December 22, 2014

Association of Asia-Pacific Physical Societies (AAPPS)

Division of plasma physics (AAPPS-DPP)

Subramanyan Chandrasekhar Prize of Plasma Physics

– Prof. Em. Setsuo Ichimaru is selected as 1st Laureate (2014) –

The Division of Plasma Physics (Chair: Mitsuru Kikuchi) under Association of Asia Pacific Physical Societies (President: Seunghwan Kim) selected Prof. Em. Setsuo Ichimaru of the University of Tokyo as the first Laureate of S. Chandrasekhar Prize of Plasma Physics, which is awarded to a scientist who has made seminal / pioneering contribution in the field of plasma physics.

Citation : For his contributions to the establishment of the theoretical basis of the science of strongly coupled plasmas and their applications, not only to laboratory plasmas and plasmas in solid- or liquid-state materials including fusion plasmas, but also to important astrophysical plasma phenomena including radiation and nuclear reactions.

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On the achievement of Prof. Setsuo Ichimaru

Prof. Em. S. Ichimaru
(Department of physics, Faculty of Science, the University of Tokyo)

The plasmas in magnetic confinement fusion research and solar flare are called the “weakly coupled plasma” since the Coulomb potential energy is much smaller than the kinetic energy. The plasma in the central region of the Sun, Jupiter, White Dwarfs, Pulsar, or Neutron Stars are on the other hand called the “strongly coupled plasma” since Coulomb potential energy becomes much larger than the kinetic energy. Typical example of the strongly coupled plasma in laboratory plasma is dusty plasma.

Prof. Ichimaru is the founder of the theoretical framework of the strongly coupled plasma and his paper published in the Reviews of Modern Physics in 1982 made a big impact to this field having citations close to 900. The applications of his strongly coupled plasma theory include dielectric properties of electron liquids at metal densities, transition from Coulomb crystal to glass state in the strongly coupled plasma, metal-insulator phase transition in the high-density hydrogen plasma, etc. In addition, he formulated the large enhanced fusion reaction as a specific phenomena in the strongly coupled plasma applied to the white dwarfs.

Prof. Ichimaru also made seminal contributions in elucidating the physical process in dense astrophysical plasmas accreting onto a compact object in a binary system such as a stellar black hole or a neutron star, and thereby clarified the mechanisms by which huge gravitational energies liberated in such accreting plasmas are converted into copious electromagnetic radiation mostly in X-rays.

Appendix-1: Ichimaru's achievement on Metal-insulator transition in dense hydrogen plasma

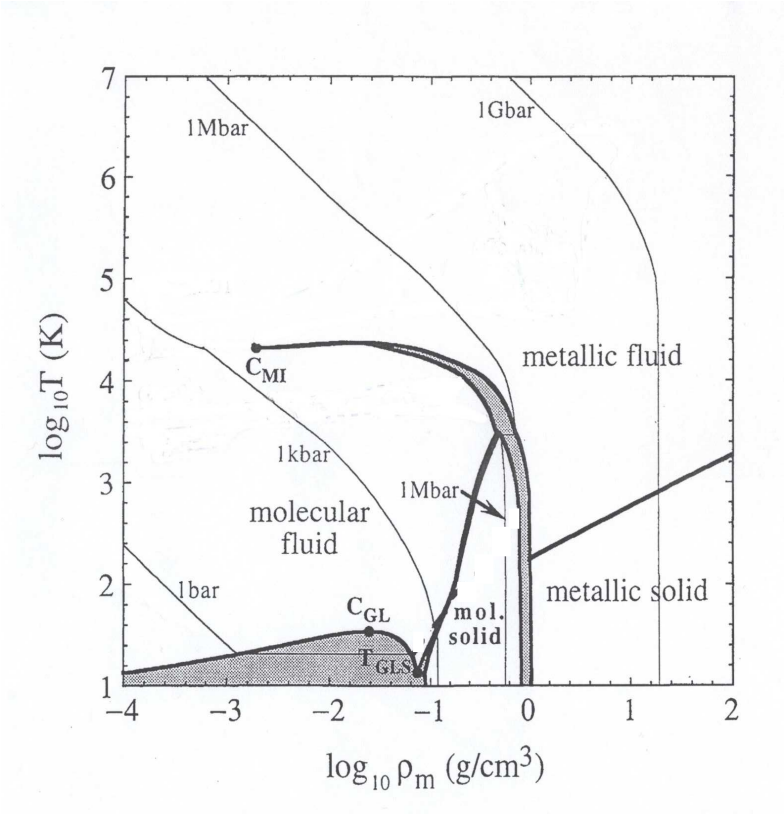


Fig. 1 Phase diagram of dense hydrogen. C_{MI} and C_{GL} denote the critical points of the metal-insulator and gas-liquid transitions, respectively. Here, "Molecular" implies insulator.

