

Superconductivity of cobalt in nanoscale cobalt thin films:

Dr. B. N. Dev, Visiting Professor, Dept. of Physics and School of Nanoscience and Technology, IIT, Kharagpur, December 10, 2018.

The phenomenon of superconductivity was discovered over a century ago. So far more than half of the number of elements in the periodic table have shown superconductivity. Usually metals possessing strong long-range magnetic order do not exhibit superconductivity. This includes cobalt – a ferromagnetic transition metal. After discovery of high density nonmagnetic (HDNM) fcc phase of Co in thin films by the speaker and team. They explored superconductivity in this Co thin films. Seminar described about the discovered superconductivity in these HDNM Co films with a superconducting transition temperature (T_c) of ~ 5 K using four-probe measurements. Point-contact spectroscopy provided a T_c value of ~ 9.5 K. The higher value of T_c obtained in point contact spectroscopy is apparently due to unavoidable pressure at the contact point. First-principles density functional theory calculations for this dense fcc phase of Co show that the phase is nonmagnetic, characterized by zero elementary moment, and the estimated T_c using BCS theory is 0.30 K. A volume preserving strain in fcc Co is shown to result in anomalous softening of zone boundary phonons which couple strongly with electrons, and stabilize superconductivity at a relatively high temperature (> 5 K). The value of T_c can indeed be higher for other strain conditions. The superconducting Co layer (~ 4 nm) in contact with a ferromagnetic Co layer (18 nm) indicates its potential application in the area of quantum information. It was mentioned that the role of scattering techniques like x-ray and neutron reflectivity were vital in the discovery of the HDNM phase of Co in Co thin films.



Towards a compact 10-GeV self-guided laser plasma accelerator and its applications, *Dr. Bobbili Sanyasi Rao, Scientific Officer - F, Laser Plasma Division, RRCAT, Indore, Dec. 21, 2018.*

Since inception of the idea of the Laser Plasma Acceleration (LPA) in 1979, active research has been pursued and progressed tremendously, particularly in the last two decades. Thanks to the 2018 Nobel Prize winning invention of “Chirped Pulse Amplification” technique (by Gérard Mourou and Donna Strickland) and subsequent development of table-top femtosecond lasers with ever increasing peak powers. Currently, to push the energy frontier of laser plasma



accelerators to 10-GeV and beyond, Quantum Beam Facility at Center for Relativistic Laser Science (CoReLS), Institute for Basic Science in Gwangju, South Korea has recently developed 4 PW, 20 fs laser which is probably the most powerful femtosecond laser operating in the world currently. Dr. Rao told about its development and use in LPA experiments and also for discovering hitherto unknown processes at extremely intense laser matter interaction conditions. It was described that recently, in the initial experiments at CoReLS employing 2.5 PW laser power, a 4.5 GeV electron beam has been produced from only 7 cm long self-guided laser plasma acceleration. Seminar discussed the simulations about the electron beams to drive short-pulsed bright source of GeV muon pairs from a compact set up, with wide-ranging applications in in-land security to compact future colliders.

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N.11: Awards and Honours

The Department of Atomic Energy has instituted the Excellence in Science, Engineering and Technology Awards Scheme from the year 2006 to recognize outstanding accomplishments and exceptional achievements of the DAE staff, who are engaged in scientific research, technology development, engineering/project implementation, teaching, healthcare and supporting services. There are ten categories of awards under the scheme and one Meritorious Service Award for auxiliary, administration, account services etc. These awards are given annually. The awards for the year 2017 were given on the Founder's Day on October 30, 2018 in BARC. The following scientists, engineers and staff members bagged the DAE awards for the year 2017.

N.11.1: DAE Excellence in Science, Engineering and Technology Awards 2017

N.11.1.1: Homi Bhabha Science and Technology Award

Dr. Christ Prakash Paul, SO/G and Head, Head, Laser Additive Manufacturing Lab., Laser Development & Industrial Applications Division, Laser Group, has been conferred with "Homi Bhabha Science and Technology Award" for his contribution to the "Laser based metal additive manufacturing". The award carried a cash prize of ₹ 5 Lakh, a citation and a medal.



N.11.1.2: Scientific and Technical Excellence Award

Shri Digamber P. Yadav, SO/H and Head, Ultra High Vacuum Technology Section, Proton Accelerator Group, has been conferred with "Scientific and Technical Excellence Award" for his contributions to the "Indigenous design and development of several essential facilities/technologies required for the performance enhancement of Indus machines, upcoming high brilliance synchrotron light source and Spallation Neutron Source (SNS)". The award carries a cash prize of ₹ 1 Lakh, a citation and a medal.



N.11.1.3: Young Scientist Award

Shri Hemant Krishna, SO/E, Laser Biomedical Applications Section, Laser Group, has been conferred the "Young Applied Scientist/Technologist Award" for his contribution in the field of "Optical spectroscopy and imaging for biomedical diagnosis". The award carries a cash prize of ₹ 50,000, a citation and a medal.



