Press Release

June 21, 2016

Association of Asia-Pacific Physical Societies (AAPPS)

Division of Plasma Physics (AAPPS-DPP)

Subramanyan Chandrasekhar Prize of Plasma Physics

– Professor Donald Blair Melrose is selected as Laureate of 2016 –

The Division of Plasma Physics (Chair: Mitsuru Kikuchi) under the Association of Asia Pacific Physical Societies (President: Seunghwan Kim) selected Professor Donald Blair Melrose of the University of Sydney as the 2016 Laureate of S. Chandrasekhar Prize of Plasma Physics, which is awarded to a scientist who has made seminal / pioneering contributions in the field of plasma physics.

Citation : For his sustained original contributions to the theory of coherent emission processes in astrophysical and space plasmas, and for his seminal contributions to the theory of quantum plasmas.

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Press Release

On the achievement of Professor Donald Melrose

Professor Donald Melrose
(School of Physics, The University of Sydney)

Professor Melrose has made seminal contributions in three plasma physics fields: plasma astrophysics, quantum plasma dynamics (QPD) and plasma kinetic theory. Amongst his many contributions to plasma astrophysics, he is most widely recognized as an expert on the theory of coherent emission processes in astrophysical and space plasmas. In QPD he initiated and developed a new field by synthesizing quantum electrodynamics (QED) and the kinetic theory of plasmas.

Professor Melrose has a significant scientific publication record related to these contributions to plasma physics. His publications have attracted over 10,400 citations in Google Scholar (H-index 51) and over 6900 citations in Web of Science (H-index 45), with 11 articles having more than 100 citations. His original books on *Plasma Astrophysics* and *Instabilities in Space and Laboratory Plasmas* are also well cited (578 and 543 citations).

Professor Melrose has served the physics community in various roles, including Director of the Research Centre for Theoretical Astrophysics in The University of Sydney (1991-1999); Chairman of the Advisory Committee of the *Australian Journal of Physics* (1979-1984, 1987-1993); Chair of the Steering Committee, Australia Telescope National Facility (1994-1997); Council member, Australian Academy of Science (1999-2001); and President of Division II, International Astronomical Union (2006-2009).

Appendix 1: Major scientific contributions by Professor Melrose:

1. **Plasma Astrophysics**: Professor Melrose is a pioneer in astro-plasma physics through his fundamental work on the theory of the emission, absorption and scattering of radio waves in astrophysical plasmas. He played significant roles in the early development of theories for coherent emission processes in astrophysical and space plasmas such as plasma emission, applied to solar radio bursts, electron cyclotron maser emission (ECME) from planets and stars, and pulsar radio emission.

   He was the first to generalize the theory of plasma emission to include the magnetic field, providing the basic theory for the interpretation of the polarization of radio bursts. He also contributed extensively to the interpretation of polarization data from solar radio bursts.

   He developed an early version of the astrophysical theory for ECME, and applied it to Jupiter's decametric radio bursts (DAM) and to the Earth's auroral kilometric radiation (AKR). He proposed the now widely accepted interpretation of solar spike bursts and coherent emission from flare stars in terms of ECME, in what became his most highly cited journal paper.

   He also made fundamental contributions to the theory of pulsar radio emission mechanisms. He was the first to propose a maser linear-acceleration mechanism for pulsar emission. He made extensive contributions to the theory of wave dispersion in pulsar plasmas, which is essential for the interpretation of the observed circular polarization.

2. **Quantum plasma dynamics**: Professor Melrose created a new branch of theoretical physics, which he has called quantum plasma dynamics (QPD), by synthesizing the kinetic theory of plasmas and QED.

