

Western Michigan University  
Department of Physics Colloquia  
2007-2008

**Speaker: Sung G. Chung**

Western Michigan University

**September 10, 2007**

**“Novel Many-body Method in Statistical Mechanics  
and Strongly Correlated Condensed Matter Systems”**

**Abstract:** To calculate the partition function is the most fundamental task in statistical mechanics. The symbolic work is that of Lars Onsager in 1944 for the 2 dimensional Ising model followed by C.N. Yang in 1952. We here developed a new method for including non-integrable systems and 3 dimensions. The method does not rely on any existing notions such as numerical renormalization group and mean field theories. The idea is "a perturbation in entanglement space." We show the converged and hence exact results, to the precision of 1%, for the specific heat and spontaneous magnetization in 2 and 3 dimensional Ising models. The method is quite simple, general and practically exact, with a tremendous potential of application. Indeed, the method has been successfully applied to the quantum ground states in 1 dimension, agreeing with the Bethe Ansatz results for the 1 dimensional Hubbard model.

**Speaker: Lihua Wang**

Western Michigan University

**September 17, 2007**

**“The Precise Implementation of Cluster Transfer Matrix  
Method in Single Electron Box”**

**Abstract:** The partition function of the single electron box (SEB), a small metallic island connected by a tunnel barrier to the environmental lead, can be expressed in path-integral form, which contains the effective action of the collective variable, phase, after integrating out the background electron degrees of freedom. The cluster transfer matrix method (CTM) is applied to the SEB. By using an improved numerical algorithm and more intensive calculations with larger cluster size, we obtained the highly accurate result for the effective charging energy of SEB up to a large barrier conductance. The CTM calculation is exact and systematic since we use neither notations nor restrictions during calculating the partition function and there is a transparent convergence procedure with increasing the cluster size. The results, to our surprise, are in excellent agreement with the real time renormalization group method of König and Schoeller.

**Speaker: R. J. Smith**

Montana State University

**September 19, 2007**

**“Applications of Ion Beam Analysis to Materials  
Characterization for Solid Oxide Fuel Cells ”**

**Abstract:** The requirements of low cost and high-temperature corrosion resistance for bipolar interconnect plates in solid oxide fuel cell (SOFC) stacks has directed attention to the use of specially engineered steel alloys with good oxidation resistance. However, volatile Cr species from the Cr<sub>2</sub>O<sub>3</sub>-based oxide scales on these steels find their way to the triple-phase boundary of the SOFC, leading to rapid degradation of cell performance. Coatings can serve not only to slow oxidation rates, but also as diffusion barriers for the Cr-derived species from the steel, slowing the degradation process. We have used various combinations of RBS, non-Rutherford scattering and NRA to characterize the coated steel plates in terms of their thermal stability, and the rate of oxide growth. In addition, RBS was used to quantify vaporization rates of Cr from several steels, with and without coatings. Also, the <sup>18</sup>O(p,α)<sup>15</sup>N reaction was used to measure absorption and diffusion of <sup>18</sup>O in yttria-stabilized zirconia, a candidate material for the SOFC electrolyte.

**Speaker: Morten Ring Eskildsen**

University of Notre Dame

**September 24, 2007**

**“Superconducting Vortices in CeCoIn<sub>5</sub>:  
Beyond the Abrikosov-Ginzburg-Landau Paradigm”**

**Abstract:** Most superconductors subjected to a magnetic field respond by the formation of the mixed state where the material is threaded by a regular lattice of Abrikosov vortices each carrying one quantum of magnetic flux. For more than half a century, the phenomenological Ginzburg-Landau theory based on the concept of characteristic length scales has provided a surprisingly good description of the Abrikosov vortex lattice state.

Here, we report small-angle neutron scattering measurements of the vortex lattice (VL) in the heavy fermion superconductor CeCoIn<sub>5</sub>. Since its discovery, a plethora of interesting phenomena has been observed in this material. Among these are one of the highest critical temperatures ( $T_c = 2.3$  K) in any heavy fermion superconductor, d-wave pairing symmetry, a paramagnetically limited upper critical field which is first-order at low temperatures, and field- and pressure-induced quantum-critical points and non-Fermi liquid behavior. Finally, several bulk measurements indicate a phase transition to a non-uniform (Fulde-Ferrell-Larkin-Ovchinnikov) superconducting state just below  $H_{c2}$  at low temperatures.