Appendix-2: Ichimaru's achievement on accretion disk (Cygnus x-1)

In 1977, Prof. Ichimaru accounted for bimodal transitions between high- and low-state in the spectral distributions of X-rays observed with Cygnus X-1 (shown in Fig. 2 A) and thereby provided a subsidiary proof of it being a stellar black hole.

Essence of the bimodal behavior is depicted in Fig. B, where high- and low states exist in accretion disks; a transition from one state to the other may take place near inner radii (~ $2\text{x}10^8$ cm, in Fig. B), where an onset of thermal instability may transfer a disk in high-state into one in low-state.

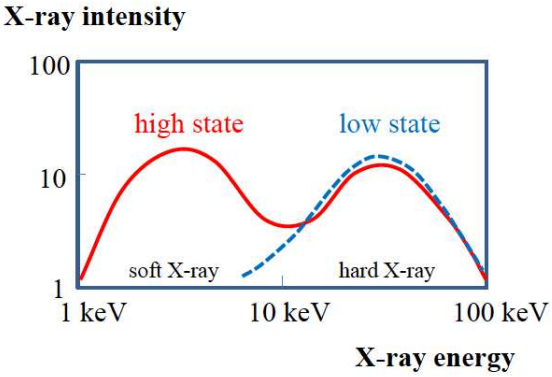


Fig. A

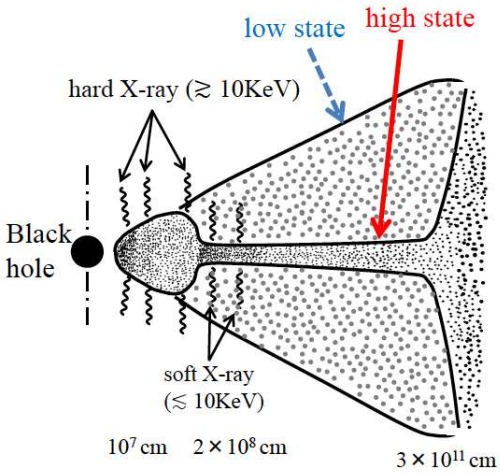
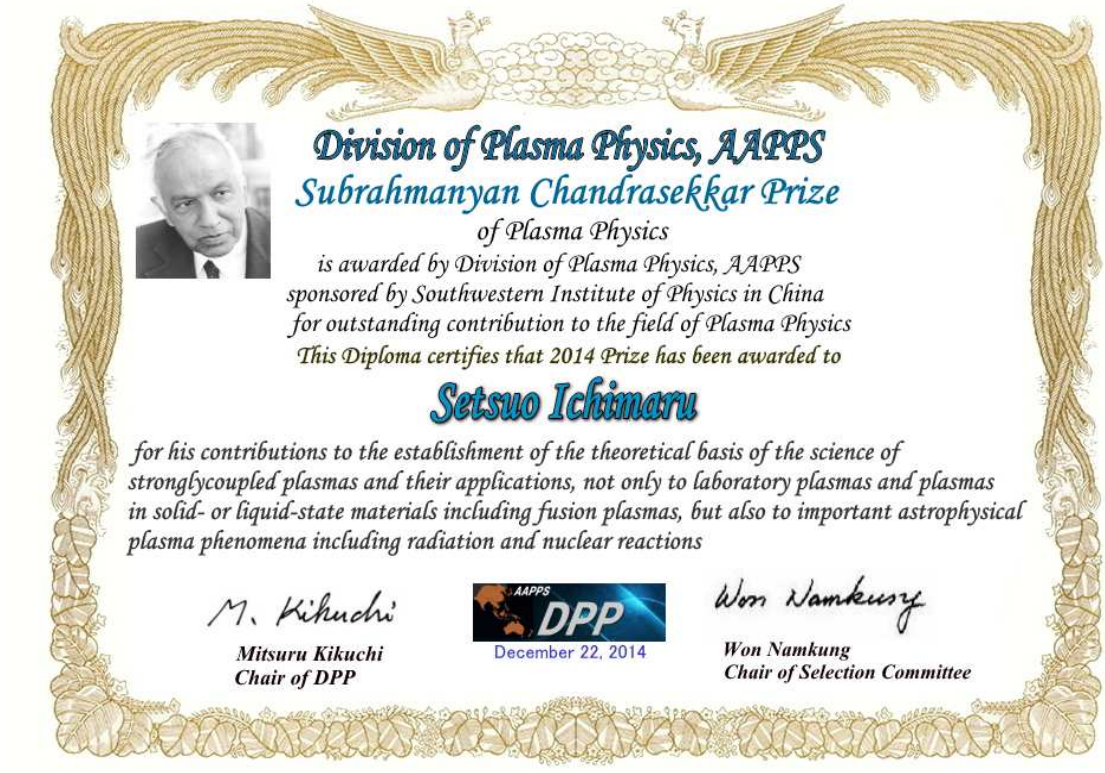


