***Tractricious*, a sculpture at FermiLab's Industrial Center**

Art Abstracts at the 2008 Sigma Pi Sigma Congress

A1: **The Quest for the Unseen Boson**, General Science, *(for display and judging)*

Melody Carlson & Sarah Beth Gross, wildaboutlondon@gmail.com, Undergraduate, Grove City College

A theory exists that is founded upon the supposition that when protons collide, the resultant measured energy must come from a larger particle. When two protons collide in the Large Hadron Collider, there is a particle so unstable, yet so large, that it can only be identified by the energy emitted when it implodes. Despite the fact that it has never been seen, it is thought that this theoretical particle has more mass than any other. This is the Higgs Boson. Inspired by an article in the March 2008 National Geographic Magazine, the hanging mobile before you gives one interpretation of this particle collision and the theoretical Higgs Boson.

A2: **Refraction in Our World**, The Citizen Scientist, *(for display and judging)*

Ashley Cetnar, cetnaraj1@gcc.edu, Undergraduate, Grove City College

As tourists visit Niagara Falls they can view the wonderful majesty of nature. Rainbows are recognized by everyone, and while most can be spotted on a rainy day, rainbows can also be seen in the small droplets of water from waterfalls. Optical refraction is the scientific reason that spectrum appears in the sky. The refraction depends upon the wavelength of the light, and that is the reason for the continuous spectrum of color that we know as a rainbow. As the angle of the refracted light gets greater, the wavelength of light gets shorter.

A3: **The Bubble Chamber Reliquary**, General Science, *(for display and judging)*

Kristal Feldt, kfeldt@ku.edu, Undergraduate, University of Kansas

The Bubble Chamber Reliquary was a project for my introductory course to metalsmithing. A previous course in astronomy at the university and further research introduced me to the beauty of neutrinos and particle collision, which have become recurring themes in both my sculpture and art jewelry. So I created a spherical container to place symbols of my sister (a more logical mind, symbolized by a Feynman diagram) and myself (a more creative mind, symbolized by the visual representation of particle collision). The reliquary itself is sealed shut (a symbol of the inescapable blood bond between the two of us). The holes, or bubbles, help represent the bubble chamber in which the particle collision occurs and give the observer a peek at the symbols inside. The bubbles might appear to be random at first glance, but a look at the side shows that they actually are symmetrical to the bubbles on the other side.

A4: **The Particle Decay Series**, General Science, *(for display and judging)*

Kristal Feldt, kfeldt@ku.edu, Undergraduate, University of Kansas

The goal I wish to achieve in the art field is not to go the average route of replicating organics, but instead bring light to the beauty of science. I seek to design sophisticated art jewelry and small scale sculpture that brings the elegance of scientific phenomena and concepts, particularly in the realm of physics, to the everyday person. I intend to accomplish this by taking my understanding of the literal and conceptual views of different topics (that I do personal research to understand to the best of my ability) and creating something beautiful out of it. In The Particle Decay Series, I created a line of artistic jewelry to express the nature of particle decay through its collision patterns. The set includes a hairpin, necklace, bracelet, earrings, brooch, and ring.

A5: **A Construction of Space-time in Cylindrical Coordinates**, General Science, *(for display and judging)*

Zack Fifer, zjf5001@psu.edu, Undergraduate, Penn State University

I attempted to sculpt the way that I sometimes think of interacting particles in empty space. The sizes are not to scale, since the particles are quite a bit too large, but I tried to show the interaction between the particles as field lines, and the resulting tears in the background (space-time why not?) when the 'binding energy' between the particles started to come undone.

A6: **Equalized Pressures on an Elastic Membrane**, General Science, *(for display and judging)*

Zack Fifer, zjf5001@psu.edu, Undergraduate, Penn State University

This is the shape that is taken when an elastic cylinder with an isotropic elastic coefficient is filled with water. The pressure from the height of the water is equalized by the tension of the membrane. Also, you can use it as a coffee cup.