The magnetic field distribution around the vortices was studied by measuring the VL absolute scattered intensity which allow a determination of the vortex form factor. The form factor shows a striking departure from the usual exponential decrease with increasing field. Rather, the form factor remains constant in fields up to 2 T, above which it increases. At  $H_{c2} = 5$  T the form factor drops abruptly to zero, probably reflecting the first order nature of the upper critical field in this material. Such a field dependence is not consistent with the notion of characteristic length scales and thus marks break with the Abrikosov-Ginzburg-Landau paradigm. We speculate that these results arise from strong paramagnetic effects in this exotic superconductor combined with its proximity to a quantum-critical point. If time permits a comparison will be made with measurements on  $TmNi_2B_2C$  in the paramagnetic state above  $T_N$ .

## **Speaker: Georg Bollen**

National Superconducting Cyclotron Laboratory

Michigan State University

**October 1, 2007**

### **“Smashed Atoms Tamed - Thermalized Rare Isotope Beams from Projectile Fragmentation for Mass Measurements and Other Precision Experiments”**

**Abstract:** The precise determination of masses of rare isotopes is the key to the understanding of processes in the nuclear synthesis of the elements, the study of the evolution of nuclear structure when leaving the valley of beta-stability, and the test of symmetries and the nature of fundamental interactions. With the Low-Energy and Ion Trap facility LEBIT at the NSCL at MSU we demonstrated that rare isotopes produced by fast-beam fragmentation at energies  $>50$  MeV/u can be slowed down and prepared such that precision experiments at rest and with low-energy beams are possible. LEBIT and its first results on exotic neutron and proton rich isotopes will be presented as well as future plans for low-energy beam experiments and related developments.

## **Speaker: Utsuno Yutaka**

Japan Atomic Energy Research Institute

**October 8, 2007**

### **“Shell Evolution and Structure of Exotic Nuclei in the sd-pf Shell Region”**

**Abstract:** Recent experiment from NSCL etc. has revealed exotic structure of very neutron-rich nuclei in the sd shell region, such as the disappearance of the magic number known as the "Island of Inversion." We proposed that the sharp change of the shell structure from stable to unstable nuclei is responsible for this exotic phenomena

based on the shell-model calculation with an interaction having such a feature. Since the tensor force has recently turned out to be the most promising source of this shell evolution, we have started to construct a new sd-pf shell interaction for the shell-model calculation focusing on the proper strength of the tensor force. With this interaction, we will show some results including the splitting of the proton hole states in K isotopes and the magicity in  $^{42}\text{Si}$ .

## **Speaker: Elizabeth Simmons**

Michigan State University

**October 15, 2007**

### **“Educational Outreach in Physics”**

**Abstract:** An outreach effort can combine an eager audience, a favorite topic, and a preferred medium of expression to achieve a wonderful teaching experience. This talk discusses the whys and hows of educational outreach and presents examples from several fields of physics.

## **Speaker: James R. Slusser**

Colorado State University

**October 19, 2007**

### **“Solar UV-B Radiation: Measurements, Models and Effects”**

**Abstract:** The stratospheric ozone layer is believed to have formed several billion years ago when enough molecular oxygen was released from the oceans and was dissociated into atomic oxygen thus forming the ozone layer. Since ozone absorbs most of the harmful solar radiation below 300 nm, life in the oceans was then able to evolve to include land based organisms. The ozone layer continues to protect life on earth. Ozone column abundances have latitudinal differences and annular as well as cyclical changes that are related to QBO or sun spot activity. The ozone concentration at any point is regulated by a number of coupled chemical reactions that determine ozone loss or gain. Most of these reactions are driven by solar UV-B radiation. Man-made chlorine and bromine compounds, under the extreme cold stratospheric conditions found in the Antarctic, destroy much of the ozone in Antarctica and northern Polar Regions. Due to the dramatic loss of polar ozone the USDA in 1992 decided to establish the UV-B monitoring network at Colorado State University to develop an accurate UV-B climatology. This talk will focus on a brief history of stratospheric ozone measurement as well as current challenges in making long-term accurate and precise measurements of UV-B; factors affecting the atmospheric transmission of UV-B (sun angle, clouds, ozone, aerosols) will be discussed as well as radiative transfer model development. There will also be a short discussion on the response of plants and animals (humans too) to elevated or reduced UV-B levels.

