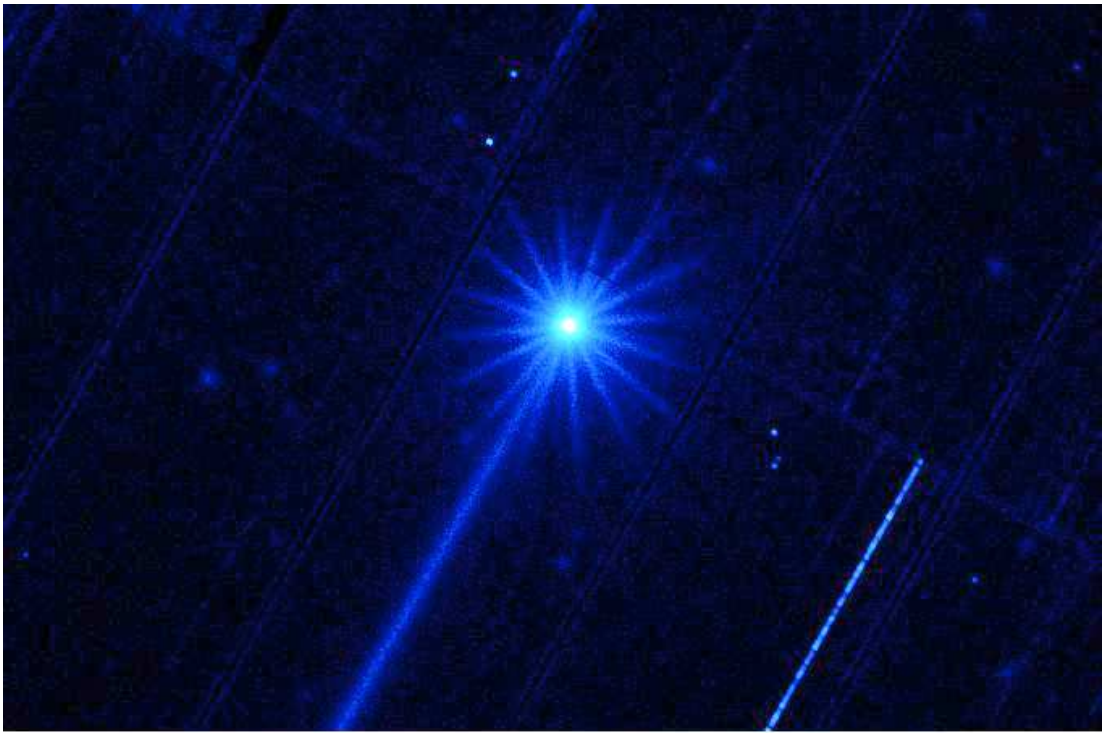
Sixth Annual Undergraduate Mini-Symposium

Department of Astronomy and Physics
Saint Mary's University
Friday September 11, 2009, Loyola 296



XMM-Newton observations of the AGN PG0003+199 in the 1.2 – 7.0 keV bandwidth, where bright white areas indicate strong x-ray emission (Robertson, Gallo)

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Sixth Annual Undergraduate Mini-Symposium