A7: **Irrylath**, Open (non-themed)

Amanda Fort, amanda.fort@usma.edu, Undergraduate, United States Military Academy

This piece depicts the anti-hero of Meredith Ann Pierce's fantasy novel series, the darkangel Irryath, and her heroine, Aeriel. Particular attention is paid to the anatomy of his twelve wings and to the architecture of his castle, and the work aims to draw a contrast between the warm, human, living Aeriel and the dead, haunted darkangel.

A8: **Laplace's Demon**, Open (non-themed), *(display only)*

Lindsay Goodwin & Cody Crewson, cody.crewson@gmail.com, Undergraduate, University of Calgary

We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes. - Pierre-Simon Laplace, 1814. This intellect was later called Laplace`s demon, which I have painted as a creature. It is painted with lines arranged so that we can only say where each line would probably be, like electrons in an atom. The red, blue and green lines represent alpha, beta and gamma particles, the yellow lines are particles that are undiscovered. The creature has large prophetic eyes, like many early eastern Mediterranean gods and goddesses. This painting has four dimensions: length, width, depth (due to multi-layering), and time (since it changes with its surroundings).

A9: **Homogenous DBD** General Science, *(for display and judging)*

David Jacome, djacome@spc.edu, Undergraduate, Saint Peter's College

Although high pressure plasmas usually are manifested as run-away transients such as arcs and lighting in this picture we see a high pressure homogenous plasma formation with a dielectric barrier discharge (DBD). The photograph focuses our attention to the center at the most important part between the two electrodes of the DBD reactor. The background is a blur since the focus of our research is to understand the formation of the plasma. Courtesy: Saint Peter's College, Physics Program, Jersey City, New Jersey

A10: **Liquid Parabola**, General Science, *(for display and judging)*

Glenn A. Marsch, gamarsch@gcc.edu, Non-Student, Grove City College

Streams of water emerge from a fountain at the Detroit Airport. Like solid objects, liquids projected upward also follow a parabolic trajectory.

A11: **Incandescent Infinity**, General Science, *(for display and judging)*

Glenn A. Marsch, gamarsch@gcc.edu, Non-Student, Grove City College

The infinity sign is etched in the night by the incandescent glow of a sparkler. The golden color is likely due to iron being oxidized by potassium nitrate oxidant at extremely high temperatures, ~ 1500 K. The sparkler's color results partly from the characteristic blackbody radiation emitted by an object at that temperature. In addition, a diffraction grating would reveal light emitted by atomic transitions of iron electrons to their lower states.

A12: **Fallen**, General Science, *(for display and judging)*

Glenn A. Marsch, gamarsch@gcc.edu, Non-Student, Grove City College

A maple leaf has fallen on a road, and rain has fallen atop the leaf. Under the leaf, the stain of water shows adhesion to the pavement, on which it has spread out, while the droplets on the leaf's surface contract to form hemispheres. The tendency for water to form spherical droplets results from cohesion, the intermolecular attraction of water molecules with each other. The cuticle of the leaf's surface consists of waxes, long-chain aliphatic hydrocarbon molecules that are hydrophobic, and repel water. Thus the water beads up on the leaf because it cannot easily adhere to the leaf.

A13: **Transparencies**, General Science, *(for display and judging)*

Glenn A. Marsch, gamarsch@gcc.edu, Non-Student, Grove City College

A still life of a crocus blossom in a shot glass, showing an interplay of light through various materials. Visible light is easily transmitted though the windowpane. Light passes through the water-filled shot glass as well, but refraction through a lens of this shape bends light more. Much of the arborvitae row in the background appears compressed after passing through the shot glass and looks similar to a "fish-eye's view." The diaphanous, white petals of the crocus blossom allow some light of all visible wavelengths to transmit through the petals. Within the blossom, veins of pigment absorb lower-energy, red light, and reflect unharvested violet light to your eyes.

