2021 CEDAR poster competition

- 136 posters were presented and 72 student posters in competition among them 14 undergraduates.
- The students presented from the US, Brazil, China, Germany, Peru, Taiwan, India, & Iran.
- Posters were presented at 3 days and for each days the poster winners were selected by the poster judges.
- Thanks to all the student presenting a poster at CEDAR

Special thanks to the judges:

Brian Harding, Xuguang Cai, Phil Richards, Lindsay Goodwin, Scott England, Meghan Burleigh, Aramesh Seif, Qingyu Zhu, Federico Gasperini, D Selvaraj, Steve Kaeppler, Shantanab Debchoudhur, Chihoko Cullens, Rafael Mesquita, Joshua Petit, Mack Jones, Luis Navarro, Leslie Lamarche

The poster judging committee:
Julio Urbina (chair), Liying Qian, Jens Oberheide, Asti Bhatt, Jonathan Snively

Criteria to select poster winners

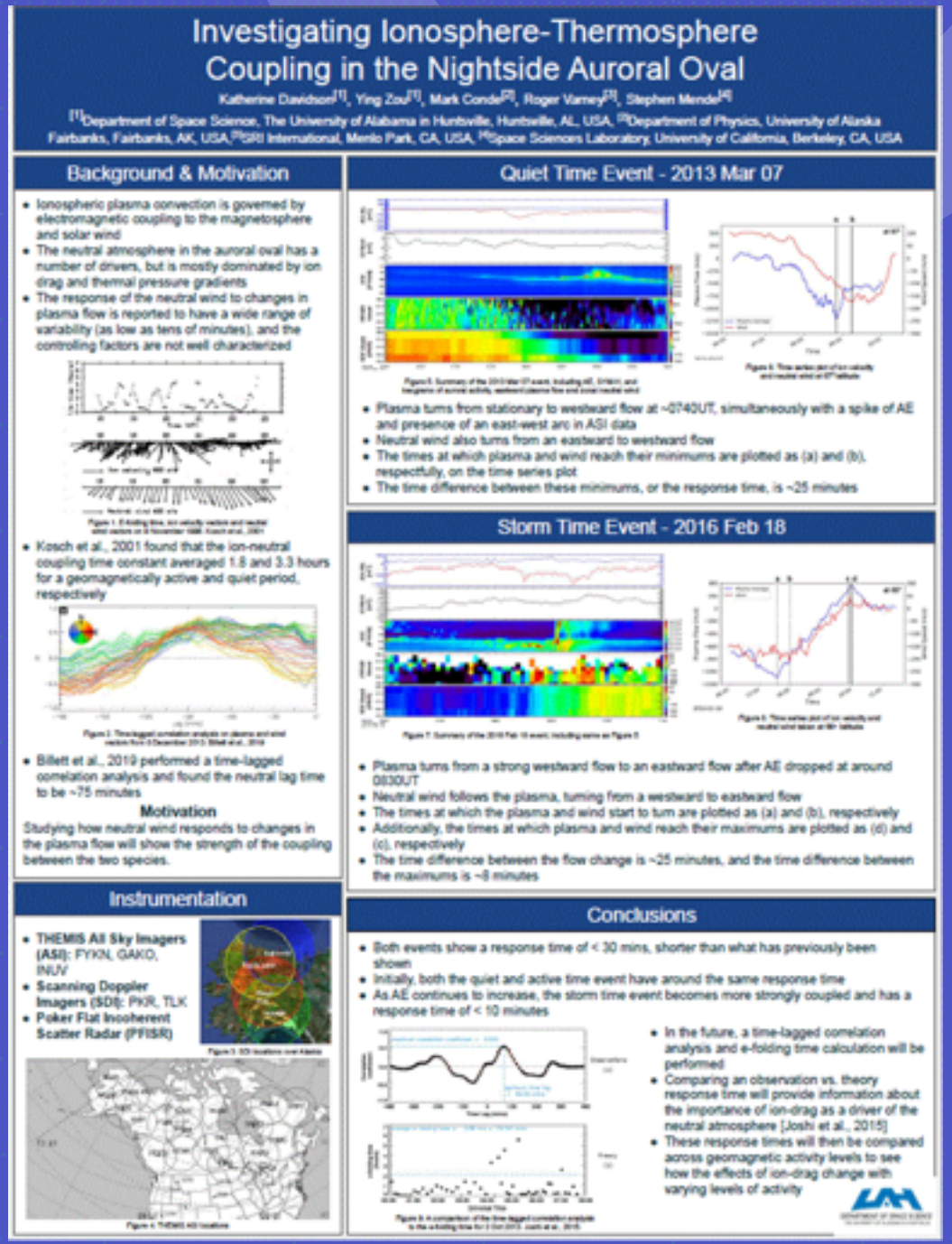
- Two members of the CEDAR CSSC facilitated the discussion but did not vote.
- Every poster received two scores: round 1 score (500 points max) and round 2 score (500 points max). These two scores were added. The judges discussed the scores and selected the best 8 posters out of this pool.
- The judges discussed these 8 posters further and selected the first place in the competition.
- The remaining best 7 posters were then discussed to select the second place.
- If an undergraduate poster made it to the top 8 and there was more than one undergraduate in the competition, an honorable mention was chosen.

