
Dr Veenu Sisodia (Guest)	Joined	6/23/2021, 10:00:53 AM
Sagar Yadav [ECE - 2020]	Joined	6/23/2021, 10:01:22 AM
Sagar Yadav [ECE - 2020]	Left	6/23/2021, 10:08:41 AM

Dr. Saikat Chattopadhyay [MU - Jaipur]	Joined	6/23/2021, 10:01:24 AM
Tara Chand Badiwal [Ph.D (SBS) - 2021]	Joined	6/23/2021, 10:01:36 AM
Tara Chand Badiwal [Ph.D (SBS) - 2021]	Left	6/23/2021, 11:08:30 AM
Tara Chand Badiwal [Ph.D (SBS) - 2021]	Joined	6/23/2021, 11:10:08 AM
Tara Chand Badiwal [Ph.D (SBS) - 2021]	Left	6/23/2021, 11:20:47 AM
Tara Chand Badiwal [Ph.D (SBS) - 2021]	Joined	6/23/2021, 11:34:22 AM
Ashutosh Anand (Guest)	Joined	6/23/2021, 10:02:06 AM
Ashutosh Anand (Guest)	Left	6/23/2021, 10:31:32 AM
krishnabp204 (Guest)	Joined	6/23/2021, 10:02:56 AM
krishnabp204 (Guest)	Left	6/23/2021, 10:04:30 AM
krishnabp204 (Guest)	Joined	6/23/2021, 10:29:42 AM
krishnabp204 (Guest)	Left	6/23/2021, 10:43:33 AM
Arpana Pal Sharma [PhD - 2020]	Joined	6/23/2021, 10:05:15 AM
devishasanandiya0638 (Guest)	Joined	6/23/2021, 10:05:16 AM
VIKRAM SHREE VATS (Guest)	Joined	6/23/2021, 10:05:54 AM
VIKRAM SHREE VATS (Guest)	Left	6/23/2021, 10:12:31 AM
nitin chaudhary (Guest)	Joined	6/23/2021, 10:09:25 AM
cool91rajesh@gmail.com (Guest)	Joined	6/23/2021, 10:11:43 AM
cool91rajesh@gmail.com (Guest)	Left	6/23/2021, 10:40:45 AM
hiralodedra103 (Guest)	Joined	6/23/2021, 10:12:55 AM
hiralodedra103 (Guest)	Left	6/23/2021, 10:37:36 AM
vsvats72 (Guest)	Joined	6/23/2021, 10:14:07 AM
pratibha singla (Guest)	Joined	6/23/2021, 10:16:20 AM
pratibha singla (Guest)	Left	6/23/2021, 10:18:44 AM
SMRITI SHILPAM - 192902004	Joined	6/23/2021, 10:16:53 AM

SMRITI SHILPAM - 192902004	Left	6/23/2021, 10:27:43 AM
Chandan Singh	Joined	6/23/2021, 10:18:23 AM
Chandan Singh	Left	6/23/2021, 11:35:31 AM
Dr. Nilanjan Halder [MU - Jaipur]	Joined	6/23/2021, 10:20:15 AM
pratibha singla (Guest)	Joined	6/23/2021, 10:20:18 AM
pratibha singla (Guest)	Left	6/23/2021, 10:21:41 AM
Dr. Pushpendra Kumar [MU - Jaipur]	Joined	6/23/2021, 10:21:09 AM
Dr. Pushpendra Kumar [MU - Jaipur]	Left	6/23/2021, 10:41:03 AM
pratibha singla (Guest)	Joined	6/23/2021, 10:22:04 AM
pratibha singla (Guest)	Left	6/23/2021, 10:27:15 AM
pratibha singla (Guest)	Joined	6/23/2021, 10:28:36 AM
pratibha singla (Guest)	Left	6/23/2021, 10:38:48 AM
Ashima Sharma [PhD - 2020]	Joined	6/23/2021, 10:29:03 AM
Ashima Sharma [PhD - 2020]	Left	6/23/2021, 11:20:06 AM
Ashima Sharma [PhD - 2020]	Joined	6/23/2021, 11:21:56 AM
Ashutosh Anand (Guest)	Joined	6/23/2021, 10:34:06 AM
Abinash Tripathy (Guest)	Joined	6/23/2021, 11:19:30 AM