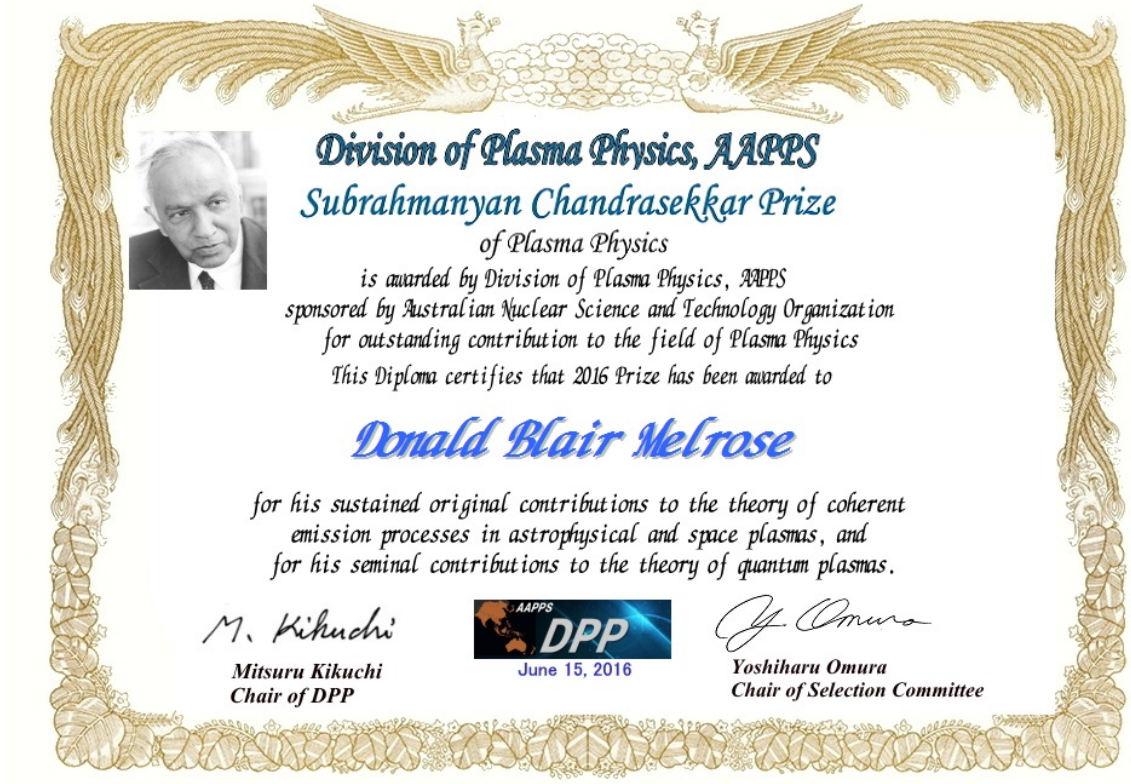
   The motivation for the development of QPD is that the modern theory of electrodynamics is QED, and conventional classical treatments of plasma physics should be regarded as approximations to a more general relativistic quantum theory. The development of QPD has been made in a sequence of steps with original contributions such as:

   - rewriting the classical kinetic theory of plasmas in a manifestly covariant and gauge-invariant form;
   - generalizing QED to treat wave-particle interactions in plasmas;
   - using QED to calculate the linear and nonlinear response tensors of the plasma;

- using exact solutions of Dirac's equation in a magnetic field to develop a form of QPD that provides a plasma-like treatment of processes in the magnetized vacuum;
- generalizing QED to include the linear and nonlinear response of a plasma.

QPD has proved useful in unanticipated ways. It led to the identification of intrinsically new phenomena including two-photon cyclotron emission.

Appendix-2: Certificate of S. Chandrasekhar prize of plasma physics: Certificate and medal will be given at the 13th APPC in Australia on December 2016.



Glossary

1. Subrahmanyan Chandrasekhar

Astrophysicist born in India. He received the Nobel Prize in Physics in 1983 *for his theoretical studies of the physical processes of importance to the structure and evolution of stars,* including the Chandrasekhar limit on the mass of white dwarf stars. His research covered several broad areas, as seen from his texts, which included *Principles of Stellar Dynamics* (1942), *Hydrodynamics and Hydromagnetic Stability* (1981), and an influential book based on his lecture notes in *Plasma Physics* (1960).

2. AAPPS: Association of Asia-Pacific Physical Societies

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

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

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

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

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

4. S. Chandrasekhar Prize of Plasma Physics

Plasma physics prize was founded by the AAPPS-DPP in July 2014. This prize is given to a plasma physicist annually for pioneering and/or seminal contribution to plasma physics. The 2014 and 2015 prize recipients were Professor S. Ichimaru and Professor P. Kaw (http://aappsdpp.org/AAPPSDPPF/prizetable.html).

The 2016 selection committee chairman is Professor Yoshiharu Omura (Kyoto University, Japan) and members are Professor Kunioki Mima (Osaka University, Japan), Professor Liu Chen (Zhejiang University, China), Professor Xiaogang Wan (Harbin Institute of Technology/CPS-DPP chair, China), Professor Taik Soo Hahm (Seoul National University, Korea), Professor Wonhoe Choe (KAIST/KPS-DPP chair, Korea), Professor Robert Dewar (Australian National University, Australia), Dr. Tony Murphy (CSIRO, Australia), Professor Abhijit Sen (IPR, India), Professor Ravindra Kumar (Tata Institute of Fundamental Research, India), Professor Lin I (National Central University, Taiwan), Professor Lin-Ni Hau (National Central University, Taiwan).

2016 Prize is sponsored by Australian Nuclear Science and Technology Organization (ANSTO).