The standard picture of Active Galactic Nuclei (AGN) or quasars consist of galaxies with extremely bright nucleus, so much so, that they usually outshine the light from other parts of the host galaxy such as arms or bulges. The reason behind intense power of AGN (radiation emitted from more than one million Suns) is believed to be that at the centre of galaxy a super massive black hole (SMBH) is accreting matter from its vicinity, known as the accretion disk. Sometimes, such systems are known to eject powerful, narrow beam of high velocity charged particles. If one happens to view such a system along the line of sight of these ejections–" known as jets"– such AGN are called blazars. The charged particles (here electrons) gain energy by a factor of ∼1,000,000 by highly efficient acceleration processes operating in the jets. Electrons accelerated up to trillion electron volt (TeV) energies produce the observed radiation in the presence of magnetic fields via non-thermal radiation processes (synchrotron and inverse-Compton) throughout the entire electromagnetic spectrum, i.e., from radio frequencies to $\gamma-$ray frequencies. These jets are also moving close to the speed of light and because of the small angle between us and the jet, the emitted radiation is modified due to relativistic effects. Not only such systems produce intense radiation, it also varies on all observable timescales and at all wavelengths. Variability of continuum emission is a basic tool for constraining the energy dissipation processes, since it gives information on the size (R) of the emitting region through *causality arguments*, i.e., the the size of emitting region cannot be smaller than the time (Δt) taken by the light (speed of light; c) to cross it ($R \geq c \times \Delta t$). The primary goals of blazar physics is to understand the energy dissipation processes in the blazar jets and how it is affected by the SMBH/accretion disk system which has launched them. Also, it is of prime importance to know if it is a single process that can efficiently accelerate the electrons and produce the radiation on the spatial sizes ranging from $\sim$ 100 million kilometers to ∼100 billion kilometers. The proposed study aims a systematic probe of blazar physics by answering some of these questions, through well-defined blazar samples and the usage of good-quality, long-duration multiwavelength light curves.

The proposed research will primarily use well-posted statistical methods for the light curve analysis: (i) in Fourier–domain by discrete Fourier transformation, (ii) in time–domain by modeling the light curve as a continuous–time auto regressive moving average (CARMA) process. For example, the light curve can be decomposed in to Fourier coefficients with amplitude and phase Fourier transform without any loss of information. The square of Fourier amplitudes when plotted against the Fourier frequency in log-log space, show a power-law distribution. This is known as the power spectral density (PSD) of a light curve which can be mathematically described as $P(\nu_k) = A\nu_k^{-\beta}$, where ν_k is the temporal frequency (corresponding to timescale $1/\nu_k$), A is the normalization constant and β is the slope. We will use data from several satellites (Giga electron-volt energies; $\gamma-$rays, and kilo electron-volt energies; X-rays) orbiting the earth as these frequencies are absorbed by Earth's atmosphere. At Tera electron-volt energies, optical and Giga-Hertz band radio frequencies, data are gathered from several ground-based observatories and publicly available archives.

The flux variability carries within itself a rich information which provides vital clues to the energy dissipation processes such as shocks, turbulence and magnetic reconnection events operating on widely different spatial scales. Such information when coupled with spectral information (for example optical with high energy X-ray or $\gamma-$ray), provides clues to discriminate among currently accepted blazar emission models. So far, the time-dependent modeling of blazar emission have resulted in constraining the location, size, magnetic field strength at the emission site and the composition of jets, though a unique scenario appears lacking. Through our novel analysis of light curves by means of PSDs which incorporates components from aggregate long-term fluctuations as well as rapid flares and flickering, we will constrain energy dissipation conditions which are guaranteed to be not affected by chance coincidences of emission at different wavebands. Our main contribution will be to verify and possibly change the fundamental paradigm for the blazar physics which involves internal shocks and emission dominated by single emission regions.