## **Speaker: Fred Becchetti**

University of Michigan

**October 22, 2007**

### **“Big-bang and Stellar Nucleosynthesis Studied in the Laboratory”**

**Abstract:** An early indication of the so-called “missing mass” problem was the apparent disagreement between nuclear isotope abundances (such as deuterium and lithium to hydrogen) calculated with standard nucleosynthesis models and the actual observations of these isotopes. This together with the known expansion rate of the Universe led to the conclusion that most of the mass in the Universe is primarily non-nuclear in origin. However the original nucleosynthesis models made extrapolations for the then-unknown nuclear reaction rates involving short-lived nuclei (such as  $6\text{He}$ ,  $8\text{B}$ ,  $8\text{Li}$ , etc.) These reaction rates now can and have been measured by our group and others. We will outline the methods used to make these measurements and the implications of the new data for the missing mass and other related astrophysical problems.

## **Speaker: Peter Mueller**

Argonne National Laboratory

**October 29, 2007**

### **“Simple Atoms, Extreme Nuclei – from Precision Atomic Physics to Exotic Nuclear Structure”**

**Abstract:** From the outset of nuclear physics, atomic physics techniques have played an important role. In particular, laser spectroscopy has revolutionized the study of short-lived isotopes. However, when applied to light nuclei ( $A \leq 20$ ) serious experimental and theoretical challenges arise.

Only recently, dedicated experiments have been realized to overcome these difficulties. Simultaneously, theoretical calculations of simple atoms have largely improved, which was essential to extract nuclear information from experimental data. These efforts will be the topic of my talk with an emphasis on our experiment to determine the nuclear charge radius of the exotic neutron halo nuclei  $6\text{He}$  and  $8\text{He}$ . This measurement is based on laser spectroscopy of individual atoms cooled and confined in a magneto-optical trap. A few hundred  $8\text{He}$  atoms trapped in June 2007 finally revealed whether their nuclear charge radius was smaller or bigger than that of  $6\text{He}$ .

## **Speaker: N. Stolterfoht**

Hahn-Meitner-Institut, Berlin

**October 30, 2007**

### **“Strong Isotope Effects on Charge Transfer in Slow Collisions of He<sup>2+</sup> with Atomic Hydrogen, Deuterium and Tritium”**

**Abstract:** Probabilities and cross sections for charge transfer by He<sup>2+</sup> impact on atomic hydrogen (H), deuterium (D), and tritium (T) at low collision energies have been calculated. The results are obtained using an ab initio theory, which solves the time-dependent Schrödinger equation. For the H target, excellent agreement is achieved between the present and previous results. Differences by orders of magnitude are observed between the cross sections for H, D, and T. A method is introduced to separate the contributions of charge transfer mechanisms due to radial and rotational coupling. The large differences observed for H, D, and T are attributed to isotope effects in the rotational coupling mechanism.

## **Speaker: Jonathan Lang**

Argonne National Laboratory

**November 5, 2007**

### **“Probing Magnetism using Synchrotron Radiation”**

**Abstract:** The advent of third generation synchrotron sources has enabled many new types of x-ray measurements. Although the sensitivity of x-rays to an atom's magnetic moment is significantly smaller than to its charge, the high-flux, high-collimation, and unique polarization properties offered by synchrotron beams have made x-rays a routine tool in the study of magnetic systems. Near certain resonances, x-ray measurements provide magnetic information specific to a particular species of atom. Such information can offer key insights in deciphering the multiple interactions present in complex magnetic materials. Furthermore, highly focused x-ray beams can be used to probe magnetic properties in sample environments such as high-pressure and high-field that can not be accessed via other techniques. I will describe how such synchrotron x-rays can be applied to study magnetism in both applied materials and to probe more fundamental properties such as quantum phase transitions.

## **Speaker: Adilson E. Motter**

Northwestern University

**November 12, 2007**

### **“Network-Based Manipulation of Complex Systems”**

**Abstract:** The rapidly developing field of complex networks has set the stage for a new era in the study of complex systems from the viewpoint of statistical physics. Previous work has focused on the structure of networks underlying systems as diverse as food webs, protein interaction networks and the Internet. In this talk I will discuss how the interplay between network structure and dynamics can be used to manipulate the behavior of complex systems. In particular, using cellular metabolism as a model system, I will present a framework for predicting environmental changes and mutations capable of enhancing or suppressing the production of specific metabolic compounds. This framework has potential applications for recovering lost metabolic function and for transforming biological materials of industrial interest. I will also discuss a relation between metabolism and the seemingly unrelated problems of synchronization phenomena and cascade control in power grids.

