

## | Brief Biography of R. Ramesh |



**Ramamoorthy Ramesh** (born 1960) is an American materials scientist of Indian descent who has contributed to the synthesis, assembly and understanding of complex functional oxides, such as ferroelectric materials. In particular, he has worked on the development of ferroelectric perovskites, manganites with colossal magnetoresistance, and also on multiferroic oxides with potential benefits for modern information technologies.

He is a Professor at the University of California Berkeley in the Departments of Materials Science and Engineering, and Physics. He is also Associate Laboratory Director (ALD) for Energy Technologies at the Lawrence Berkeley National Laboratory.

He joined Lawrence Berkeley National Laboratory in 2004 as a Faculty Scientist and became Associate Laboratory Director (ALD) for Energy Technologies in 2014 with three Divisions focused on Energy Technologies. The Energy Technologies Area conducts research for the U.S. Department of Energy other federal entities, as well as state governments, with a focus on California and the private sector. Ramesh served as the founding Director of DOE's SunShot Initiative and subsequently he also served in a leadership position at Oak Ridge National Laboratory.



## BOSE-125 Distinguished Lecture

on

SIXTH MARCH  
2018

सत्येन्द्र नाथ बसु की 125 वीं जयंती

1894 - 2018

125<sup>th</sup> Birth Anniversary of Satyendra Nath Bose



सत्येन्द्र नाथ बसु राष्ट्रीय मौलिक विज्ञान केन्द्र  
Satyendra Nath Bose National Centre for Basic Sciences



## Emergent Chirality & Phase Coexistence in Polar Vortices formed in Oxide Superlattices

R. Ramesh

### ABSTRACT

The complex interplay of spin, charge, orbital, and lattice degrees of freedom has provided for a plethora of exotic phase and physical phenomena. Among these, in recent years, topological states of matter and spin textures have emerged as fascinating consequences of the electronic band structure and the interplay between spin and spin-orbit coupling in materials. In this work, we leverage the competition between charge, orbital, and lattice degrees of freedom in superlattices of  $\text{PbTiO}_3/\text{SrTiO}_3$  to produce complex, vortex-antivortex pairs (that exhibit smoothly varying ferroelectric polarization with a 10 nm periodicity) that are reminiscent of topological features such as skyrmions and merons. Using a combination of advanced layer-by-layer growth techniques, atomic-resolution mapping of structure and local polar distortions using scanning-transmission electron microscopy, and phase-field modeling approaches we present a comprehensive picture of the nature of the varying polarization profile in such vortex states. The continuous rotation of the polar state into the vortex structures is thought to occur from an interplay of polar discontinuities at the  $\text{PbTiO}_3 / \text{SrTiO}_3$  interface (where  $\nabla \cdot \mathbf{P} \neq 0$ ) the phase transformation strain and gradient energy in the  $\text{PbTiO}_3$  layer, and the strain imposed by the substrate. Finally, the implications of these observations are discussed as they pertain to producing new states of matter and emergent phenomena (such as chirality) in such superlattices



S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES  
KOLKATA

Director  
and

Staff and students of S. N. Bose National Centre for Basic Sciences  
request the pleasure of your company at the

### BOSE-125 Distinguished Lecture

by

**R. Ramesh**

Department of Materials Science and Engineering &  
Department of Physics, University of California, Berkeley  
Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley

on

Tuesday, 6<sup>th</sup> March, at 4:00 pm

to celebrate

**125<sup>th</sup> Birth Anniversary of Professor Satyendra Nath Bose**

**Prof. Samit Kumar Ray**  
Director

Venue :

**Silver Jubilee Hall**

S. N. Bose National Centre for Basic Sciences

Block JD , Sector-III, Salt Lake City,

Kolkata - 700 106, India

Phone: +91-33-2335 1313/0312/3057/3061/5705/6/7/8

Web: [www.bose.res.in](http://www.bose.res.in)