THAPAR UNIVERSITY

TUSAT STUDENT INITIATIVE

Thapar University

Student Satellite

Initiative

About Thapar University

Thapar University is located in 250-acre lush green campus, in the historic city of Patiala. It came into existence in 1956 when Foundation Stone was laid down by First President of India Dr.Rajendra Prasad. Thapar University is today recognized among the leading privately managed grant-in-aid engineering institutions of the country and the best of its kind in the north-western region of India. As a fitting to laudable achievements and its pioneering role in promoting the growth and development both at National and International levels, we were granted full autonomy and the status of a Deemed University in 1985 by University Grant Commission, India (UGC).

Thapar University has tryst with excellence. Since its inception, the University has remained committed to creation, archiving and dissemination of knowledge in Science,Engineering and Technology for the service to humanity. We have been given the highest ratings by the accrediting agencies like National Board of Accreditation and University Grants Commission-NAAC and the surveys such as NASSCOM and India Today.

Research has been a corner stone of the University. Major research products supported by the European Union, Naval Research Board, Department of Science and Technology, Department of Biotechnology and others are underway. For this purpose, Thapar Center for Industrial Research and Development had been set up on campus. Thapar University regularly invite the leaders and motivators of all walks of life and encourage the students to share time and space with them.

About TUSSAT Initiative

The Thapar University Student Satellite Initiative was launched in June 2009 by Thapar University, India to get students involved in real space missions. The initiative aims at giving students practical hands-on experience and encourages them to take up careers in space technology and science, thereby helping to create a pool of talented experts for the future.

The objective of this project is to develop spacecrafts, which will be entirely conceptualized , designed and developed by students and the faculty of Thapar University. The project aims at launching at least 5 satellites within the next decade. These Satellites could be test-beds for new technology that is being developed in the institute and need space qualification.

From the Director's Desk

Dr. Abhijit Mukherjee

It is a matter of great pride for me to unveil Thapar University's Student Satellite Initiative, our own contribution to the solution for a global crisis as well as a gigantic technological feat to add to our achievements. Under this initiative we work to develop a small scale satellite to be put into orbit in the next 2 years, a satellite developed completely by the students themselves, right from the design board to the launch pad. Few universities have thought of such a feat, fewer still have been successful.

Through this initiative we give our students an opportunity to expand their technical knowledge base in leaps and bounds, and take it to a never before achieved level of learning and application.

The success of this endeavour depends not just on the advanced technical skill set which no doubt is a necessity, but also on human elements such as a strong team spirit, inspirational leadership, powerful motivation and a never ending dedication, all of which the students shall experience, inculcate and emulate in their long journey to success.

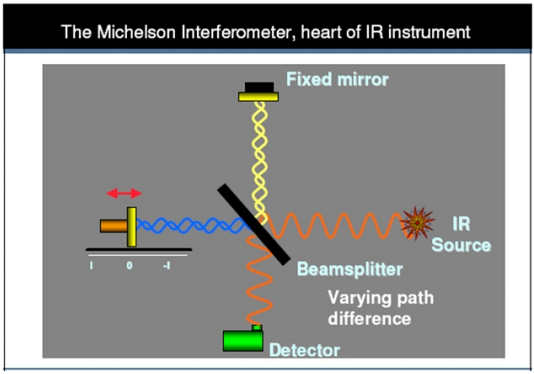
Thapar University has always believed in making positive changes through technology and innovation, which is what we wish to accomplish through this initiative of ours. In a world consumed by industrialisation and consumerism, we are fast forgetting how our acts our changing our own home for the worse. This is our little contribution to what we believe is the need of the hour, the right thing to do.

Mission TUSSAT - I

Our main mission for TUSSAT-I is to be able ascertain the global distributions of carbon dioxide (Co2). The basic sensor we are planning to use for this purpose will be an FTIR Spectrometer.

Principle: It is based on the fact that every molecule has a unique 'spectral signature' and when light is passed through it absorbs some specific wavelengths depending upon the unique bonding present in the molecule. From a maintained library of spectral signatures we can easily find out about the molecules present in a sample and by noting the amount of absorbance and comparing it with standard samples we also find out the amount of the target molecule present.

Working: The basic sensor is an Fourier Transform Infrared(FTIR) Spectrometer which works on the principle of Michelson Interferometer.
FTIR Spectrometer is an instrument that utilizes optical interference. Within the instrument the incoming light which has already passed through the sample in our case this being the earth's atmosphere and specific wavelengths have been absorbed by it, is split into two beams using a beam splitter which propagates in two different optical paths to create an optical path difference between the two also in one of these paths there is a constantly moving mirror placed so that there is a continuous change in path difference.

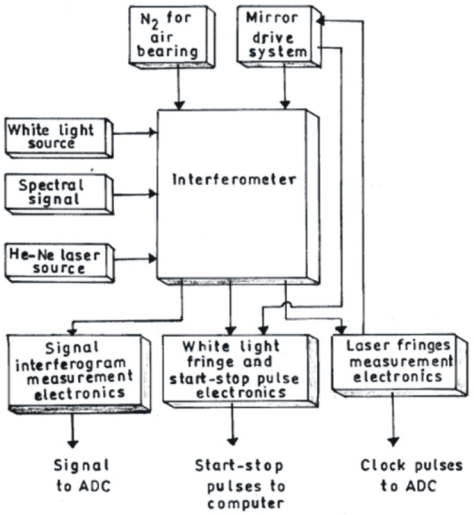


These beams are then recombined to cause interference and an Interferogram is produced.

Basic Block Diagram: Here the spectral signal is the IR rays emitted by the earth which have already passes through the atmosphere and have some specific wavelengths absorbed by it. He-Ne laser source is used for self calibration of the instrument so that we know the position

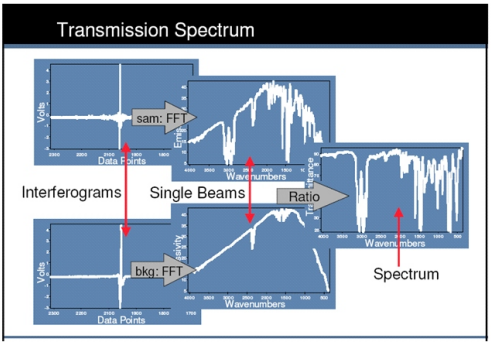
Block Diagram of FTIR Spectrometer

of the moving mirror at each instant of time and the white light source is used to detect the completion of one cycle of measurement. Electromagnetic waves from all these three sources pass through the same beam splitter and the mirrors and later the analogue signals are converted into digital so that further processes transformations can be carried out on a computer. Also the moment of the mirror is controlled from the laser signals and the complete cycle from the white light.



Fourier Transformation: Now the observed spectrum of the sample is divided at each wavelength with a calibration spectrum obtained with a blank sample to take care of instrument noise and other affecting factors. The transmission spectrum so obtained is now used measure the amount of various compounds absorbed using standard calibration tables available. Column abundances of CO2 and CH4 are can be calculated from working on the band ranges of around 1.6 um and 2 um.

Advantages of FTIR Spectrometer: FTIR Instruments have improved signal to noise ratio because there is a concurrent measurement of detector signal for all the resolution elements of the spectrum known as the multiple or ***Fellgett Advantage*** and of high optical throughput known as throughput or Jacquinot advantage. The improvement in frequency accuracy of the FTIR instrument is because of use of a laser for calibration known as laser reference or ***Connes advantage***.



WE CONTROL CLIMATE CHANGE.

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