Collaboration between IGCAR and FNAL in Nuclear Energy

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Back ground

- **IGCAR – late starter in collaboration proposals**
- **Compilation of Proposals based on -**
- **TIFR meeting and subsequent internal discussions**
- **Visit of Prof. Shekhar Mishra**

IGCAR Proposals

Areas of Collaboration

(a) Material Science

(b) Reactor Physics

(c) Nuclear Data

(d) Chemistry of Lead-Bi alloy

Material Science -1

- **In core structural materials used for FBR in India presently can with stand maximum 80 dpa of neutron irradiation.**
- **For high fuel burnups and cost reduction in FBR fuel cycle, it is necessary to go to 150 dpa in near future and possibily 300 dpa as the long term target.**
- **Material testing in the proposed ADS will be beneficial to quickly generate data complementary to the data generated in irradiation at an Indian FBR**

Material Science -2

- **Large He-appm/dpa ratio is characteristic of materials for ADS use**
- **Swelling behaviour and behavior of oxide coating on structural material are to be investigated**
- **New material physics at**

  (i) 68 dpa/fpy, (ii) 1500 appm He/fpy and (iii) 28000 appm H/fpy

  at temperatures in the range of 550-600 C

Reactor Physics -1

- **Safety clearance of accelerator used as neutron source is easier than reactor used as neutron source**
- **Neutron and gamma shield experiments are of interest to IGCAR better than those performed in ORNL tower shielding facility**
- **Neutron and gamma streaming experiments in shield penetrations – difficult to model due to high attenuations**

Reactor Physics -2

- India plan to use FBR closed fuel cycle for minor actinide (MA) incineration and ADS for thorium utilisation
- MA based reactor experiments can be performed only after few years
- Participation in MA target experiments planned at FNAL is of interest to IGCAR
- Measurement of reaction rate and decay heats in the MA target

Nuclear Data

- **Neutron reaction data related to MA incineration**

  Isotopes (a) Np-238, (b) Am-241, (c) Am-242 and (d) Cm-242 and (e) Cm-244

- **Neutron reaction data related to thorium utilisation**

  Isotopes (a) Pa-231, (b) Pa-232 and (c) U-234

Chemistry of Pb-Bi Alloy

High solubility of alloy metals of steel in Pb-Bi

- **Investigations on control of oxygen in Pb-Bi and formation of protective oxide layer**
- **Study of thermo-chemical behaviour of ternary Pb-M-O and Bi-M-O systems**
- **Development of rugged and reliable oxygen sensors capable of working in high temperature heavy liquid**

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Collaboration and Use of Existing FNAL Facilities by IGCAR

- **Inputs to be gathered by the DAE visiting FNAL shortly**

THANK YOU