N.11.1.4: Meritorious Technical Support Awards

1. Shri Lal Viswanath, SA/E, Precision Power Supplies Division, Electron Accelerator Group has been conferred the "Meritorious Technical Support Award" for his contributions to the "Layout planning, assembly wiring, testing and maintenance of magnet power supplies and their control cards". The award carries a cash prize of ₹ 20,000, a citation and a medal.



2. Shri Madan Kumar Verma, Sr. Techn/J, RF Division, Proton Accelerator Group, has been conferred the "Meritorious Technical Support Award" for his contributions to the "Fabrication of RF transmission line components". The award carries a cash prize of ₹ 20,000, a citation and a medal.



3. Shri J. C. Suthar, Foreman/C, Design & Manufacturing Technology Division, Technology Development and Support Group, has been conferred the "Meritorious Technical Support Award" for his contributions to the "Precision joining of ferrous and nonferrous metals for accelerator and laser components". The award carries a cash prize of ₹ 20,000, a citation and a medal.



N.11.1.5: Meritorious Service Award

1. Shri B. Devadasan, Pr. Pvt. Sec., Director's Office, has been conferred the "Meritorious Service Award" for his contribution to "Secretarial service, office administration". The award carries a cash prize of ₹ 20,000, a citation and a medal.



2. Shri Jairam, Sr. Work Asst-A, Materials Science Section, Materials Science Group, has been conferred the "Meritorious Service Award" for the "excellent services rendered by him in the cosmetic maintenance of R&D Block-A". The award carries a cash prize of ₹ 20,000, a citation and a medal.



N.11.1.6: Group Achievement Awards

1. A group comprising 115 members was conferred the Group Achievement Award for their excellent team work in the field of "Design, development, installation and commissioning of transverse bunch by bunch feedback system of Indus-2 synchrotron radiation source" and "Design, development, testing and integration of orbit control systems & beam based alignment systems in Indus-2 SRS". The award carried a cash prize, citation and medals. The award was received by the Group Leaders, **Shri T. A. Puntambekar**, OS and Head, Beam Diagnostics & Coolant Systems Division, and **Shri Pravin Fatnani**, SO/H and Head, Accelerator Control Systems Division, Electron Accelerator Group.



2. A group comprising 52 members was conferred the Group Achievement Award for their excellent team work for successfully accomplishing the activity titled "Indigenous development of 60 kW, CW 505.8 MHz circulator using in-house developed indium doped calcium vanadium garnets for RF system of Indus-2". The award carried a cash prize, citation and medals. The award was received by the Group Leader, **Shri R. S. Shinde**, OS and Head, Accelerator Magnet Technology Division, Electron Accelerator Group.



3. A group comprising 49 members was conferred the Group Achievement Award for their excellent team work on "Adopting novel techniques for economic design & construction of Convention Centre at RRCAT". The award carried a cash prize, citation and medals. The award was received by the Group Leader, **Shri G. Parchani**, SO/H and Head, Construction and Services Division, Technology Development and Support Group.



4. A group comprising 20 members was conferred the Group Achievement Award for their excellent team work on "Design, development and utilization of optical spectroscopic techniques for cancer diagnosis". The award carried a cash prize, citation and medals. The award was received by the Group Leader, **Dr. S. K. Majumder**, SO/H and Head, Head, Laser Biomedical Applications Section, Laser Group.



N.11.2: Award of Doctor of Philosophy (Ph. D.) Degree

The Homi Bhabha National Institute (HBNI), a Deemed University has awarded Ph.D. Degree to following employee / students of RRCAT:

1. **Dr. Jitendra Kumar** was awarded Doctor of Philosophy in Physical Sciences on the dissertation, titled "Development and studies on fiber grating sensors" which was supervised by Dr. Om Prakash.



2. **Dr. Ravindra Jangir**, was awarded Doctor of Philosophy in Physical Sciences on the dissertation, titled "Studies of photoluminescence characteristics of β -Ga₂O₃ and In₂O₃ nanostructures deposited by different growth techniques" which was supervised by Dr. Tapas Ganguli.



3. **Dr. Pragya Tiwari** was awarded Doctor of Philosophy in Physical Sciences on the dissertation, titled "Studies on electron beam and ion beam lithography techniques for fabrication of diffractive optical elements" which was supervised by Dr. Arvind Kumar Srivastava.



4. **Dr. Himanshu Srivastava** was awarded Doctor of Philosophy in Physical Sciences on the dissertation, titled "Growth and characterization of metal oxide nanowires" which was supervised by Dr. Tapas Ganguli.



5. **Dr. Sunita Ahlawat** was awarded Doctor of Philosophy in Physical Sciences on the dissertation, titled "Raman optical tweezers and their use for biomedical applications" which was supervised by Dr. P. K. Gupta.



