



Origin of Diffuse Aurora at Earth and Jupiter: Legacy of Prof. Richard Thorne and Recent Advances

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Diffuse aurorae, which are naturally occurring phenomena without discernible patterns or structures, are commonly observed at various planets in our solar system. Since diffuse auroral precipitation provides an important source of energy input into planetary atmosphere and leads to enhanced ionization and chemical changes, it is critical to understand the origin of diffuse aurora. Although diffuse aurora is generally known to be excited by downward-streaming electrons into the upper atmosphere, identifying the driver of the electron precipitation has been a long-standing problem.

Prof. Richard Thorne made novel contributions to reveal the origin of diffuse aurora at Earth and Jupiter, by taking full advantage of multi-satellite observations, theory, and modeling. One of the major findings by Prof. Richard Thorne and his team is that Earth's diffuse aurora is generated by precipitation of energetic electrons due to pitch angle scattering primarily driven by chorus waves at $L < 8$ and electrostatic electron cyclotron harmonic waves at $L > 8$ [1]. At Jupiter, Prof. Thorne and his coworkers suggested that diffuse auroral emissions are caused by pitch angle scattering of energetic electrons that are trapped in the Jovian magnetosphere [2, 3].

In this presentation, we will summarize some of the early work and contributions of Prof. Richard Thorne regarding the origin of diffuse aurora at Earth and Jupiter, as well as discuss the recent advances in understanding the origin of diffuse aurora at Earth and Jupiter based on multi-satellite observations (THEMIS, Van Allen Probes, Juno, etc.), theory, and modeling. Furthermore, I will share my personal experience with Prof. Richard Thorne, who was an incredible mentor, colleague, and friend.

1. Thorne, R. M., Ni, B., Tao, X., Horne, R. B., and Meredith, N. P. (2010), Scattering by chorus waves as the dominant cause of the Earth's diffuse aurora, *Nature*, 467, 943–946, doi:10.1038/nature09467.

2. Thorne, R. M. and Tsurutani, B. T. (1979), Diffuse Jovian aurora influenced by plasma injection from Io. *Geophys. Res. Lett.*, 6: 649-652. doi:10.1029/GL006i008p00649.

3. Bhattacharya, B., R. M. Thorne, and D. J. Williams (2001), On the energy source for diffuse Jovian auroral emissivity, *Geophys. Res. Lett.*, 28, 2751-2754, doi:10.1029/2000GL012616.