Approved Cycle 19 Programs

191023

LAURA CHOMIUK

THE GAMMA-RAY LUMINOSITY FUNCTION OF NOVAE

We propose to measure the GeV gamma-ray luminosity function of Galactic novae based on 17 years of Fermi/LAT data. From 25 nova detections with LAT to date, we know that gamma-ray luminosity spans at least three orders of magnitude, but we remain ignorant of the form of the underlying luminosity distribution. We will uniformly analyze LAT data for 189 novae, and couple these gamma-ray constraints (including upper limits) with unbiased distance estimates and Bayesian hierarchical modelling to reveal this luminosity function. The luminosity function is the key to estimating what fraction of novae are shock-powered (as opposed to thermonuclear dominated), the contribution of novae to the Galaxy s neutrino yield, and to calibrating novae as shock-powered transient laboratories.

191030

DANIEL KOCEVSKI

THE FERMI LAT LIGHT CURVE REPOSITORY

We propose to continue developing and maintaining the Fermi LAT light curve repository (LCR), consisting of a public library of light curves for over 1500 variable LAT sources on timescales of days, weeks, and months. This proposal would support managing the real-time ingestion pipeline that update databases of recent transient events displayed on the portal, as well as the continued maintenance of the repository and its automated analysis pipeline. We also propose to transition the LCR from being hosted at the FSSC to NASA s Science Managed Cloud Environment (SMCE), which leverages Amazon Web Services (AWS) cloud computing. This move would improve the overall performance of the portal and ensure its long term stability.

191033

SLAVKO BOGDANOV

UNCOVERING AND CHARACTERIZING FERMI-SELECTED REDBACK MILLISECOND PULSARS

Redbacks are a recently recognized class of eclipsing binary millisecond pulsars that appear to be an evolutionary link between "recycled" radio millisecond pulsars and their low-mass X-ray binary progenitors. We request support to continue the successful comprehensive multi-wavelength program to identify and characterize redback binaries in unassociated Fermi LAT sources, discover their radio and gamma-ray pulsations, and obtain phase-connected timing solutions. This effort will lead to improved understanding of the peculiar phenomenology of these systems, Galactic MSP demographics, and compact binary evolution.

191035

SVETLANA JORSTAD

OPTICAL POLARIMETRIC AND PHOTOMETRIC MONITORING OF GAMMA-RAY BLAZARS

We propose to observe optical linear polarization, along with multi-band flux monitoring, of a sample of 56 gamma-ray bright blazars for 8-10 nights each month using a ~2m telescope. The ultimate goal of our program is to use LAT gamma-ray light curves and optical polarimetric and photometric monitoring to probe physical processes such as energization of the electrons and collimation and acceleration of the jet. We will analyze properties of the magnetic field in optical emission regions in quiescent and flaring states, and search for patterns of gamma-ray and polarization behavior to infer mechanisms of particle acceleration in the different sub-classes of gamma-ray blazars. We will include new sources in the sample according to Fermi, VHE, and neutrino alerts.

191039

ALAN MARSCHER

MONTHLY 43 GHZ IMAGING OF GAMMA-RAY BRIGHT AGN WITH THE VLBA

The investigators propose to image the total and polarized intensity of 35 radio/gamma-ray bright AGN monthly for 3 years with the VLBA at 43 GHz. They will determine the extent to which production and dynamics of new moving knots, and variations in intensity and polarization of compact features in the jet, are associated with gamma-ray/multi-wavelength variability and high-energy neutrino production. Comparison of the polarization angle (PA) of features in the jet with the jet direction, and with the PA at optical and X-ray frequencies, will constrain the physics (e.g., shocks) and potentially identify the high-energy emission regions with features seen in the 43 GHz images. Calibrated data, images, and movies will be made publicly available.