Day 1: 2nd Prize

Katherine Davidson

University of Alabama, Huntsville

Title:
Investigating Ionosphere-Thermosphere Coupling in the Nightside Auroral Oval

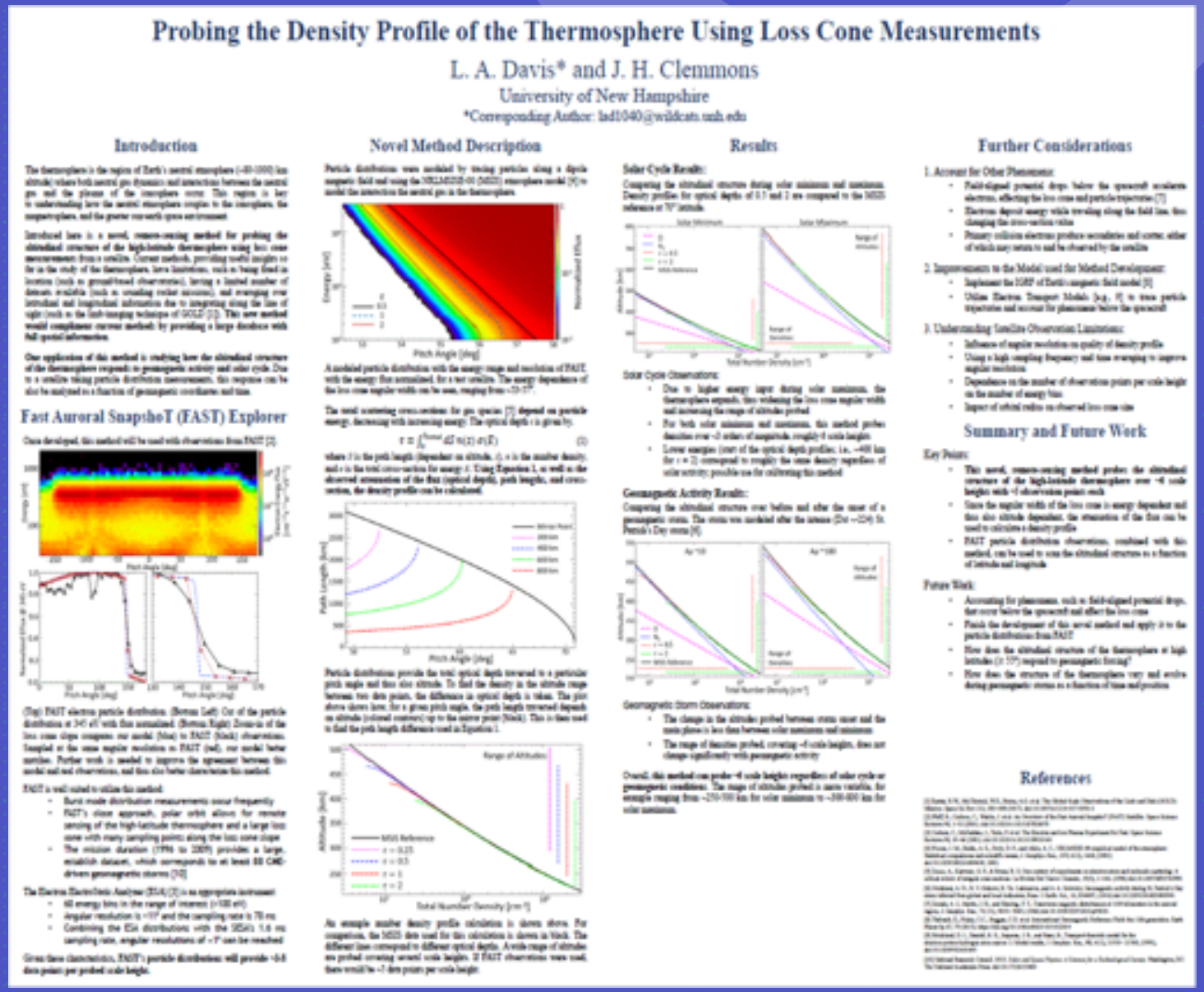


Day 1: 1st Prize

Lance Davis

University of New Hampshire

Title:
Probing the Density Profile of the Thermosphere Using Loss Cone Measurements



