



Indian Academy of Sciences, Bengaluru
Indian National Science Academy, New Delhi
The National Academy of Sciences India, Prayagraj
SUMMER RESEARCH FELLOWSHIPS — 2021

Format for the Four-week Report^{*,^}

Name of the candidate : Vikash K

Application Registration no. : PHYS411

Date of Commencement of work : 15/06/2021

Mode of work : From Home: ☒ Guide's Laboratory: ☐

Name of the guide : Dr Shashi Bhushan Pandey

Guide's institution : Aryabhata Research Institute of Observational Sciences

Place of stay during the tenure of the fellowship (if working in guide's institution) : Hostel provided by _____
 Guide _____
 Own arrangement _____
 Other (Specify) _____

Signature of the candidate

Date: 04/09/2021

Signature of the guide

Date: _____

INSPIRE/KVPY FELLOWSHIP (please fill this box)[#]		
1.	I am currently a recipient of	INSPIRE FELLOWSHIP <input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No KVPY FELLOWSHIP <input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No If, YES, fill cols. 2, 3 & 4
2.	INSPIRE/KVPY Fellowship is from _____ [month]/_____ [yr] to _____ [month]/_____ [yr]	
3.	I receive a monthly fellowship of Rs. _____ from INSPIRE/KVPY towards my living expenses	
4.	I also receive towards contingencies a sum of Rs. _____ per year	
I affirm that the information given above is correct. <div style="text-align: right; margin-top: 10px;"> Signature of the candidate </div>		

(For office use only; do not fill/tear)

Candidate's name:	Fellowship amount:
Student: Teacher:	Deduction:
Guide's name:	Amount to be paid:
KVPY Fellow: INSPIRE Fellow:	A/c holder's name:
PFMS Unique Code:	Others:

IMPORTANT NOTES:

* The four-week report could be between 300 and 350 words.

^ This format should be the first page of the report and should be stapled with the main report.

Mandatory to fill this section, this should be filled and signed by you even if you are not an INSPIRE/KVPY Fellow. Otherwise release of fellowship amount will be withheld.

Microphysics Parameters Estimation

Vikash Kotteeswaran

Four-week report

Gamma-Ray Bursts are caused by massive cosmic explosions that result in jet streams. These jet streams produce shock waves that show an apparent behaviour similar to an isotropic fireball initially after their early stages past the burst but their true jet nature is revealed as time progresses [time at which this happens is called the jet break] and the shock waves become less relativistic. This study focuses on the shock waves and estimates their characteristic parameters p (electron distribution index), ϵ_e , ϵ_B (fractional energy in the accelerated electrons and magnetic fields immediately behind the shock wave respectively), along with them the isotropic and jet equivalent energies and the half opening angle of GRB jets are also estimated.

The Synchrotron radiation paints a huge part in the Afterglow radiation from GRBs after those early stages and they are characterized by the spectral breaks ν_a [frequency corresponding to the regime where the Synchrotron self-absorption is dominant], ν_m [frequency corresponding to the minimum Lorentz factor of electron injected into a system that follows a power-law distribution (γ^{-p})], ν_c [frequency corresponding to the Lorentz factor that decides the cooling process (fast or slow) depending on the average Lorentz factor of the electrons which also happens to be the minimum Lorentz factor], they are also related to the microphysics parameters in such a way, their relationship could be inverted to find the microphysics parameters from the spectral breaks.

Multi-wavelength data of a GRB is collected to form their spectral energy distribution and their light curves, they are then fitted with broken laws and are used to find the spectral breaks, p and jet break time, which, then used in the inverted equations to estimated the microphysics parameters. The fitting light curves [LCs] and creating spectral energy distributions [SED] will be performed in python. So far, the progress has been with collecting the data to generate the light curves and SED, and the GRB chosen is GRB 130603B. Necessary mathematical tools are also been collected to perform the fitting of LCs and SED and inversion.