191050

JOSHUA BAXTER

COSMOLOGY WITH THE FERMI-LAT

The extragalactic background light (EBL), shaped by star formation, attenuates very high-energy gamma rays from distant sources, enabling Hubble constant (H0) measurements via gamma-ray optical depth. A new study using 15 years of Fermi-LAT data from ~1500 blazars doubles past samples, extending redshifts to ~4. We aim for ~3% Hubble precision, leveraging those high-precision EBL constraints. We will also examine whether the H0 changes with redshift, as some findings suggest a lower value for distant sources than nearby ones, raising questions about deviations from the standard cosmological model. Unlike methods that determine the H0 at specific epochs, gamma-ray optical depth provides a continuous view of cosmic expansion, making it a powerful tool to study its evolution.

191052

ABE FALCONE

DISCOVERING NEW X-RAY COUNTERPARTS OF FERMI-LAT 4FGL-DR4 (+ 5FGL) UNASSOCIATED SOURCES USING SWIFT OBSERVATIONS

We propose to use Swift to find X-ray and UV/opt. counterparts of new unassociated 4FGL-DR4 Fermi-LAT sources (and possibly 5FGL when released). Prior programs led to Swift observations of 261,199,600,& >750 Fermi unassociated sources from 1,2,3,4FGL catalogs respectively. X-ray counterparts are found in ~1/3 of these, representing a huge fraction of discovered counterparts. We propose >200(!) new observations. These new data will determine properties, and ~5 arcsec positions, of all detected X-ray sources in the LAT regions, contributing to identification, classification, and follow-up. This proposal supports the large analysis and interpretation task, including data reduction, source classification, and enabling public data. Swift observing time has been committed.

191063

RACHEL HAMBURG

SEARCHING FOR SYNCHROTRON COOLING BREAKS IN GRB PROMPT EMISSION WITH FERMI/GBM AND SVOM/ECLAIRS

The detection and characterization of low-energy (<20 keV) features in gamma-ray burst (GRB) prompt emission remain critical to understanding their emission mechanisms. In particular, fast-cooling synchrotron models predict the presence of a low-energy break below the spectral peak, but such breaks can be difficult to identify due to limited instrument energy bands. By combining the low-energy sensitivity of SVOM/ECLAIRs (4 120 keV) with the broadband coverage of Fermi/GBM up to 40 MeV, we propose to search for synchrotron cooling breaks in a sample of jointly detected GRBs. We will perform time-integrated and time-resolved spectral analysis on these GRBs, assess the statistical significance and evolution of potential breaks, and compare features between long and short GRBs.

191065

CORINNE FLETCHER

A FERMI-GBM WEB PORTAL FOR SUBTHRESHOLD SEARCHES OF GAMMA-RAY TRANSIENTS

The Fermi Gamma-ray Burst Monitor (GBM) is a pivotal instrument in multimessenger and multi-wavelength astronomy and an ideal instrument for detecting various gamma-ray transients, such as gamma-ray bursts (GRBs). The Gamma-ray Targeted Search is a publicly available toolkit that searches GBM's data for gamma-ray events below the the triggering threshold. We propose to create a publicly available and user-friendly web portal for running the sub-threshold search and presenting the results. This portal would also allow for a user to request a search to be performed around a specific time through a form, similar to a target of opportunity. Providing an easy and accessible way for to search for subthreshold events and maximizing the scientific output of the Fermi-GBM.

191070

PETER CRAIG

COMPARISON OF GAMMA-RAY EMISSION AND EJETA MASSES IN NOVAE

Since 2010, 24 novae have been detected by Fermi/LAT as significant GeV gamma-ray sources. These GeV photons are thought to be produced by internal shocks in the nova ejecta between two colliding outflows. The gamma-ray luminosities of novae can vary by at least two orders of magnitude, but our understanding of what drives these variations between novae is still in its infancy. We propose to compile a sample of novae with constraints on both the outflow velocity from optical spectroscopy, an the ejecta mass and density through the supersoft X-ray emission combined with multi-frequency radio light curves. We will compare the gamma-ray emission from novae with their ejecta properties constrained at other wavelengths, in order to test models of gamma-ray emission and internal shocks in novae.