Probing the Density Profile of the Thermosphere Using Loss Cone Measurements

L. A. Davis* and J. H. Clemmons

University of New Hampshire

*Corresponding Author: lad1040@wildcats.unh.edu

Introduction

Novel Method Description

Results

Further Considerations

Fast Auroral SnapshoT (FAST) Explorer

Summary and Future Work

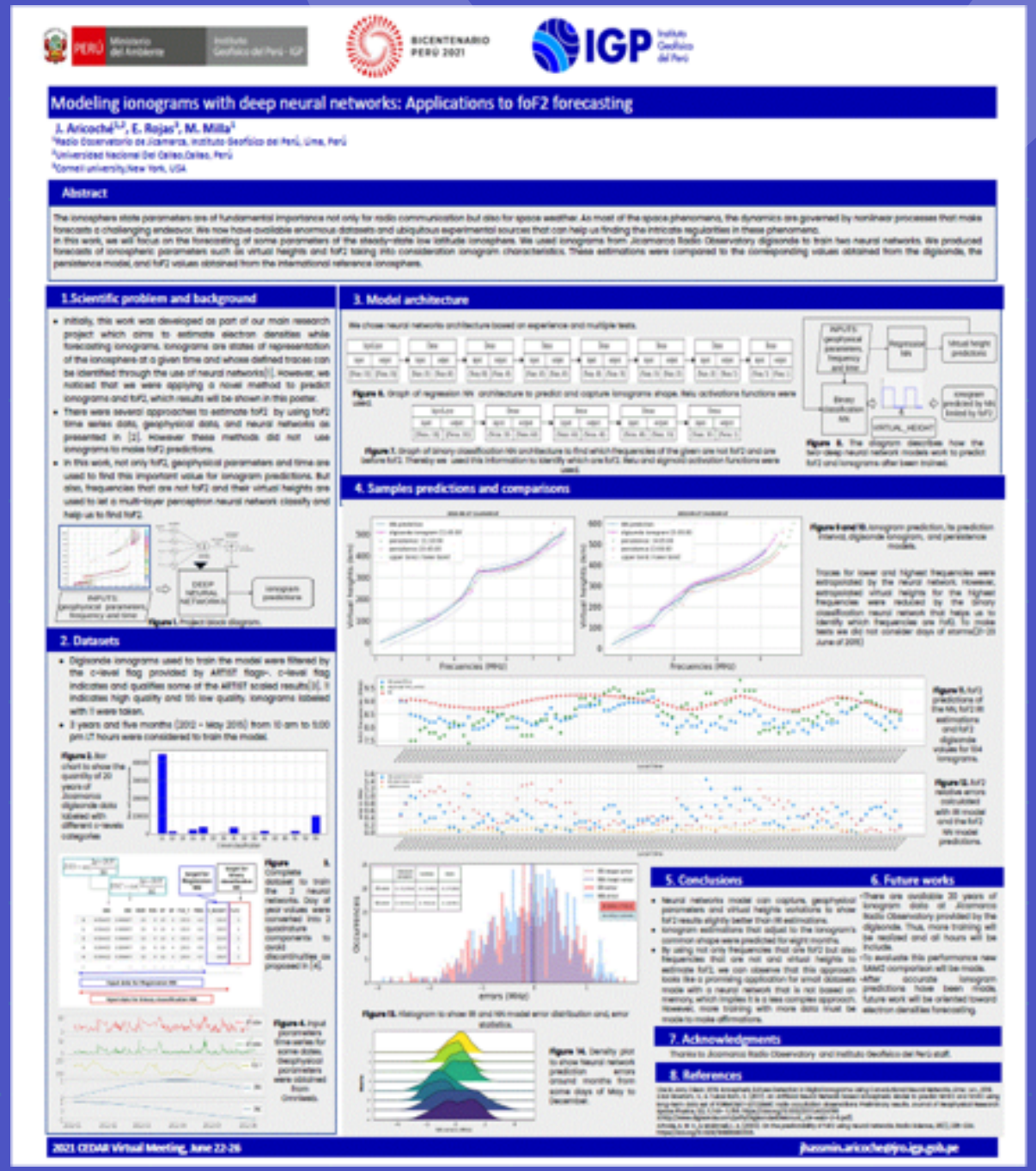
References

Day 2: Honorable mention Undergraduate

Jhassmin **Aricoché**

Radio Observatorio de Jicamarca, Instituto Geofísico del Perú, Lima, Perú

Title:
Modeling ionograms with deep neural networks: Application to foF2 forecasting