## **Speaker: W. Andreas Schroeder**

University of Illinois at Chicago

**November 19, 2007**

### **“Thermal Lens Shaping: A New Modality for Diode-Pumped Solid-State Lasers”**

**Abstract:** The past two decades have seen unprecedented advances in solid-state laser technology; continuous-wave multi-kW lasers are now available commercially and lasers with ultrashort pulse durations of only a few optical cycles (i.e., 5-10 femtoseconds;  $1\text{fs} = 0.00000000000001\text{s}$ ) are now relatively routine. In large part, these advances have been enabled by semiconductor diode laser pump sources, which have facilitated direct pumping into the optical absorption lines of doped solid-state laser crystals like Nd:YAG. The consequent dramatic increase in laser efficiency over previous arc- and flash-lamp pumped technology has also resulted in a significant increase in thermo-optic aberrations and distortions (e.g., astigmatism and stress birefringence) in solid-state laser gain media due to the larger heat loading precipitating serious thermal management issues.

In this talk, after introducing the basic concepts in modern laser physics, I will present the analysis of a novel pumping geometry that, by design, compensates for astigmatism and eliminates stress birefringence through exploitation of the directionality of today's diode laser pump sources. Results from two high-power ( $\sim 10\text{W}$ ), TEM<sub>00</sub>-mode laser resonators operating on this thermal lens shaping (TLS) principle will be presented. Prospects for improving the efficiency and scaling the power of such TLS lasers will also be discussed.

## **Speaker: Rolf Schimmrigk**

Indiana University South Bend

**November 26, 2007**

### **“Experimental Tests of Extra Dimensions and String Theory”**

**Abstract:** In the past few years efforts have been underway in several collaborations to explore the existence of extra dimensions experimentally. The existence of a higher dimensional universe is an old idea that has re-emerged as an essential ingredient in string theory, as well as in other more phenomenological models. This talk provides an introduction to these ideas and some of the experimental results in this direction.

## **Speaker: William P. Halperin**

Northwestern University

**December 3, 2007**

### **“Acoustic Birefringence in Superfluid $^3\text{He}$ ”**

**Abstract:** The magneto-optical effect discovered by Michael Faraday in 1845, called Faraday rotation of light, is intimately associated with birefringence. Recently the acoustic analog of this effect was predicted to exist in superfluid  $^3\text{He}$  and was observed in my laboratory. This discovery has led to development of high resolution spectroscopy of excited states of this superfluid, states that can be classified by good quantum numbers of angular momentum, spin angular momentum and total angular momentum. However, these are not atomic or molecular states. They are the excited levels of the condensate consisting of millions of atoms in a collective quantum state. I will introduce some of the properties of superfluid  $^3\text{He}$  and discuss the transverse acoustic techniques we have used and the interpretation of new results.

## **Speaker: Kirk Korista**

Western Michigan University

**January 14, 2008**

### **“Quasars and the Birth and Evolution of Galaxies”**

**Abstract:** It was on February 5, 1963 (just 8 days before my birth) that astronomer Maarten Schmidt ran through the hallways of Caltech announcing that he had discovered the high redshift nature of quasars, then known only as mysterious points of light recently identified in radio surveys. In the interim period our understanding of their

place in the universe has gone from that of isolated, ultra-luminous freaks of nature to crucial links in the birth and evolution of massive galaxies. I will present an overview of these very recent and dramatic developments.

## **Speaker: Chris Boden**

The Geek Group

**January 28, 2008**

### **“The Geek Group: Like Willy Wonka with High Voltage”**

**Abstract:** The president and founder of Kalamazoo's Geek Group will present a basic description of the group, including its history and some recent developments. The Geek Group is a registered 501(c)3 non-profit organization focused on science, technology, engineering, math, and arts education. Membership is open to anyone who shares these interests, especially if they like to get their hands dirty with science and technology. Mr. Boden will describe their new facilities and programs, and answer questions from the audience. Why? Because the Geek shall inherit the Earth.

## **Speaker: J. Christopher Howk**

University of Notre Dame

**February 4, 2008**

### **“Gas Phase Physics and the Evolution of Galaxies”**

**Abstract:** One of the major accomplishments of modern astrophysics is the development of a picture for the evolution of star formation in the Universe. The stars in the Universe formed from the gas within the galaxies containing stars. Indeed, the gas itself can be an important indicator of the physics of galactic evolution. I will describe some of our on-going work to use the gas phase of galaxies to study their evolution from the early Universe to today, including the physics of the interstellar gas in early galaxies and the creation and distribution of elements in the Universe.