Friday September 11, 2009, 9:30 am – 1:30 pm

Loyola 296

Programme

Opening remarks (Clarke)			9:30 – 9:40
Session I: Nuclear Physics (Sarty)			
1.1	R. d'Entremont (Austin)	*Summer work at TRIUMF*	9:40 – 9:55
1.2	M. Uchida (Kanungo)	*Determining dead layer of silicon detector for measuring density distribution of neutron-rich nuclei*	9:55 – 10:10
1.3	C. Collicott (Sarty)	*Probing the structure of the proton using high-energy Compton scattering*	10:10 – 10:25
1.4	A. Campbell (Sarty)	*A simulation of a novel scintillating fiber particle detector*	10:25 – 10:40
Coffee			10:40 – 11:00
Session II: Astronomy and Astrophysics (Sawicki)			
2.1	M. Palmer (Sawicki)	*Spectral energy distribution fitting of spatially resolved high-redshift galaxies*	11:00 – 11:15
2.2	W. Beslin (Deupree)	*Mode splitting in rapidly-rotating stars*	11:15 – 11:30
2.3	K. Fulford (Gallo)	*Investigating the relationship between X-ray and UV flux in Type I AGNs: I. Data Processing*	11:30 – 11:45
2.4	D. Robertson (Gallo)	*Investigating the relationship between X-ray and UV flux in Type I AGNs: II. Results*	11:45 – 12:00
2.5	M. Hiland (Lane)	*New spectroscopic capabilities for the BGO*	12:00 – 12:15
Lunch			12:15 – 1:00
Session III: Undergraduate Thesis (Gallo)			
3.1	N. Pressé (Gallo)	*Getting at the core of RX J0136.9–3510: High-energy observations of a narrow-line Seyfert 1 galaxy*	1:00 – 1:20
Awards and closing remarks (Clarke)			1:20 – 1:30

1.1 *Summer work at TRIUMF*

Roland d'Entremont (Austin)

TRIUMF has been a leader in the physics research since the cyclotron began operations in 1974. In this talk I will be discussing my participation in an experiment at TRIUMF. The 8-pi germanium array spectrometer was used to measure the beta particles and gamma rays resulting from the decay of ^{19}Ne. I will also discuss SHARC, a silicon array, which was attached to TIGRESS (TRIUMF-Isac Gamma Ray Escape-Suppressed Spectrometer) for preliminary calibration and testing.

1.2 *Determining dead layer of silicon detector for measuring density distribution of neutron-rich nuclei*

Masaki Uchida (Kanungo)

The distribution of neutrons and protons inside the nuclear volume is one of the fundamental properties of nuclei that govern its behaviour. This distribution is quite different for nuclei having a large excess of neutrons. Knowledge of such a distribution is necessary for our understanding of neutron-rich matter in the universe.

We will perform an experiment at the Fragment Separator (FRS) in GSI, Darmstadt, Germany to determine the density distribution of ^{72}Ni. To detect the energies of scattered particles, Si and NaI detectors will be used.

I have worked on testing Si and NaI detectors for three weeks at GSI. My presentation will discuss the results, the procedure of testing the detectors, and the method to solve the encountered problems during the test.

1.3 *Probing the structure of the proton using high-energy Compton scattering*

Cristina Collicott (Sarty)

Upcoming experiments at the Institute for Nuclear Physics in Mainz, Germany will seek to use data obtained from high energy Compton scattering events to probe into the internal structure of the proton. An updated trigger system is currently being designed for the experiments. Geant4 is a powerful toolkit for simulating the passage of particles through matter. Recently, intelligent models of the Crystal Ball and TAPS detectors used in Mainz have been implemented into this toolkit. Geant4 simulations will be completed to analyse various possible triggering systems and the simulations performed will directly contribute to the design of the trigger system.

1.4 *A simulation of a novel scintillating fiber particle detector*

Ashley Campbell (Sarty)

A unique particle detector design using scintillating fibers was being considered as Saint Mary's contribution towards the Super-Bigbite Spectrometer 12 GeV upgrade for the Thomas Jefferson National Accelerator Facility (JLab), in Virginia, USA. This talk will describe a simulation package developed over the summer that accounts for the design and geometry of this particular detection system. It will present preliminary results that favor the design in question by demonstrating that the constraints of the simulated scintillating fiber detection system perform as expected for this task. For example, the simulation accounts for fiber firing characteristics as well as the detector and particle geometry in order to evaluate the efficiency at which the fibers fire. Finally, the presenter will identify the work that will be required to develop a future particle tracking capability within the current framework of the simulation in order to determine the position and tracking-angle resolution of the detected particles.

2.1 *Spectral energy distribution fitting of spatially resolved high-redshift galaxies*

Michael Palmer (Sawicki)

This summer my research with Dr. Sawicki looked into the possibility that the current way galaxies are modelled could be giving erroneous results. At present the total flux from a galaxy is measured and from these measurements, different parameters such as age and mass are found. Our concern is that using this method, an active region of star formation within the galaxy could dominate the flux used and we could be missing information from the outlying regions.