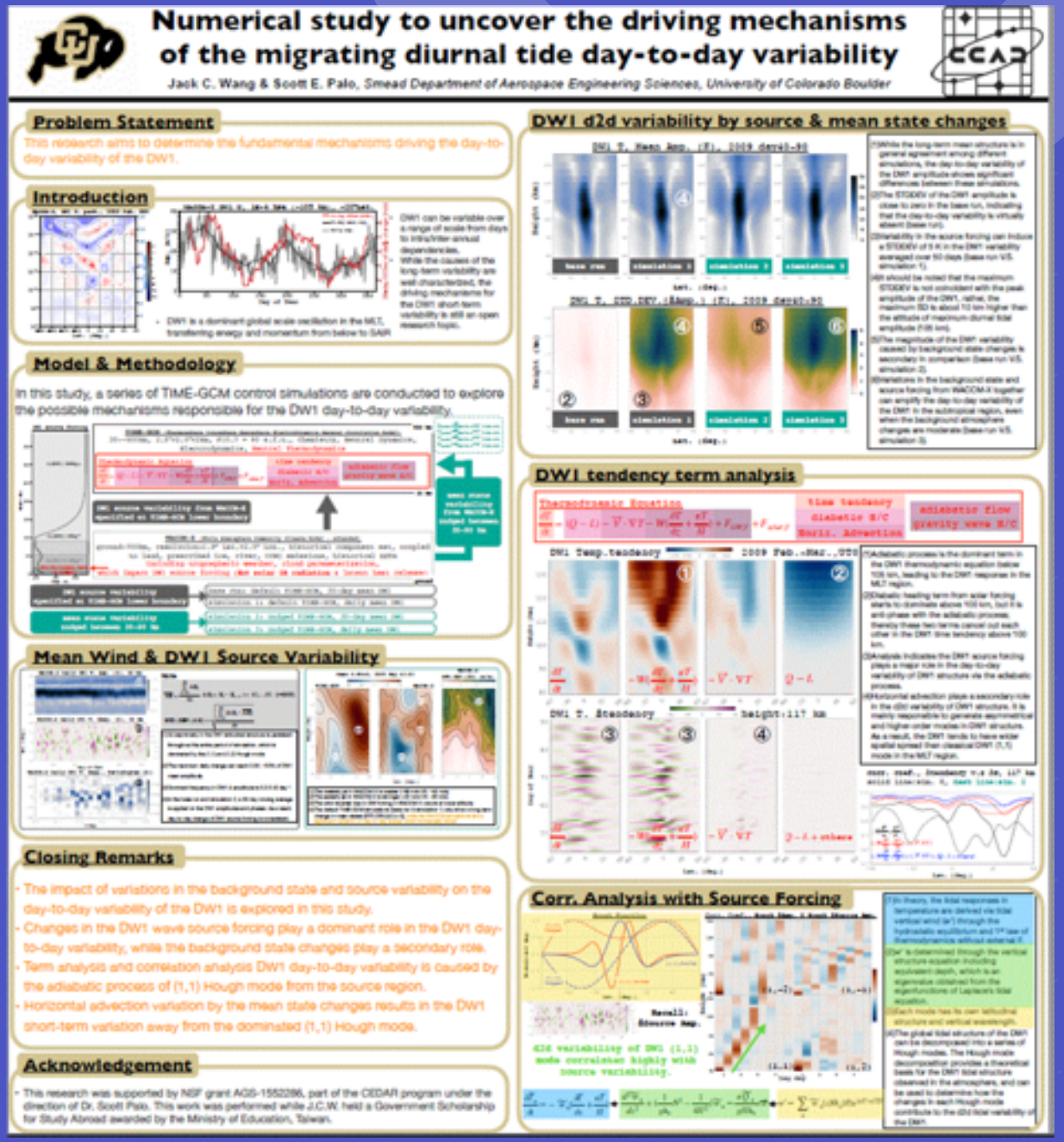
Day 2: 2nd Prize

Jack Wang

University of Colorado, Boulder

Title:

Numerical study to uncover the driving mechanisms of the migrating diurnal tide day-to-day variability