191073

RISHANK DIWAN

SYSTEMATIC STUDY OF GAMMA-RAY PULSARS ABOVE 10 GEV

Fermi-LAT revolutionized our understanding of pulsars, revealing pulsations from over 300 sources with distinct characteristics and biases compared to traditional radio and X-ray pulsars. The detection of pulsations from a growing number of pulsars in VHE with pointing cherenkov telescopes challenges our understanding of their emission. We propose a systematic study of the signal of all Fermi-LAT pulsars above 10 GeV over 17 yr, expanding on the pilot work within 1FHL (3 yr) in terms of data and techniques. With LAT's full-sky coverage, such a project is sure to lead, on the one hand, to a state-of-the-art population study of pulsars in this band, constraining emission models, and, on the other hand, to a reference guide for follow-up observations with current and future VHE observatories.

191078

AVA WEBBER

SYSTEMATIC STUDY OF STAR-FORMING REGIONS IN THE GALAXY

Galactic star-forming regions (SFRs) are expected to be gamma-ray emitters and sites of cosmic ray (CR) acceleration. Host to known sites of particle acceleration as well as the ambient material and radiation fields needed for CR interactions, these systems are potentially important sources of gamma-rays in the Galaxy. While a few SFRs have been associated with gamma-ray sources, the majority lack detections. Using all available Fermi data in the energy range 1 GeV to 1 TeV, in combination with improved optical measurements, we will characterize the gamma-ray properties of established and potential gamma-ray SFRs in the Galaxy. We will conduct a systematic population study of gamma-ray emission from Galactic SFRs, including morphological and spectral analysis of detected SFRs.

191110

MILTIADIS MICHAILIDIS

THE LMC UNVEILED: FERMI-LAT'S HUNT FOR HIDDEN COSMIC RAY ACCELERATORS

The last deep view of the LMC with Fermi-LAT was conducted by Fermi collaboration utilizing 6 yr of LAT data. Subsequently, Fermi has accumulated more than 11 yr of additional data. To date, only two SNRs and one SFR have been detected in LMC at GeV. As observed in numerous Galactic objects, such a substantial increase in available data necessitates a reassessment of the objects' position and extension. As such, we propose to reevaluate the adequacy and refine the LMC diffuse "background" components with more than 18 yr of LAT data. Subsequently, we will conduct a comprehensive analysis of newly identified locations of enhanced GeV emission, spatially coincident with the intriguing N11 and R136 SFRs, eROSITA SNRs, as well as the SN 1987A. The first Fermi LMC SNR catalog will be released.

191112

GEORGE YOUNES

MEV PULSED EMISSION FROM NEUTRON STARS WITH FERMI GBM

We propose a systematic search for and characterization of pulsed emission from millisecond pulsars, young rotation-powered pulsars, and magnetars in the hard X-ray to soft gamma-ray (MeV) band using 14 years of \textit{Fermi} GBM Time-Tagged Event data. The MeV band remains poorly explored yet is critical for probing magnetospheric pair cascades, particle acceleration, and strong-field QED effects. Using a scalable timing pipeline, we demonstrate high-significance Crab pulsation detections on multiple timescales and derive an empirical sensitivity curve for a 14-year integration. We will detect or place stringent pulsed upper limits on the aforementioned sources, constraining spectral turnovers, emission sites, and magnetospheric geometry, and providing context for future MeV missions.