Fig. B

Fig. 2 A. Schematic diagrams of X-ray spectrum. Fig. 2 B. Bimodal behavior of accretion disks with black holes: "soft X-ray" in Fig. A arises from the region: r ~ $2x10^8$ cm; "hard X-ray" in Fig. A arises near the critical radius, r > 10^7 cm.

Appendix-3: Certificate of S. Chandrasekhar prize of plasma physics

Certificate and medal will be given at the 2016 APPC in Australia.



Division of Plasma Physics, AAPPS

Subrahmanyan Chandrasekkar Prize

of Plasma Physics

is awarded by Division of Plasma Physics, AAPPS
sponsored by Southwestern Institute of Physics in China
for outstanding contribution to the field of Plasma Physics
This Diploma certifies that 2014 Prize has been awarded to

Setsuo Ichimaru

for his contributions to the establishment of the theoretical basis of the science of stronglycoupled plasmas and their applications, not only to laboratory plasmas and plasmas in solid- or liquid-state materials including fusion plasmas, but also to important astrophysical plasma phenomena including radiation and nuclear reactions

M. Kikuchi
Mitsuru Kikuchi
Chair of DPP

AAPPS DPP
December 22, 2014

Won Namkung
Won Namkung
Chair of Selection Committee

Glossary

1. Subrahmanyan Chandrasekhar

Astrophysicist born in India. He received Nobel Prize in physics due to his seminal contribution on black hole (Chandrasekhar limit) in 1983. This research area is broad and the contribution to the plasma physics is significant which can be seen from his texts “Principles of Stellar Dynamics (1942)” and “Hydrodynamics and Hydromagnetic Stability (1981)”.

2. AAPPS: Association of Asia-Pacific Physical Societies

（HP: http://www.aapps.org/main/index.php）

Association of physical societies in the Asia Pacific region founded by the Nobel Prize in physics Laureate, C.N. Yang and Prof. Akito Arima in 1983. AAPPS held 12th Asia Pacific Physics Conference under the president (at that time) Shoji Nagamiya in Makuhari, Japan. Current president is Prof. Swan Kim, Postech, Korea.

3. AAPPS-DPP: Division of Plasma Physics, AAPPS

（HP : http://aappsdpp.org/AAPPSDPPF/index.html ）

The first division under AAPPS based on the success of the plasma physics program in the APPC-12. This division is formed January 2014 based on the recommendation of Prof. Nagamiya at the AAPPS council.

4. S. Chandrasekhar Prize of Plasma Physics

Plasma physics prize founded by the AAPPS-DPP sponsored by Southwestern Institute of Physics on July 2014. This prize is given to a plasma physicist annually who has made pioneering and/or seminal contribution to the plasma physics and sponsored by Southwestern Institute of Physics, China.

The first selection committee is held during November to December. The chairman is Prof. Won Namkung (former director of Pohang accelerator lab.). Members are Profs B. Buti (India), A. Sen (India), R. Dewar (Australia), T. Murphy (Australia), Liu Chen (China), B. Wan (China), T.S. Hahm (Korea), Lin I (Taiwan), K. Mima (Japan), T. Terasawa (Japan).