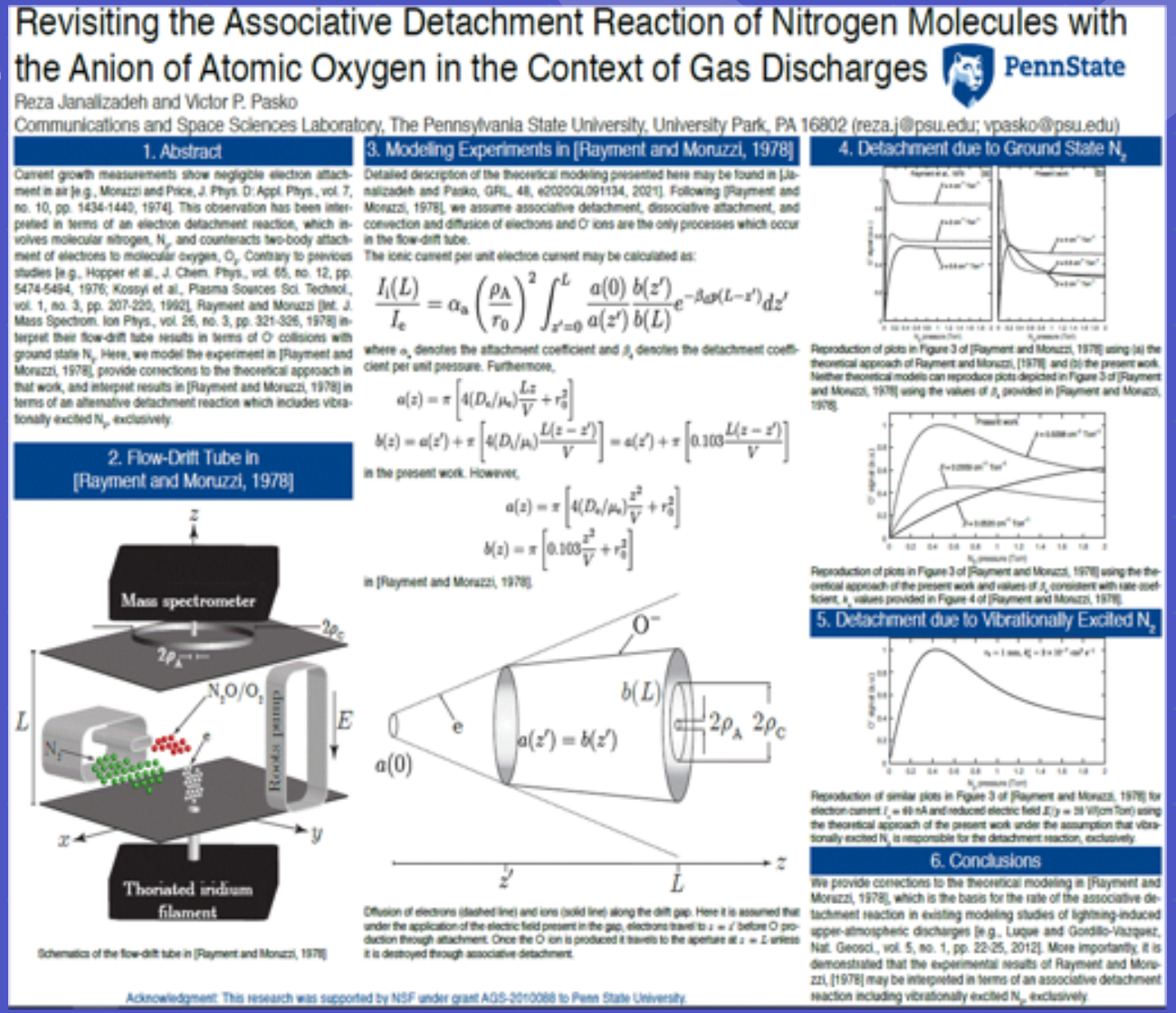


Day 2: 1st Prize

Reza Janalizadeh

Penn State University

Title:
Revisiting the associative detachment reaction of nitrogen molecules with the anion of atomic oxygen in the context of gas discharges



Revisiting the Associative Detachment Reaction of Nitrogen Molecules with the Anion of Atomic Oxygen in the Context of Gas Discharges

PennState

Reza Janalizadeh and Victor P. Pasko

Communications and Space Sciences Laboratory, The Pennsylvania State University, University Park, PA 16802 (reza.j@psu.edu; vpasko@psu.edu)

1. Abstract

Current growth measurements show negligible electron attachment in air [e.g., Morruzzi and Price, J. Phys. D: Appl. Phys., vol. 7, no. 10, pp. 1434-1443, 1974]. This observation has been interpreted in terms of an electron detachment reaction, which involves molecular nitrogen, N_2, and counteracts two-body attachment of electrons to molecular oxygen, O_2. Contrary to previous studies [e.g., Hopper et al., J. Chem. Phys., vol. 65, no. 12, pp. 5474-5494, 1976; Kossyi et al., Plasma Sources Sci. Technol., vol. 1, no. 3, pp. 207-220, 1992], Rayment and Moruzzi [Int. J. Mass Spectrom. Ion Phys., vol. 26, no. 3, pp. 321-326, 1978] interpret their flow-drift tube results in terms of O^- collisions with ground state N_2. Here, we model the experiment in [Rayment and Moruzzi, 1978], provide corrections to the theoretical approach in that work, and interpret results in [Rayment and Moruzzi, 1978] in terms of an alternative detachment reaction which includes vibrationally excited N_2, exclusively.

2. Flow-Drift Tube in [Rayment and Moruzzi, 1978]

Schematics of the flow-drift tube in [Rayment and Moruzzi, 1978]

3. Modeling Experiments in [Rayment and Moruzzi, 1978]

Detailed description of the theoretical modeling presented here may be found in [Janalizadeh and Pasko, GRL, 48, e2020GL091134, 2021]. Following [Rayment and Moruzzi, 1978], we assume associative detachment, dissociative attachment, and convection and diffusion of electrons and O^- ions are the only processes which occur in the flow-drift tube.