191117

RAHUL GUPTA

UNVEILING THE EARLY AFTERGLOWS OF FERMI-DETECTED GAMMA-RAY BURSTS USING MASTER AND BOOTES ROBOTIC TELESCOPE NETWORKS

We propose to utilize the complementary capabilities of the MASTER and BOOTES global robotic telescope networks to search, localize, and conduct early optical follow-up of Fermi-detected bright GRBs. This program will target a statistically significant sample of newly detected Fermi GRBs over the Fermi GI Cycle 19. MASTER's dual-tube, wide-field telescopes with polarization capabilities and BOOTES' fast-slewing and multi-band imaging uniquely complement Fermi's high-energy data and provide unparalleled early-time data. In addition to rapid optical localization, this program will provide low-latency feedback using MASTER's existing JSON-based automatic GCN Circular triggered in real time by Fermi GCN Notices, enabling immediate coordination with fast facilities.

191119

KUNG-YI SU

GAMMA-RAY CONSTRAINTS ON AGN-DRIVEN COSMIC RAYS IN THE MILKY WAY AND CLUSTER BCGS

AGN-driven cosmic rays (CRs) can efficiently quench massive galaxies and are major contributors to gamma-ray emission. However, detailed modeling of AGN-driven CRs remains uncertain, with key uncertainties in the injection site (black hole vicinity vs large-scale shocks via Fermi acceleration), energy budget, particle species (proton vs lepton), and the injected spectrum in each scenario. We propose a suite of Milky Way analog and cluster BCG analogue (M87 and NGC 1275) simulations with FIRE physics, AGN jets, and multi-bin, multi-species CR transport, systematically varying the AGN-CR launching model and constraining it by comparing predicted gamma-ray emission with Fermi-LAT upper limits for cluster BCGs and spatially resolved gamma-ray maps of the Fermi Bubbles in the Milky Way.

191120

MATTHEW KERR

A NEW MODE-CHANGING GAMMA-RAY PULSAR: EVIDENCE FOR MAGNETIC FIELD EVOLUTION

We have serendipitously discovered the second mode-changing gamma-ray pulsar, PSR J2240+5832. Unlikely the previously-known case, J2021+4026, the pulse profile changes of J2240+5832 appear to be triggered by glitches: a small glitch signals the onset of the pulse profile change, and 1000 days later, after a large glitch, the pulse profile appears to revert to its original shape. This link with glitches in turn suggests a connection to changes in the neutron star magnetic field. We propose to perform a detailed study of the changes in the pulse profile, gamma-ray spectrum and luminosity, and radio properties of PSR J2240+5832.

191121

ANDREW PACE

IMPROVING SEARCHES FOR DARK MATTER ANNIHILATION AND DECAY IN MILKY WAY DWARF GALAXIES WITH FERMI-LAT

A key science goal of the Fermi mission is to probe the nature of dark matter. The nearby dark-matter-dominated Milky Way dwarf galaxies are among the most sensitive and robust targets to search for the products of dark matter annihilation or decay. Their dark matter density profiles are inferred from stellar-kinematic samples and are the largest source of uncertainty in current Fermi-LAT searches. We propose to analyze a significantly larger archival and literature spectroscopic dataset to decrease the statistical and systematic errors of the inferred dark matter annihilation flux. Our projections improve existing Fermi-LAT constraints by a factor of 2-4.5 on the dark matter annihilation cross section. We will publicly release our dark matter density, annihilation, and decay profiles.

191124

MARCOS SANTANDER

PROMPT IDENTIFICATION OF GAMMA-RAY COUNTERPARTS TO HIGH-ENERGY NEUTRINOS WITH FERMI-LAT

The identification of a joint gamma-ray and neutrino source would represent a smoking gun signature of cosmic ray acceleration. The first tantalizing correlation between both channels was enabled by Fermi-LAT with the identification of the flaring blazar TXS 0506+056 coincident with the IceCube neutrino event IC170922A, which triggered an intense multiwavelength campaign. We here propose to complete the development of an automated pipeline to promptly identify potential gamma-ray counterparts to neutrino events and post the results of this search to the community to help enable additional follow-up observations.