## **Speaker: Ray Arvidson**

Washington University in St. Louis

**February 11, 2008**

### **“The Mars Exploration Rover Mission”**

**Abstract:** The two rovers, Spirit and Opportunity, have been traveling across the surface and making scientific measurements for over 1200 Mars days or sols. Opportunity landed on Meridiani Planum on what we now know are ancient lake beds formed in an acid-sulfate aqueous system. Spirit landed on olivine-bearing basaltic plains

and then drove to the older Columbia Hills. The Hills are an ancient volcanic complex with extensive evidence for the interaction of water and magmatic systems, including hydrated sulfate and silica deposits. The evidence for the interaction of water and crustal materials will be discussed, along with implications for habitability and life on Mars.

## **Speaker: Werner Richter**

University of the Western Cape, South Africa

**February 13, 2008**

### **“The Fascinating World of Exotic Nuclei”**

**Abstract:** Less than 300 isotopes in nature are stable. These lie on a "line of stability" with very specific neutron to proton ratios. Moving away from the stability line the nuclei become progressively more unstable, and often have only a fleeting existence. So why would they be interesting to study at all if they are hardly relevant to our world? Firstly, they manifest new properties of nuclear matter and constitute a potential laboratory of about 7000 nuclei. Then they are also cosmologically relevant, as many stable isotopes are formed in extreme environments such as supernovae where these exotic nuclei form crucial links in the nucleosynthesis chains.

## **Speaker: Koblar Alan Jackson**

Central Michigan University

**February 18, 2008**

### **“Predicting the Properties of Atomic Clusters when ‘Every Atom Counts’”**

**Abstract:** Atomic clusters are small clumps of matter containing a few to a few hundred atoms. The small end of this range is a regime where “every atom counts,” i.e. where the physical and chemical properties of the clusters can change dramatically with the addition of even a single atom. At the large ends the variation becomes much more limited as the properties approach bulk values. Cluster science seeks to understand the unique properties of clusters, with an ultimate goal of exploiting them, for example, in materials composed of cluster building blocks.

In the first part of this talk, I will give a brief overview of cluster science and survey some recent developments in the field. I will then turn to the problem of determining the most stable isomer for a specific cluster size and describe results from my group at CMU on the optimal structures for SiN and CuN. Our studies use quantum mechanical calculations based on Density Functional Theory to predict cluster properties. In the last part of the talk, I will present recent work on cluster polarizabilities. We have developed a new method to break the global cluster polarizability into site-specific contributions from individual atoms or groups of atoms in the cluster. The

results show how the response of a cluster to a static electric field is distributed across its atoms and give direct insight into such questions as metallicity in clusters.

## **Speaker: Robert Roser**

Fermi National Accelerator Laboratory

**February 25, 2008**

### **“The Tevatron and the CDF Experiment – A Year in Review”**

**Abstract:** The Tevatron has had remarkable success over the years. With the start of the new year, it is natural to reflect back on 2007 and take stock in what has been accomplished. In this talk, I will discuss some of the physics goals of the Tevatron program, how we are actually able to make measurements in such a complicated environment and finally cover a few of the many highlights of the program through the eyes of the CDF program. I will close with where we are heading and the physics motivation behind an additional year of running.

## **Speaker: Ed Loh**

Michigan State University

**March 10, 2008**

### **“Spartan Infrared Camera, High Resolution Imaging for the Soar Telescope”**

**Abstract:** The Spartan Infrared Camera is a major instrument for the SOAR 4-m telescope on Cerro Pachon, Chile. Its primary goal is to provide high angular resolution imaging in the near-infrared atmospheric windows at 1000-2500nm. It has four HgCdTe detectors for a total of 16 megapixels. It has two plate scales: At f/22, its images are diffraction-limited at  $\lambda > 1600\text{nm}$ . At f/13, it covers a wide (5×5) arcmin field with undersampled pixels. The Physics-Astronomy Department at Michigan State University is building the instrument; installation is scheduled for Spring 2008. I will talk about (1) the design of the instrument, how design is an application of undergraduate physics, (2) results of laboratory tests of image quality, and (3) some of the science goals.