The ionic current per unit electron current may be calculated as:

$$\frac{I_i(L)}{I_e} = \alpha_a \left(\frac{\rho_A}{r_0}\right)^2 \int_{z'=0}^{L} \frac{a(0)}{a(z')} \frac{b(z')}{b(L)} e^{-\beta_d p(L-z')} dz'$$

where α_a denotes the attachment coefficient and β_d denotes the detachment coefficient per unit pressure. Furthermore,

$$a(z) = \pi \left[4(D_e/\mu_e)\frac{Lz}{V} + r_0^2\right]$$

$$b(z) = a(z') + \pi \left[4(D_e/\mu_e)\frac{L(z-z')}{V}\right] = a(z') + \pi \left[0.103\frac{L(z-z')}{V}\right]$$

in the present work. However,

$$a(z) = \pi \left[4(D_e/\mu_e)\frac{z^2}{V} + r_0^2\right]$$

$$b(z) = \pi \left[0.103\frac{z^2}{V} + r_0^2\right]$$

in [Rayment and Moruzzi, 1978].

Diffusion of electrons (dashed line) and ions (solid line) along the drift gap. Here it is assumed that under the application of the electric field present in the gap, electrons travel to $z = z'$ before O production through attachment. Once the O^- ion is produced it travels to the aperture at $z = L$ unless it is destroyed through associative detachment.

4. Detachment due to Ground State N_2

Reproduction of plots in Figure 3 of [Rayment and Moruzzi, 1978] using (a) the theoretical approach of Rayment and Moruzzi, [1978] and (b) the present work. Neither theoretical models can reproduce plots depicted in Figure 3 of [Rayment and Moruzzi, 1978] using the values of β_d provided in [Rayment and Moruzzi, 1978].

Reproduction of plots in Figure 3 of [Rayment and Moruzzi, 1978] using the theoretical approach of the present work and values of β_d consistent with rate coefficient, k_a values provided in Figure 4 of [Rayment and Moruzzi, 1978].

5. Detachment due to Vibrationally Excited N_2

Reproduction of similar plots in Figure 3 of [Rayment and Moruzzi, 1978] for electron current I_e = 69 nA and reduced electric field E/p = 39 V/(cm Torr) using the theoretical approach of the present work under the assumption that vibrationally excited N_2 is responsible for the detachment reaction, exclusively.

6. Conclusions

We provide corrections to the theoretical modeling in [Rayment and Moruzzi, 1978], which is the basis for the rate of the associative detachment reaction in existing modeling studies of lightning-induced upper-atmospheric discharges [e.g., Luque and Gordillo-Vázquez, Nat. Geosci., vol. 5, no. 1, pp. 22-25, 2012]. More importantly, it is demonstrated that the experimental results of Rayment and Moruzzi, [1978] may be interpreted in terms of an associative detachment reaction including vibrationally excited N_2, exclusively.

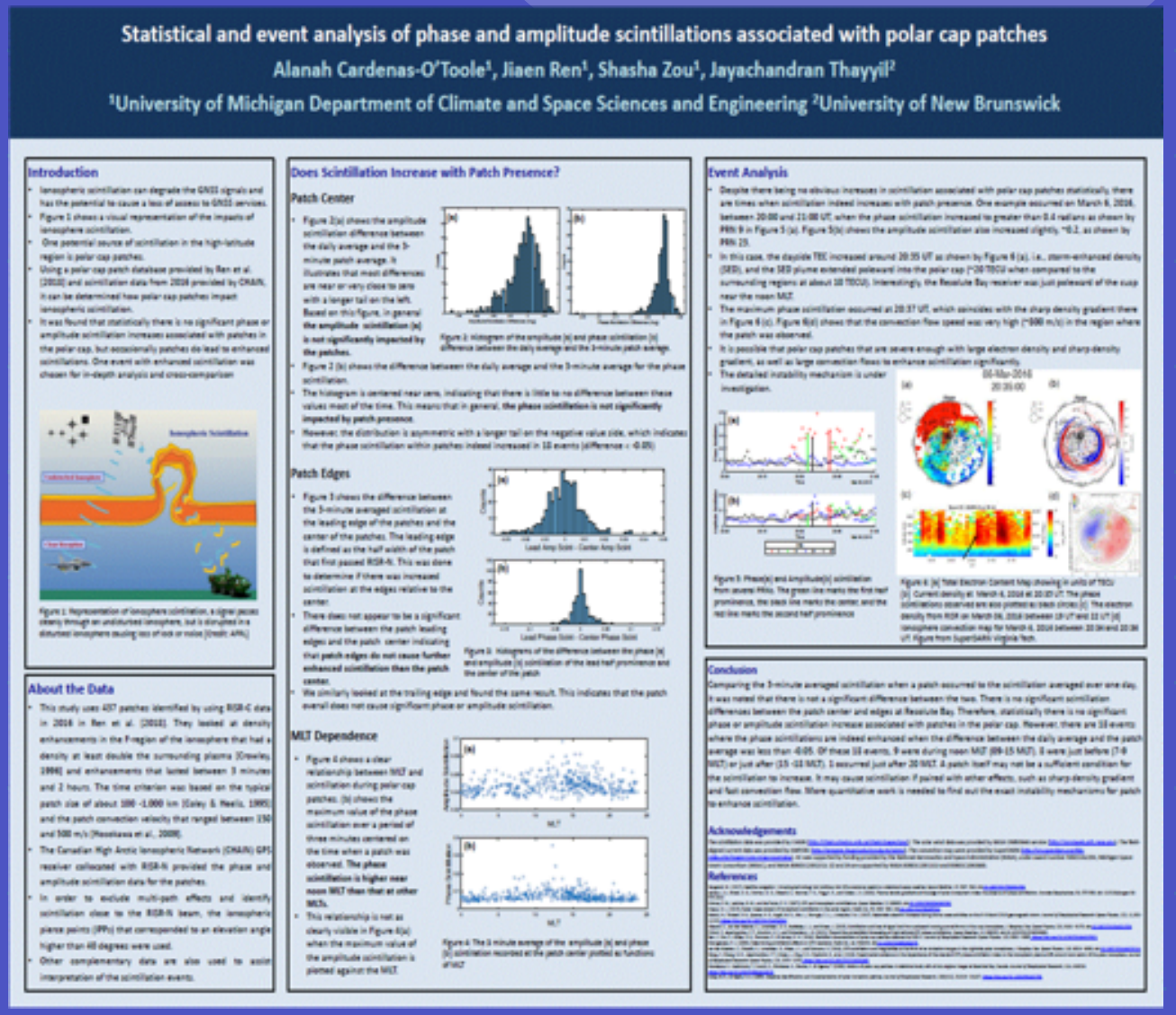
Acknowledgment: This research was supported by NSF under grant AGS-2010088 to Penn State University.