191125

PETER MARINOS

STELLAR HALOS AS PROBES OF INTERSTELLAR COSMIC-RAY ELECTRONS WITH FERMI

High-precision measurements of cosmic-ray (CR) electrons are confined to the heliospheric environment, leaving the distribution in the nearby interstellar medium poorly constrained. We propose to probe the CR-electron spectrum outside the heliosphere by searching for extended Compton emissions from the stellar radiation fields surrounding individual stars in Fermi-LAT data. We have identified a sample of isolated O-type stars at high Galactic latitudes where the predicted Compton emission is comparable to the diffuse background, reducing the source confusion that limited previous studies. Detection of these Compton gamma-ray halos would enable the first direct constraints on the CR electron intensity at distances of 100 400 pc from the Solar system.

191128

MANEL ERRANDO

RESOLVING LAT BLAZAR JETS WITH VLBA TO MEASURE THE INTERGALACTIC MAGNETIC FIELD

TeV emission from blazars probes intergalactic magnetic fields (IGMF). The IGMF deflects electron-positron pairs produced by TeV gamma-rays from blazars, resulting in broadened beams of secondary GeV emission detectable by LAT that develops along the projected direction of the blazar jet. Our search for this pair halo signal in a stacking analysis of 21 LAT blazars finds evidence for a non-zero IGMF with a significance of 4.7 s.d. In order to improve the sensitivity of our search, we request VLBA observations of 16 high-frequency-peaked blazars for which the large-scale radio jets have not yet been resolved. With this program, we expect to increase the number of TeV-emitting blazars with resolved radio jets from 21 to >30, increasing the sample of objects for which our search can proceed.

191129

JAMIE KENNEA

ENRICHING FERMI/GBM GRBS WITH GUANO AND NITRATES: A FERTILE APPROACH TO IMPROVING LOCALIZATIONS

We seek to improve the localization of Fermi/GBM detected GRBs using GUANO, a system where Swift is commanded to dump BAT event data, usually discarded on board, based on a GBM Alert. These data will be analyzed for evidence of a co-detection of the GRB by BAT. If detected, then we will utilize BAT data either to localize the GRB to ~arc-minute resolution (if within BAT FOV), or if outside the BAT coded FOV, combine information from GBM and BAT to significantly reduce the GBM error region. We estimate obtaining arc-minute localizations for 15 GBM GRBs per year, in addition to those co-detected by BAT, and many more will allow us to significantly reduce the GBM error region. This is vitally important multi-messenger detections of NS mergers by GBM during the the O4.5 run of IGWN.

191136

FULYA KIROGLU

REVEALING THE CENTRAL ENGINES OF ULTRA-LONG GAMMA-RAY BURSTS VIA GRMHD SIMULATIONS

Ultra-long gamma-ray bursts (ULGRBs) are among the most puzzling high-energy transients, exhibiting prompt emission lasting hours, extreme variability, X-ray signatures, and signs of quasi-periodic activity. Despite growing samples from Fermi and Swift, no self-consistent models currently link their observed emission to the underlying accretion and jet physics of proposed progenitors. Collisions between stars and stellar-mass black holes, or micro tidal disruption events, naturally produce long-lived accretion and are compelling candidates for ULGRBs. We propose to test this scenario by combining large-scale hydrodynamic simulations of stellar disruption with GRMHD simulations of accretion and jet production, enabling physical interpretation of the most extreme GRBs discovered by Fermi.

191139

OINDABI MUKHERJEE

ESTIMATING THE BINARY NEUTRON STAR MERGER RATE

We develop and validate a Bayesian population model that accounts for GBM detection bias to infer the local volumetric binary neutron star (BNS) merger rate density, R0, from Fermi GBM short gamma-ray burst (sGRB). Instead of classifying bursts as short or long using a hard 2-second threshold, a probabilistic mixture model approach is used. We forward-model detections with a luminosity function, redshift evolution, and a calibrated GBM detection-efficiency model. Inference with Bilby and Dynesty yields posteriors on R0 (and secondary population parameters), validated via injection recovery and sensitivity tests. We propose to release an open, reproducible toolkit and rate posteriors for comparison with GW results and joint GW GRB forecasts.