A14: **Sumac in Scarlet**, General Science, *(for display and judging)*

Glenn A. Marsch, gamarsch@gcc.edu, Non-Student, Grove City College

A study of the contrasting colors of sumac leaves posed against a crystalline blue sky. The scarlet color in autumn leaves results from light absorption by carotene and anthocyanin molecules. Carotene pigments are present in the leaf during the growing season, but become visible when chlorophylls degrade in the fall. Anthocyanins are synthesized at the end of the growing season as the leaf shuts down. Light absorption is a process governed by the quantum physics of molecular electronic states. The characteristic color of the sky can be understood by classical Rayleigh scattering of sunlight. The efficiency of Rayleigh scattering is proportional to the reciprocal-fourth power of the wavelength (1/lambda^4), so that high-energy, short wavelength light is scattered best. This would be violet light; but human eyes detect blue much better than violet, so the sky appears blue.

A15: **Evensong**, General Science, *(for display and judging)*

Glenn A. Marsch, gamarsch@gcc.edu, Non-Student, Grove City College

A tryptich of Pennsylvania sunsets showing different aspects of atmospheric physics. As the sun sets, the path length of light rays through air is greater, and blue light is scattered more efficiently than when the sun is high in the sky. Thus the low-energy orange and red light penetrates the atmosphere without much scattering and reaches your eye. In the middle image, crepuscular rays can be seen streaming through gaps in the clouds, and in the lower photograph, a sun pillar is faintly superimposed on high clouds of ice. Sun pillars appear as light refracted through plate-like hexagonal ice crystals. The lower photo also shows altocumulus and altostratus clouds, and very high cirrus clouds. An ice contrail is even illuminated by the westering sun. For more fun information about atmospheric optics, see Les Cowley's excellent website at www.atoptics.co.uk.

A16**: Mu Arae Alpha**, General Science, *(for display only)*

Douglas Parsons, dparsons1@angelo.edu, Undergraduate, Angelo State University

Mu Arae is a fifth magnitude (5.15) class G (G3) subdwarf-dwarf (implying it has given up core hydrogen fusion or is about to) that lies at a distance of 50 light years. Its temperature of 5813 Kelvin and luminosity 1.7 times that of the Sun leads to a radius 1.3 times solar and reveals a mass 10 percent greater than that of the Sun. Like the majority of planet-holding stars, Mu Arae is metal-rich, with an iron content (relative to hydrogen) that is double solar. The star rotates more slowly than the Sun, with a period of about 27 days. Mu Arae Alpha orbits in 9.55 days, has a mass at least 0.03 times that of Jupiter (only 10 times that of Earth, one of the lowest mass-limits known), and is 0.09 Astronomical Units (AU) from the star (13.5 million kilometers, 8 million miles, or 23 percent Mercury's distance from the Sun). As expected for such a close planet, the orbit is circular.

A17: **Jovian Marbles**, Open (non-themed) , *(for display and judging)*

Douglas Parsons, dparsons1@angelo.edu, Undergraduate, Angelo State University

Recently, The New Horizons probe - on its way to explore Pluto - passed by the Jovian System and took some rather nice snap-shots of the system. This is not a representation of Jupiter, but rather just a simple gas giant system in orbit around some far off star system.

A18: **Fire in Paradise**, Open (non-themed), *(for display and judging)*

Douglas Parsons, dparsons1@angelo.edu, Undergraduate, Angelo State University

In the deep, cold reaches of space, there are places where fire, ice, and dust come together to form new stars. These molecule rich nebulae are the birthplaces of stars. Our own star condensed out of a similar cloud during its infancy. It is from these nebulae that many amazing images are taken, most by the Hubble Space Telescope.

A19: **412 Nebula**, General Science, *(for display and judging)*

Douglas Parsons, dparsons1@angelo.edu, Undergraduate, Angelo State University

Spectroscopy is an important tool that astronomers use when observing the cosmos. The process allows astronomers and physicists to observe the inherent elements that comprise a star or region of dust, ice, or gas. By observing the spectra, either emission or absorption, elements such as carbon, nitrogen, helium, and even heavier elements can be identified. Each element has its own signature wavelength of light that it emits when it falls from an excited state. This is what gives stars and nebulae their characteristic colors.

