IIT Indore joins CBM Experiment at GSI, Germany

The Indian Institute of Technology Indore has recently joined the Compressed Baryonic Matter (CBM) experiment at FAIR (Facility for Anti-proton and Ion Research) of German national laboratory GSI, Darmstadt, with Prof. Raghunath Sahoo, Associate Professor of Physics, IIT Indore, as the Principal Investigator. The Compressed Baryonic Matter (CBM) experiment is a future fixed target experiment, that aims to produce a state of matter consisting of the fundamental constituents the quarks and gluons. Experimentalists try to re-create the “Big Bang Collision” inside the laboratory by colliding heavy-ions in ultra-relativistic speeds, almost 99.999% of the speed of light. IIT Indore is a part of the ALICE experiment at the Large Hadron Collider (LHC), CERN, Geneva, Switzerland, participating in the efforts to produce and study Quark-Gluon Plasma (QGP) in the laboratory. QGP is a state of matter formed at extremely high temperatures and densities, when protons and neutrons may dissolve into a “soup” of quarks and gluons, called QGP. Another way of forming QGP in the laboratory is through compression: compress the nuclei beyond their typical dimensions so that the constituent quarks and gluons are free in a nuclear domain. For a few microseconds, shortly after the Big Bang, the Universe was filled with the QGP matter. The search and study of Quark-Gluon Plasma is one of the most fundamental research topics of our times. The QGP matter has been probed by colliding heavy ions at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory, New York, USA and the Large Hadron Collider (LHC) at CERN, Geneva. By colliding

heavy-ions at a speed close to that of light, scientists aim to obtain – albeit over a tiny volume of the size of a nucleus and for an infinitesimally short instant - a QGP state. This QGP state can be observed by dedicated experiments as it reverts to hadronic matter through expansion and cooling. The LHC creates QGP in the laboratory by creating a state of very high temperature and densities, whereas the FAIR facility at GSI, Darmstadt, Germany will create the same by producing high baryon density matter through compression.

IIT Indore will play a major role in building the Gas Electron Multiplier (GEM) detector for the detection of subatomic particles produced in the collision. We shall take part in the physics simulation, detector R & D and physics data analysis, says Prof. Sahoo, who is the lead scientist from IIT Indore and the Principal Investigator of both ALICE and CBM projects. He is also the member of Collaboration Boards of ALICE and CBM experiments. Trained as a high energy physicist through his Ph.D. at RHIC and subsequently postdoctoral research at RHIC (French national laboratory- Subatech, Nantes) and LHC (INFN Fellow, INFN Padova), Prof. Sahoo has created a very active group at IIT Indore to work in these frontier research areas. The GEM detector has got potential applications in biomedical engineering and allied applications. IIT Indore's Physics discipline in collaboration with Biosciences and Bioengineering and Electrical Engineering disciplines will explore possible detector development for such interdisciplinary applications.