191140

MANAMI ROY

CONSTRAINING COSMIC RAY PHYSICS IN THE GALAXY HALOS

Cosmic rays (CRs) are a key non-thermal component of galaxy evolution, yet their transport in the circumgalactic medium (CGM) remains poorly understood. Fermi-LAT observations reveal extended GeV gamma-ray emission around M31 and late-type galaxies, potentially reaching CGM scale (~100 kpc), but its origin remains uncertain, with both CR interactions and dark matter (DM) annihilation being viable explanations. We will model MeV-100GeV gamma-ray emission from hadronic and leptonic CR interactions in the CGM contributed by Milky Way- and M31-like galaxies and their satellites. Using idealized simulations with spectrally resolved CRs, we will predict spatial and spectral signatures, anchor to existing Fermi-LAT constraints, and guide future MeV observations to break the CR vs. DM degeneracy.

191144

MALLORY ROBERTS

A GBT ULTRA-WIDE BAND SEARCH FOR PULSARS IN NORTHERN FERMI SOURCES

We propose to search 50 unassociated sources in the $FGL-DR4 catalog at declinations above 65 degrees for pulsars using the newly commissioned Ultra Wide Band Receiver on the Green Bank Telescope. This will provide unprecedented sensitivity to pulsars with relatively flat spectra while maintaining sensitivity to steep spectra pulsars. The higher frequencies of the receiver will minimize the effects of scattering due to the interstellar medium or intrabinary material. This combination of telescope and receiver is the most efficient pulsar search machine for sources in the far North.

191149

EILEEN MEYER

A CIRCULAR POLARIZATION SURVEY OF FERMI BLAZARS

Measurements of intrinsic circular polarization are a unique way to probe the matter content and particle acceleration mechanism of jets, but very few observational campaigns have been carried out. We propose optical circular polarization monitoring of bright Fermi blazars during cycle 19 (2026-2027) to enable the first catalog of optical circular polarization measurements for 18 sources in our primary sample as well as linear and circular polarization observations of serendipitous and flaring targets.

191150

RAHUL GUPTA

COMPREHENSIVE CHARACTERIZATION OF MULTI-COMPONENT PROMPT EMISSION IN GAMMA-RAY BURSTS THROUGH SYSTEMATIC FERMI DATA

We propose a comprehensive, time-resolved spectral investigation of a complete sample of bright GRBs jointly detected by Fermi GBM, LLE, and LAT. Using joint keV--GeV spectral modeling within the Multi-Mission Maximum Likelihood framework, we aim to: (1) systematically identify and characterize all spectral components in GRB prompt emission; (2) track their independent temporal evolution on sub-second timescales; (3) measure component flux ratios and their evolution to constrain emission mechanisms; (4) derive physical parameters including bulk Lorentz factors, emission radii, and photospheric properties; and (5) establish population-level trends linking multicomponent behavior to GRB class, luminosity, and spectral hardness. This program fully exploits Fermi's unique energy coverage.

191151

ROBIN CORBET

A NOVEL PERIODIC SOURCE IN THE GALACTIC PLANE

A variety of interacting binary star systems can produce gamma-rays that may be modulated on their binary periods. From a search for modulation from all cataloged LAT sources, we have identified a source that may be a completely unique type of system. It lies 0.5 deg. from the Galactic plane and exhibits a periodicity of \sqig0.1 days. The nature of the source is unclear. While the period length would be compatible with the orbital period of a "spider", its other properties would make it unlike any other spider system. This goal of this proposal is to determine the nature of this extraordinary source using already approved VLA radio observations, together with deeper analysis of the LAT data.