A20: **Fractalline Fluids**, General Science, *(for display and judging)*

Jeanette Powers, PowersJ@rockhurst.edu, Undergraduate, Rockhurst University

This painting represents a dynamic system of the movement of fluid and the drying rate and interactions of acrylic pigment. The fractured surface is created by crumpling cellophane over a wet surface of paint. Pigment is then forced into the channels of the cellophane while the canvas is tilted at an angle, to allow gravity to pull the pigment down through the fractured system. This technique I have developed allows the artist to use the natural mixing that fluid dynamics creates along with the control of the artist to create an art piece which exists on the boundary between order and chaos. The result is a chaotic landscape reminiscent of leaves, cells, rivulets, the cracked dirt of arid land: all chaotic processes which leave a recognizable mark. The pattern is not exact, but exhibits self-similarity at different scales. In my experience, the struggle with creating science-based art is to keep the technical details while still creating art which is warm, human and ultimately still relates to people from all walks of life.

A21: **In Dimension**, Future Faces of Physics, *(for display and judging)*

Jeanette Powers, PowersJ@rockhurst.edu, Undergraduate, Rockhurst University

The painting begins with a point in the lower left corner. A point is described by zero dimension. A conglomeration of points in a row creates a line, which is one dimensional. Likewise, a collection of lines creates a plane, which is two dimensional. Finally, she approaches three dimensions in the right hand side of her face where an artist's concept of depth, volume and form is taken into account. The grid lines are left behind to show the beings that occupy the physical, spatial dimensions we live in. As you walk past this in a gallery, you experience it moving through time, and it lives with you in four dimensions. Fractal dimensions also enter into this piece. There are instances of a phase transition between laminar flow and viscous fingering, a fractal-like boundary. The underlying texture is created by using crumpled plastic wrap as a sort of stamp, and so is similar to the fractal dimension of the crumpled paper ball. This painting exemplifies the theme Future Faces of Physics both by being a self-portrait of an aspiring physicist and by addressing the emerging science of dynamical systems and fractal dimensions.

A22**: The Marly Horse**, The Citizen Scientist, *(for display and judging)*

Briana Reprogle , reprogle@gmail.com, UG, Kettering U./Northwestern U., Feinberg School of Medicine

Guillaume Cousteau's 'Marly Horses' are a pair of statues that were commissioned by Louis XIV and completed in 1745. The original pieces are housed in the Louvre, a reproduced pair guard an end of the Champs Elysees (a historic street in Paris), and one is reproduced here, in 0.5mm Bic. Physics is the study of the most fundamental laws of the physical world; I find that Cousteau's Marly Horses are a study of the most fundamental interaction between the scientists and the natural world they are born into. Our intelligence enables us to harness the physical power of the horse species. In exercising our mental capacities over these animals, we are bound to work under certain moral obligations. It is very established that all scientists should abide by two fundamental creeds: exercise respect and compassion for the natural world in methods of research, and seek an equilibrium between the natural resources our technologies use and those products which humanity needs. It is the Citizen Scientist who can humbly wield his intelligence and perspective to serve both humanity and the physical realms, and to pass his insight and passion to the future generations.

A23: **Untitled**, Open (non-themed), *(for display and judging)*

Sarah Richards, srichar9@emich.edu, Undergraduate, Eastern Michigan University

This work was an experiment to see how acrylic could be used to mimic the baroque style of skin shading. The colors are also characteristic of the baroque style, but the composition and subject matter are not.

A24: **The Crab Nebula from 7.5 Light Years**, Future Faces of Physics, *(for display only)*

Tracy Schwab, tschwab@aip.org, Non-Student, American Institute of Physics

In my role as SPS/Sigma Pi Sigma Communications Coordinator for the past seven and a half years, I've had the pleasure of working with and photographing some of the best and brightest physics students from across the United States. In addition, I have archived photos submitted by nearly all of the SPS interns, award winners, scholarship recipients, and national council members. I've also collected hundreds of photos from various SPS chapter activities, zone meetings and Sigma Pi Sigma induction ceremonies. In a nod to the 2008 SPS Theme "Future Faces of Physics, the 2008 Quadrennial Congress, and the 2009 SPS Them "A Universe of Wonder," I've prepared more than 3,500 individual SPS and Sigma Pi Sigma photos in various ways (sorting, rotating, sizing, cropping, and color correcting), and uploaded them to an online application that generates photo mosiacs. I present here The Crab Nebula from "7.5 light years..." these are the Future Faces of Physics.