Using resolved galaxies of $z \sim 1.9$ – 2.5 from the Hubble Deep Field, individual pixels for each galaxy are examined and modelled. They are then pieced back together to look for structure within the galaxys parameters, such as age, mass and star formation rate. This can give insight into whether or not the current way galaxies are modelled are giving us reliable answers or do we need to re-examine our standard methods.

2.2 *Mode splitting in rapidly-rotating stars*

Wilfried Beslin (Deupree)

Many stars, including the sun, oscillate in a number of low amplitude normal modes defined by three integers: n, l, and m. The frequencies of these modes are of value to astrophysicists, as they depend on the interior properties of these stars. When rotation is slow, the frequency separation between different values of n is much larger than for different values of l, which are in turn larger than the separations for different values of m. This produces a clear pattern in the frequency spectrum which helps with mode identification. However, this clarity becomes lost when stars rotate more rapidly because the frequency separation for different values of m becomes quite large and overlaps with the separations of both n and l. The goal of my

research was to unravel the complexity of the rapidly rotating case. I will describe a few of the methods I tried, and my success with them.

2.3 *Investigating the relationship between X-ray and UV flux in Type I AGNs: I. Data processing*

Kendra Fulford (Gallo)

$\alpha_{\rm OX}$ is the hypothetical power law between the UV (2,500 Å) and X-ray (2 keV) fluxes in AGN. By using the space telescope XMM-Newton, which has multiple instruments and observational filters, simultaneous UV and X-ray flux measurements can be collected in order to get clean estimates of $\alpha_{\rm OX}$. However, before $\alpha_{\rm OX}$ can be measured, the Observational Data Files (ODF's) collected from XMM-Newton must undergo processing in order to create usable spectral files. Part I of this talk will cover the types of samples used for the research as well as the steps taken to process the data properly. Part II of the talk, which will be given by Damien Robertson, will cover the results of the research as well as future research possibilities.

2.4 *Investigating the relationship between X-ray and UV flux in Type I AGNs: II. Results*

Damien Robertson (Gallo)

Space telescopes allow us to study certain properties of objects that would otherwise be invisible to observers on the ground. In this work, we examine X-ray and UV properties of unobscured type I AGNs. Continuing from Kendra Fulfords talk, I will present correlations found between X-ray and UV fluxes derived directly from simultaneous observations of a sample of AGN. I will discuss implications and suggest further directions of study.

2.5 *New spectroscopic capabilities for the BGO*

Mike Hiland (Lane)

This talk will summarize the newest addition in observational equipment to the Burke-Gaffney Observatory, namely, the Lhires III High Resolution Spectrograph. The Lhires III is an inexpensive lightweight yet powerful instrument allowing for stellar classification, chemical composition, and physical properties and dynamics in bright stars. Also to be discussed are the methods used in calibrations and techniques on data acquisition along with plans to implement observational projects suited for undergraduate students.

3.1 *Getting at the core of RX J0136.9−3510: High-energy observations of a narrow-line Seyfert 1 galaxy* (Honours thesis presentation)

Nick Pressé (Gallo)

Simple virial-based arguments of Active Galactic Nuclei (AGN) have informed us that within

$\sim$ one cubic parsec lies 109 ± 1 solar masses. This region can outshine the combined thermal emission due to the host galaxys stars. The culprit responsible for this incredible generation of energy is widely accepted to be the accretion of matter around a super-massive black hole. X-rays are believed to originate closest to the black hole and are thus vital to our understanding of AGN as they allow us to "probe" the heart of the nucleus.

In my talk I will discuss the implications of the X-rays (0.3 – 10.0 keV range) received from a Narrow-Line Seyfert 1 galaxy. Spectral analysis was used in order to determine the separate components of the spectrum generated by unique processes, which combine to best represent the true energy distribution. Temporal aspects of the source were also investigated to dispose of or give further credence to these models.