6. **Dr. Arijit Chakraborty** was awarded Doctor of Philosophy in Physical Sciences on the dissertation, titled "Studies on radio frequency dressed potentials for cold atoms" which was supervised by Dr. Satya Ram Mishra.



N.11.3: Best Thesis Award

1. **Smt. Usha Chakravarty**, SO/F, Laser Development & Industrial Applications Division, was awarded Best Thesis Award of the Indian Laser Association (ILA) at the DAE-BRNS National Laser Symposium (NLS-27) held at RRCAT, Indore during December 03 - 06, 2018. The title of the thesis was "Investigation of ytterbium doped fiber laser". The award carries a certificate from ILA and a prize money of ₹ 7,500.



N.11.4: Best Poster Awards
N.11.4.1: Best poster awards in 27th DAE-BRNS National Laser Symposium held at RRCAT, Indore during Dec. 03 - 06, 2018

Following three posters of RRCAT received the best poster awards of the Indian Laser Association at the DAE-BRNS National Laser Symposium (NLS-27) held at RRCAT, Indore during December 03 - 06, 2018. The award carries a cash prize of ₹2,500 and a certificate. The details of the poster papers are given below:

1. *Title:* Effect of synchrotron x-ray radiation on fiber Bragg gratings written in hydrogen loaded telecommunication and erbium doped fiber

Authors: Sudhir Kumar, J. Kumar, A.K. Agarwal, B. Singh, G.S. Purbia, O. Prakash, S.K. Dixit, S.V. Nakhe

Mr. Sudhir Kumar, SO/D, Fibre Sensors & Optical Spectroscopy Section, who presented the poster paper, received the award.



2. *Title:* K- α x-ray emission spectroscopy in a high contrast ultrashort laser interaction with thin foil target for fast electron characterization

Authors: V. Arora, T. Mandal, A. Moorti, J.A. Chakera

Dr. Vipul Arora, SO/F, Advanced Plasma Acceleration Section, who presented the poster paper, received the award.



3. *Title:* Development of 700 W of single transverse mode all-fiber Yb-doped CW fiber laser at 1080 nm

Authors: Pushkar Misra, Avdhesh Kumar, R.K. Jain, Rajpal Singh, B.N. Upadhyaya, K.S. Bindra

Mr. Pushkar Misra, SA/G, Laser Development & Industrial Applications Division, who presented the poster paper, received the award.


N.11.4.2: Best poster awards at other conference / symposium / theme meetings

1. **Shri Mukund Kumar**, SO/E, received the best poster award at the DAE-BRNS Theme Meeting on Ultra-Fast Sciences (UFS-2018) held at RRCAT, Indore during Oct. 22 - 24, 2018. The award carries a cash prize of ₹ 2,500.

The details of the poster paper are:

Title: High resolution electron time of



flight spectrograph for temporal characterization of ultrashort high order harmonic pulses

Authors: M. Kumar, H. Singhal, A. Ansari, J.A. Chakera

2. **Ms D. Hazra**, SRF, HBNI received the best poster award at the 33rd National Symposium on Plasma Science & Technology (PLASMA- 2018), held at University of Delhi, Delhi during Dec. 4-7, 2018. The award carried a cash prize of ₹ 5,000.



The details of the poster paper are:

Title: Generation of quasi-monoenergetic electron beams through direct laser acceleration using ionization induced injection in high-Z mixed gas target

Authors: D. Hazra, S. Mishra, A. Moorti, R. A. Khan and J. A. Chakera

3. **Shri Priyabrata Mudi**, SRF, HBNI received one of the best poster award during the 63rd DAE-SSPS organized by BARC, Mumbai at Guru Jambheshwar University of Science and Technology, Hisar, Haryana during Dec. 18-22, 2018. The award carries a certificate.



The details of the poster paper are:

Title: Observation of strong photo-induced inverse spin Hall effect in heavily doped n-GaAs.

Authors: P. Mudi, Shailesh K. Khamari and T. K. Sharma

N.12: New Recruits

RRCAT welcomes the following personnel who have joined during July to December 2018.

- Shri Ashwin Pandey, SOC, PHPMD
- Shri Bhuvnesh, SOC, LDIAD
- Kum. Alka, SOC, LBAS
- Shri Gaurav Agrawal, SOC, CDCAS
- Shri Basant Kumar Kumre, ASO(A), ADMIN
- Shri Manoj Soni, ASO(A), ADMIN
- Shri Monil Solanki, ASO(A), ADMIN
- Shri Dinesh Carpenter, ASO(A), ADMIN
- Shri Kharat Jagdish Ramesh, ASO(A), ADMIN
- Shri S.V.R. Krishna Raju Sagi, ASO(A), ADMIN
- Shri Gaffar Khan, ASO(A), ADMIN
- Shri Bhupesh Sharma, ASO(A), ADMIN
- Shri Surendra Kalyane, ASO(A), ADMIN
- Shri Gaurava Chaurasia, ASO(A), ADMIN
- Shri Satyanarayan Jat, ASO(A), ADMIN