Day 3: Honorable mention Undergraduate

Alanah Cardenas-O'Toole

University of Michigan

Title:
Statistical and event analysis of phase and amplitude scintillations associated with polar cap patches



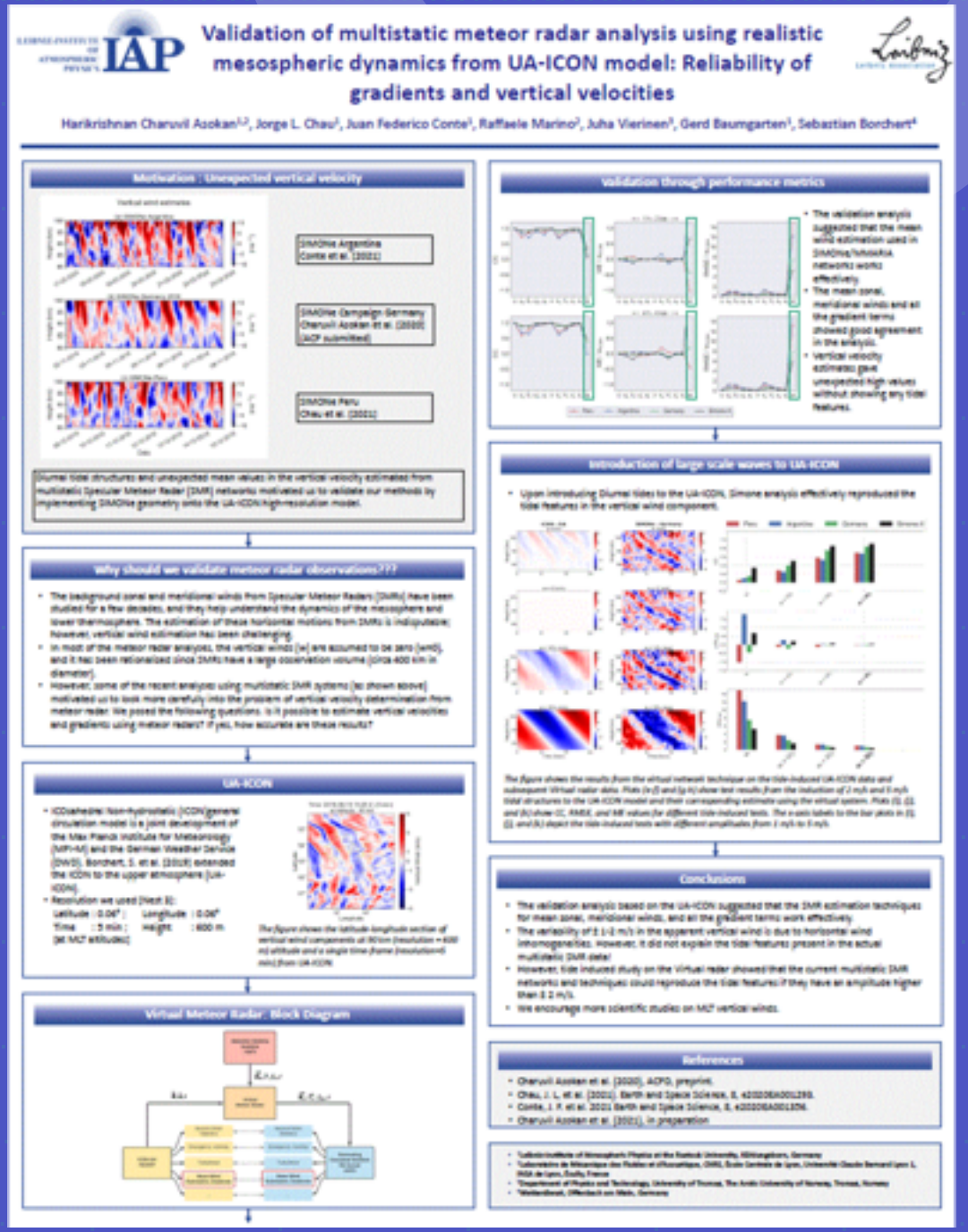
Day 3: 2nd Prize

Harikrishnan Charuvil Asokan

