

## N.8: RRCAT Seminars during January-June 2017

### 1. Journey of Binary Black Holes: From Universe to LIGO to Supercomputers:

Dr. Karan Jani, Doctoral Researcher, Georgia Institute of Technology, US and a member of the LIGO Science Collaboration. Jan 04, 2017.



The detections of binary black hole mergers in the first science run of Advanced LIGO has inaugurated the era of Gravitational Wave Astronomy. In this talk speaker recapped the new astrophysics they have learned about black holes from these detections, and narrated their search techniques to hunt for binary black holes as massive as 1000 solar masses in the current generation of LIGO. In doing so, speaker emphasized the role, supercomputer simulations of Einstein Equations play in confirming these gravitational wave signals as originating from binary black hole merger. The talk was concluded by highlighting the scope of binary black hole astrophysics during LIGO-India and next generation of ground-based gravitational wave detectors.

### 2. Reduce, Reuse, and Recycle: Shri B. Girish, Director I/C, National Productivity Council, Feb 09, 2017.

Waste management is a burning issue in the whole world including our country. As enlightened and educated citizens it is our duty and responsibility to ensure the sustainability of environment. This talk elaborated on the three keywords "reduce" (waste), "reuse" (things) and "recycle" in simple terms. Talk provided various real life examples in this important field.



### 3. Prognostic Health Management of Engineering Systems, Dr. Debabrata Datta, Head, Radiological Physics and Advisory Division, BARC, Mumbai, Feb 23, 2017.

Prognostic Health Monitoring (PHM) is a proactive approach to monitor the ability of structures, systems and components (SSCs) to withstand structural, thermal and chemical loadings over its planned lifespan. Implementing a PHM system would strengthen the safety of any engineering system (e.g. nuclear power plants, accelerator, waste management, fuel fabrication & reprocessing facility etc.), reduce plant outage time and operation & maintenance costs. However, in any nuclear or accelerator system thousands of SSCs exist, so implementing a PHM system that covers all SSCs requires careful planning and prioritization. Accordingly, PHM is an enabling



discipline consisting of technologies and methods to assess the reliability of a product in its actual life cycle conditions to determine the advent of failure and mitigate system risk. Sensor systems are needed for PHM to monitor environmental, operational, and performance-related characteristics. The gathered data can be analyzed to assess product health and predict remaining useful life. Since prognostics deals with predicting the future behaviour of engineering systems, it is necessary to account for the different sources of uncertainty that affect prognostics and develop a systematic framework for uncertainty quantification and management. Researchers have developed computational methods for prognostics, both in the context of testing-based health management and condition-based health management. While both the frequentistic (based on the presence of true variability) and Bayesian (based on subjective assessment) approaches are applicable in the context of testing-based health management, only the Bayesian approach is applicable in the context of condition-based health management. This lecture gave an overview of various aspects of uncertainty quantification in prognostics and health management.

### 4. Where are we heading? A story of two frontiers: Dr. Gagan Mohanty, TIFR, Mumbai, April 12, 2017.

The discovery of the long-sought-after Higgs boson by CMS and ATLAS experiments at LHC has almost brought the field of particle physics to a standstill! On the one hand, it has completed the jigsaw of Standard Model. On the other, however, we have no clear idea which path would lead to the next layer of the cosmic onion. Very likely, the data will drive the next breakthrough. Talk discussed about the attempt to show how two experiments operating at the energy and luminosity frontiers are posed to address this fundamental question.



### 5. Quantum Phase Transitions in Presence of a Magnetic Field, Prof. Saurabh Basu, IIT, Guwahati, April 24, 2017.

The seminar covered quantum phase transitions of particles, such as bosons and fermions in presence of a magnetic field. The quantum Hall state which is a topologically non-trivial state was discussed at length. The Hall effect for relativistic Dirac fermions was also provided. On the other hand, bosons which are charge neutral may also interact with an external magnetic field. The condensation scenario and the zero temperature phase diagram that depicts a phase transition from an insulating to superfluid phase was also discussed.



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