

Center for Nuclear Astrophysics, Shanghai Jiao Tong University

Young Scientists Study Group on

Neutrino & Nuclear Physics for Nucleosynthesis & Chemical Evolution

June 29 - July 8, 2015

**Scientific motivation:**

Nuclear astrophysics is undergoing a revolution on two frontiers. At the fundamental level, neutrinos have opened up both search for new physics beyond the standard model of particle physics and new windows to observe the universe. Neutrino oscillations have been demonstrated by a number of experiments. Neutrinos from the earth's atmosphere, the sun, Supernova 1987A in the Large Magellanic Cloud, and unknown cosmic sources have been detected. The next generation of neutrino experiments are being planned to find out the neutrino mass hierarchy, whether neutrinos violate CP symmetry, and whether they are Majorana or Dirac particles. On the cosmic frontier, a number of observations, in particular those about anisotropies of the cosmic microwave background, provide strong support of the inflation-based cold dark matter cosmology, which in turn enables ab initio investigations of formation of the first stars in the first galaxies. In addition, there are ongoing and planned large-scale surveys of stars in the Milky Way. The rich data they will provide on elemental abundances and dynamics of stars will bring deep insights into not only the origin of the elements, but also the formation and evolution of the Galaxy.

In China, the Jiangmen Underground Neutrino Observatory (JUNO) will be both searching for new physics and observing astrophysical neutrinos. The Jinping Underground Laboratory for Nuclear Astrophysics (JUNA) will be measuring key nuclear reactions for stellar evolution and nucleosynthesis. The Center for Nuclear Astrophysics (CNA) at Shanghai Jiao Tong University (SJTU) aims to lead the development of nuclear astrophysics research in China by forging collaborations among theorists, modelers, experimentalists, and observers across the fields of particle physics, nuclear physics, astrophysics, and cosmology, and by training young scientists who will actively contribute to and capitalize the scientific returns of JUNO and JUNA.

In partnership with the Joint Institute for Nuclear Astrophysics – Center for the Evolution of the Elements, which is funded by the US National Science Foundation to address fundamental questions about the evolution and properties of matter and the origin of the chemical elements, CNA will sponsor a series of activities of several Young Scientists Study Groups. To initiate this series, CNA will host a Study Group on neutrino and nuclear physics for nucleosynthesis and chemical evolution from June 29 through July 8, 2015 at SJTU.

**Topics to be discussed:**

I. Neutrino Physics & Astrophysics (vPA)

1. Effects of neutrino wave packets on neutrino experiments
2. Treatment of collective neutrino oscillations in supernovae
3. Production of sterile neutrinos in the early universe
4. Treatment of active-sterile neutrino oscillations in supernovae
5. Neutrino emission during pre-supernova evolution
6. Astrophysical sources of ultra-high-energy neutrinos

II. Nuclear Physics & Astrophysics (NPA)

1. Cross sections of neutrino-nucleus interaction for nucleosynthesis
2. Nuclear reaction rates for stellar evolution & nucleosynthesis
3. Neutron-capture cross-sections for nucleosynthesis
4. Beta-decay rates for nucleosynthesis
5. Fission rates & fragment distributions for nucleosynthesis
6. Nuclear mass models

III. Nucleosynthesis & Chemical Evolution (NCE)

1. Abundances in metal-poor stars of the Galactic halo
2. Radioactive isotopes in the early solar system
3. Abundances in satellite galaxies of the Milky Way
4. Mixing processes in the interstellar medium
5. Gas dynamics in chemical evolution models
6. Cosmological framework for chemical evolution

**Tentative Schedule:**

	M 6/29	Tu 6/30	W 7/1	Th 7/2	F 7/3	Sa 7/4	Su 7/5	M 7/6	Tu 7/7	W 7/8
Morning	Arrival	NPA	NPA	vPA	vPA	Excursions	Off	NCE	NCE	NCE
Afternoon	NPA	NPA	NPA	vPA	vPA	Excursions	vPA	NCE	NCE	End