**Topics in Astronomy**

**High-redshift Galaxies:** *The formation and early evolution of galaxies.*(von der Linden, Koda, Lanzetta)

**Galactic Black Hole Binaries:** *X-ray observations of binary black hole systems present challenges to conventional theory. Describe the issues and possible solutions.*(Lattimer)

**Big-Bang Nucleosynthesis:** *Describe the present understanding of nucleosynthesis and discuss resulting constraints on particle physics and cosmology.*(LoVerde, Lanzetta)

**Quasar Absorption Lines:** *What do they tell us about intervening galaxies and gas.* (Lanzetta)

**Type II Supernovae:** *Discuss the process of explosive star death in detail. Or, discuss the observational and theoretical understanding of how the ejecta interact with the interstellar medium, and produce what we see as supernova remnants.*(Swesty, Calder, Lattimer)

**Neutron (Quark?) Stars:** *Discuss the structure, "birth", and evolution of neutron stars. Discuss recent attempts to measure neutron star radii or to infer the  
properties of superfluids in their interiors.* (Lattimer)

**Dark Matter:** *Discuss the observational evidence for darm matter in the Universe. Discuss the various proposed types of dark matter, and way to detect it directly and indirectly.*(Sehgal, von der Linden, LoVerde, Essig)

**Cosmic Microwave Background:** *Discuss the lates results from measurements of the Cosmic Microwave Backgroud. What are the cosmological implications of these results?* (Sehgal, LoVerde)

**Dark Energy:** *Discuss the observational evidence for dark energy. What are the implications of dark energy for cosmology, particle physics, and General Relativitly? background. What are measurments that can be used to probe the nature of dark energy?*(Sehgal, von der Linden, LoVerde)

**Gamma-ray Bursts:** *Discuss the basic properties of gamma-ray bursts and the post-1997 developments in our understanding of these cosmic fireworks.* ( Perna, Lattimer)

**Type Ia Supernovae and the Accelerating Universe:** *Give a critical assessment of recent evidence from supernova studies that the cosmological constant is non-zero, and discuss the implications of a non-zero cosmological constant.* (Sehgal, LoVerde, Lanzetta)

**Type Ia Supernovae Explosion Models:** *Describe the theoretical picture of a Type Ia supernova explosion. Discuss the current outstanding questions.* (Zingale, Calder, Swesty)

**Type I X-ray Bursts:** *Explain the physics of Type I X-ray bursts, summarizing the observational properties and the theoretical model. Explain their importance in determining the properties of the underlying neutron star.*(Zingale, Perna, Lattimer)

**Classical Novae:** *Describe classical novae and their role in the production of intermediate mass elements. Discuss the underlying theory and the problem of envelope enrichment.*(Zingale, Calder, Walter)

**Star and Planet Formation:** *Describe what we know about the process, including the role of the interstellar medium and the nature of circumstellar disks.*(Koda, Perna)

**Accretion Processes:** *Mass transfer in cataclysmic variables and X-ray binaries. Includes classical novae and X-ray bursters. Also accretion in pre-main sequence stars. Active and passive disks*. (Walter, Perna)

**Brown Dwarfs and Exoplanets:** *What they are and how they form. Describe their atmospheric characteristics.*(Walter, Perna)

**Magnetic Processes in Stellar Atmospheres:** *Stellar chromospheres*

*and coronae, the Sun and solar physics. Magnetic activity (could subsume the stellar flares topic). Magnetic dynamos. Evolution of magnetic activity.*(Walter, Perna)

**Is Pluto a Planet?:** *Pluto was recently declared a “dwarf planet.” Why is this important? Kuiper Belt objects and observations thereof*. (Walter)

**Gravitational Radiation:** *Discuss the concept of gravitational radiation, the astrophysical sources of gravitational radiation and/or the physics and design of gravitational wave detectors, including methods of extracting super-weak signals*.(Zingale, Calder, Swesty, Lattimer, LoVerde)

**The Cosmic Distance Ladder:**  *Measuring distances in astronomy, particulalry at cosmological scales, can be difficult. Observations utilizing “standard candles,” “standard rulers,” and “standard crayons” address distance measurment. Discuss these and contemporary methodologies*.(Sehgal, von der Linden, Koda, LoVerde)

**Simulation in Astrophysics:** *Discuss hydrodynamics, N-body, and other techniques used in astrophysics to model stellar evolution and explosions, galactic dynamics, an large-scale cosmological structure. Describe the challenges of high-performance computing, analysis and data management, verification and validation, and more.* (Zingale, Calder, Swesty, Koda, Lattimer, Sehgal).