## **Speaker: Jennifer Hampton**

Hope College

**March 17, 2008**

### **“Magnetic Measurements of Electrodeposited Thin Films and Multilayers”**

**Abstract:** The 2007 Nobel Prize in Physics was awarded to two European physicists who discovered in 1988 that multilayered materials with alternating magnetic and nonmagnetic layers exhibit a large change in electrical resistance with the application of an external magnetic field. They named the effect Giant Magnetoresistance (GMR), and today it is the technology being used in almost every computer hard drive. In this talk, I will describe GMR and how it has been influential in the ever-increasing amount of data you can store on your computer. Then I will show how electrodeposition can be used to fabricate GMR-type materials and present data on their magnetic behavior.

## **Speaker: Christine Jones**

Harvard University

**March 24, 2008**

### **“Reflections of AGN Outbursts in the Hot Gas in Galaxies and Clusters”**

**Abstract:** Astronomers now know that most galaxies harbor a super-massive black hole at their center. At high redshifts, these galaxies experienced a very active phase, when these black holes produced enormous amounts of energy, likely fueled through galaxy mergers. Today, some of these super-massive black holes still undergo occasional outbursts that are seen through spectacular jets, cavities and buoyant bubbles and shocks in the surrounding X-ray gas. In this talk I will review recent Chandra results on AGN outbursts in the rich clusters MS0735.6+7421, Perseus, Hydra A and M87/Virgo as well as the effects of outbursts in Centaurus A and other elliptical galaxies and groups.

## **Speaker: Andrew Richter**

Valparaiso University

**March 31, 2008**

### **“Valparaiso, INsing X-rays to Probe Biomolecular Interfaces”**

**Abstract:** Protein interactions at surfaces govern a wide range of important phenomena, from biomedical applications to biosensors to surface-mediated biochemistry. To date, it has not been possible to perform simultaneous time-resolved, high-resolution structural studies of protein adsorption at the liquid-solid interface. I am developing the new technique of in situ x-ray reflectivity to do so, thereby gaining further insight into the fundamental properties of protein interactions with surfaces that cannot be obtained using any other technique. Furthermore, by controlling the functionality of the solid interface using organic self-assembled monolayers and polymer thin films, specific interactions can be examined, quantitative analysis of adsorption kinetics can be performed, and the surface functionality of proteins can be probed. In this talk, I will discuss the technique of reflectivity and show some results of the initial studies that have been performed at the Advanced Photon Source at Argonne National lab.

## **Speaker: David Brookes**

University of Illinois at Urbana-Champaign

**April 7, 2008**

### **“The Role of Language in Learning Physics”**

**Abstract:** How do physicists communicate the concepts of physics to students? We use multiple representational modes, including graphs, diagrams, equations, and words. Students are then expected to make sense of those representations in order to create a coherent understanding of the physics they are learning. Making meaning out of representations is complex and there are certain necessary (but insufficient) criteria for successful communication. My talk will examine the role of spoken and written language in how physicists communicate their ideas to students, and how students interact with and make sense of that language. If we agree that language serves as a representation of a physicist's model just like equations, graphs, or diagrams, then there should be a relationship between our language choices in teaching physics and students' subsequent understanding of those ideas. I will show how remarkably systematic, yet flexible we are in using language to model the physical world around us. With this understanding, seemingly inexplicable student reasoning in quantum mechanics can easily be illuminated by linguistics. For example, many quantum mechanics students conceptualize the potential energy graph as a physical object or geographical feature. A careful examination of language can give us clear insights into the cognitive processes that underpin some of students' reasoning in physics.

**Speaker: Robert Manweiler**

Valparaiso University

**April 14, 2008**

**“Hans Bethe – Master Calculator  
and Gentleman of Science”**

**Abstract:** Hans Bethe was one of the greatest of those great scientists of what we call modern physics. In the nineteen thirties he solved the riddle of the sun’s energy, and awarded the physics Nobel Prize only after a quarter-century. Bethe’s many decades of theoretical research as well as his success at helping shape the new quantum and nuclear research programs did much to give twentieth century science its character. As master calculator, model mentor of young scientists, and great statesman for science as well, he earned the respect of many diverse communities. Naturally he generated a few adversaries along the way as well.

In this talk I sketch Bethe’s work and style, as experienced by the extended “Cornell Community” in which he served some seventy years. I hope to capture the “Bethe” as seen through the eyes of these colleagues, students, and friends.