191152

JUNG-TSUNG LI

PROBING THE ORIGIN OF SMALL-SCALE PHOTOSPHERIC MAGNETISM WITH GAMMA RAYS

The Sun's quiet photosphere harbors magnetic flux in intermittent fields at small scales. The origin of this magnetism is unclear: it may arise from active-region decay, large-scale dynamo noise, or local small-scale dynamo. Solar-disk gamma rays, produced by hadronic Galactic cosmic-ray (GCR) interactions with solar gas, are sensitive to photospheric magnetic structure, providing a unique diagnostic. We propose an integrated program that couples solar and heliophysics modeling with Fermi-LAT observations. Our framework combines GCR transport, magnetoconvection simulations, and Alfven wave turbulence. By comparing observations with model predictions for the gamma-ray spectrum, we will constrain photospheric magnetic intermittency and resolve between competing field-generation mechanisms.

191155

MARK LEISING

FERMI GBM MEDIUM LENGTH TRANSIENTS

We develop a method to search Fermi GBM data optimized for transient emission lasting from several minutes to a day and characterize them. We search several energy bands over the entire GBM range, and record environmental, spectral, and directional characteristics for each. The cause of some is quite clear, and while many are due to local background effects, many are celestial photon events. Because of the numbers of events over sixteen years, characterizing all is a challenge, so we use machine learning techniques to classify them. We expect that we will identify events from known flaring sources, and find new sources. The variable sky at these timescales and energies is nearly unexplored, and Fermi GBM represents by far the most extensive data set available.

191160

ALEX LANGE

PHASE-RESOLVED POPULATION STUDY OF BRIGHT YOUNG GAMMA-RAY PULSARS FROM THE 3PC

Gamma-ray pulsars offer a unique laboratory for studying particle acceleration, radiation mechanisms, and magnetic-field geometry under extreme conditions. With the release of the Third Fermi-LAT Pulsar Catalog (3PC) and nearly two decades of continuous all-sky monitoring by Fermi-LAT, gamma-ray pulsar studies can now move beyond phase-averaged characterization toward population-level, phase-resolved investigations. We propose a systematic phase-resolved spectral and temporal analysis of the brightest gamma-ray pulsars in the 3PC, selecting all sources with fluxes 2x10 erg cm^2 s^-1 (or 34 pulsars). This study will measure phase-dependent variations in spectral index, cutoff energy, and flux across the pulsar population, enabling direct tests of emission geometry and particle acceleration.

191161

WEI LIU

PROBING THE PUZZLE OF LONG-DURATION AND BEHIND-THE-LIMB SOLAR GAMMA-RAY FLARES

This proposal addresses the origin of long-duration and behind-the-limb solar gamma-ray flares by testing the hypothesis that shock-accelerated protons travel from CME-driven shocks back to the Sun. We combine data-driven global MHD simulations with kinetic modeling of particle transport and multiwavelength observations to quantify shock properties, magnetic connectivity, and proton precipitation. Direct comparisons with Fermi/LAT centroid evolution and complementary EUV data provide stringent tests of this scenario. The results will establish a self-consistent framework linking flares, CMEs, SEPs, and sustained gamma-ray emission, while clarifying the physical connection between gamma-rays and shock-accelerated particles with direct relevance to space weather and human exploration.

191164

SAM GROETSCH

UNVEILING THE GEV COUNTERPARTS TO NEW TEV SOURCES FROM THE FOURTH HAWC CATALOG

A new catalog of Very-High-Energy Gamma-ray sources in the fourth High Altitude Water Cherenkov (HAWC) catalog (4HWC) is releasing soon. This catalog identifies 11 new TeV sources without a known counterpart or origin in the TeV energy range. This project will explore these sources in Fermi-LAT data to help further our understanding of their properties and possible origins. Dedicated region-of-interest analyses will be performed to identify counterparts or provide upper limits of GeV emission nearby. A multi-wavelength study will be carried out jointly fitting physics-driven models to the GeV--TeV gamma-ray spectra. This project will deepen the understanding of high-energy phenomena by exploring the mechanisms of the newly discovered particle accelerators at the highest photon energies.