



THE INSTITUTE OF MATHEMATICAL SCIENCES  
**Golden Jubilee Meeting**  
2 – 4 January 2013  
<http://imsc50.imsc.res.in/article/celebration>

**Public Talks at the Ramanujan Auditorium**

3rd January 2013, 4.15pm

**Many electrons moving but strongly avoiding each other**  
**T V Ramakrishnan**

*Indian Institute of Science, Bangalore, and  
Banaras Hindu University, Varanasi, India*

Condensed matter consists of atoms nearly *touching* each other, so that the outer electrons of each atom are strongly influenced by other atoms. A daring but surprisingly successful, more than a century old hypothesis of Drude, that the outer electrons can be regarded as *free*, ie moving independently of each other, is the basis of our present understanding of metals, semiconductors and insulators. In the last several decades, we have come across many many families of systems in which electrons do move, but need to very strongly avoid each other when close by (eg because of inevitable coulomb repulsion). They are home to many strange phenomena and seem qualitatively different from *conventional* systems. In this talk, I will touch on the happenings in some of these *strongly correlated* electronic materials and our attempts to make physical sense of them. This is a large part of the immediate past of quantum condensed matter physics; perhaps its future will be greatly influenced by a better understanding of this large class of things.

3rd January 2013, 6:00pm

**Massive Online Courses: Gutenberg in the 21st Century?**  
**Umesh Vazirani**

*Berkeley Quantum Computation Center (BQIC) University of California at Berkeley, USA.*

Do Massive Open Online Courses (MOOCS) constitute a revolution in education that will flatten the World more than outsourcing ever could? Naysayers argue that once the novelty fades, MOOCS will prove to be no better than textbooks or videotaped courses as a conduit for self-study. Then there are those who worry that MOOCS portend the doom of Academia. Others hope that educational tools developed in the context of MOOCS will lead to much more effective classes at universities.

In this lecture I will share my experience teaching a MOOC on "quantum mechanics and quantum computation," earlier this year. This advanced undergraduate course starts with a novel introduction to quantum mechanics and concludes with the basic principles of quantum computation. I will briefly describe the course as well as what the MOOC taught me about teaching.



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4th January 2013, 4.00pm

**Geometry from Order and Number:  
Causal Sets**

**Rafael Sorkin**

*Perimeter Institute, Canada.*

*Professor Emeritus at Syracuse University, USA.*

Among the various ideas put forward in the search for a theory of quantum gravity, the causal set hypothesis is distinguished by its logical simplicity and by the fact that it incorporates the assumption of an underlying spacetime discreteness organically and from the very beginning. After presenting the problem of quantum gravity in general, I will precis the causal set programme and touch on some old and some recent developments.

4th January 2013, 5:45pm

**Some simple open problems in Mathematics**

**J Oesterle**

*University of Paris VI, France*