A25: **Seraina**, Future Faces of Physics, *(for display and judging)*

Cara Taber, tabercs1@gcc.edu, Undergraduate, Grove City College

Seraina spent many hours in high school pouring over physics homework with me, and through our joint effort, we passed the class and grew to love physics. Now Seraina studies physics at Case Western Reserve University. Represented here in this linoleum block print is her determination and hope for the future. This determination is also reflected in the background-- the Swiss Alps, a tribute both to Seraina's dual Swiss-American citizenship, and the famous CERN located on the France-Switzerland border. She proudly represents the ever increasing communities of both international and female physicists. No doubt the physics community will see great research in the future from Seraina, probably still proudly sporting her "Schr÷dinger's cat is dead / Schr÷dinger's cat is not dead" t-shirt.

A26: **When Life is Looking Up**, Open (non-themed) , *(for display and judging)*

Cara Taber, tabercs1@gcc.edu, Undergraduate, Grove City College

This self-portrait watercolour gives a new perspective.

A27: **Awe**, The Citizen Scientist, *(for display and judging)*

Cara Taber, tabercs1@gcc.edu, Undergraduate, Grove City College

This collage shows how important it is to get children excited about physics. It also reminds each of us how it feels to stand in awe of both the mystery of physical phenomena and the even more astounding concept that we can understand such amazing things through physics. The citizen scientist wants other people to experience this amazing feeling-- not necessarily a teacher by trade, but still committed to share with others a passion for physics.

A28: **Transition,** Open (non-themed), *(for display and judging)*

Ann Viano, viano@rhodes.edu, Non-Student, Rhodes College

Observation confronts expectation. What defines reality? Winter sunset over Poplar Tree Lake, Meeman-Shelby State Park, TN

A29: **Exploring** Future Faces of Physics, *(for display and judging)*

Ann Viano, viano@rhodes.edu, Non-Student, Rhodes College

Curious minds need time and space to explore, to seek answers which only prompt more questions. Why do the leaves fall? Why does the Sun rise? Why does the Earth spin? How does the universe work?

A30: **Exploration**, Future Faces of Physics, *(for display only)*

Gary White, gwhite@aip.org, Non-Student, American Institute of Physics

Snapped in the mid-1980s at the Mid-America Science Museum in Hot Springs, Arkansas, this photo features a young explorer amid a rainbow of pastel flags. The subject is the photographer's brother, and now, some 20 years after the photo was taken, he has just begun a new adventure as a high school physics teacher in New Orleans. His path from museum exploring to engineering to physics teaching might seem unlikely to some, but for this photographer, he is an especially welcome addition to the faces in the physics community.

A31: **Still Dawn**, Open (non-themed) , *(for display only)*

Gary White, gwhite@aip.org, Non-Student, American Institute of Physics

Early morning light streams through textured curtains onto crystalline surfaces, reflecting and transmitting a somber ambiance.

A32: **Replicating Roses**, Open (non-themed) , *(for display only)*

Gary White & Myrle K. White, gwhite@aip.org, Non-Student, American Institute of Physics

A painting by MKW of a photograph taken by GDW of an actual rosebush planted and nurtured by MKW.

A33: **Heel Over Heels**, General Science, *(for display and judging)*

Karen Williams, kwillims@mac.com, Non-Student, East Central University

"Heel Over Heels" photo was taken with a Kodak camera at an art museum in Hot Springs, AR. No 'touching up' or Photoshopping was done on the photo. The photo was taken of a colleague and myself in a 'crazy' mirror. Note also the crazy pattern of the carpet in the mirror.