Leibniz-Institute of Atmospheric Physics, Rostock University, Kühlungsborn, Germany.

Title:

Validation of multistatic meteor radar analysis using realistic mesospheric dynamics from UA-ICON model: Reliability of gradients and vertical velocities



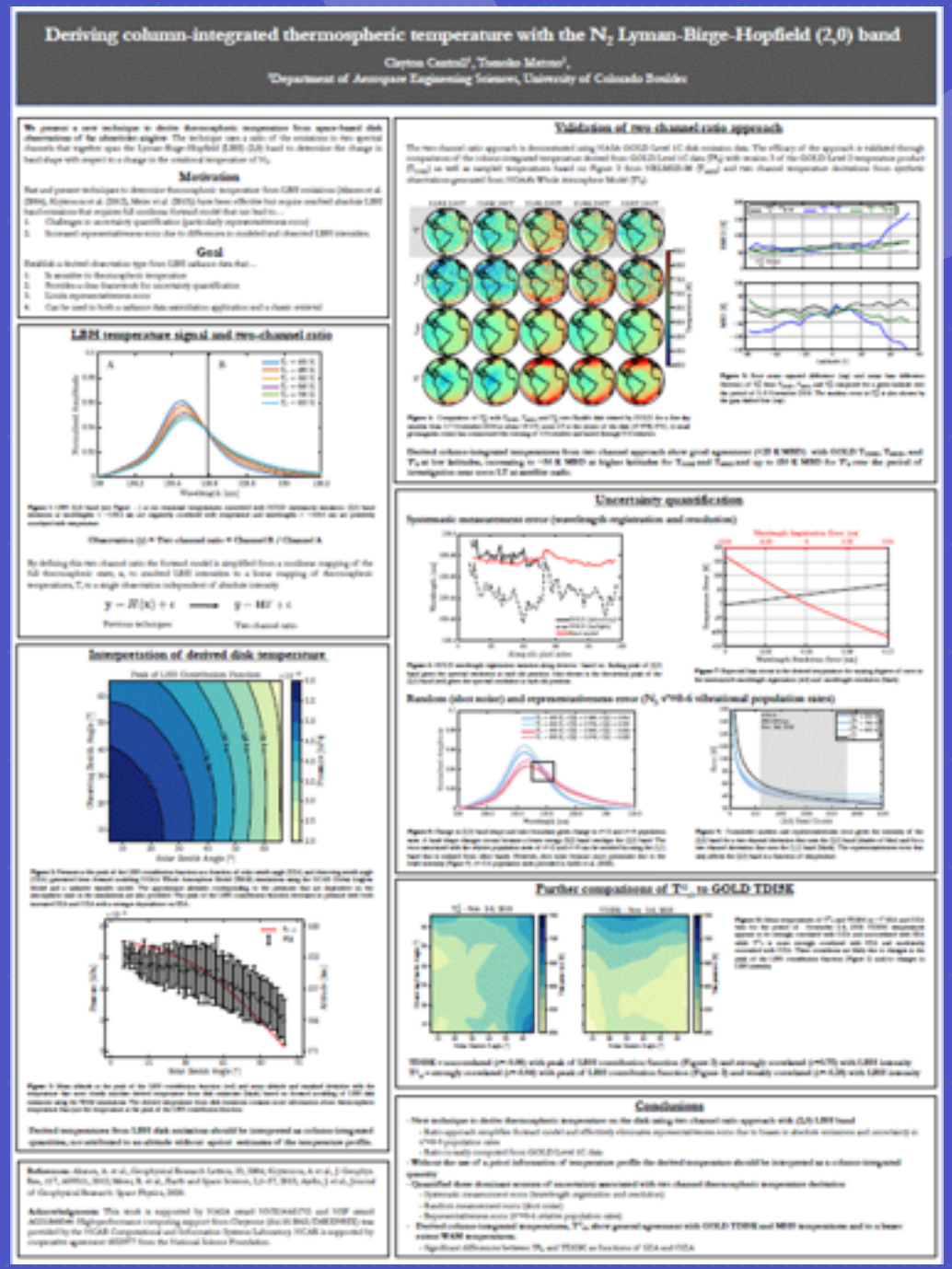
Day 3: 1st Prize

Clayton Cantrall

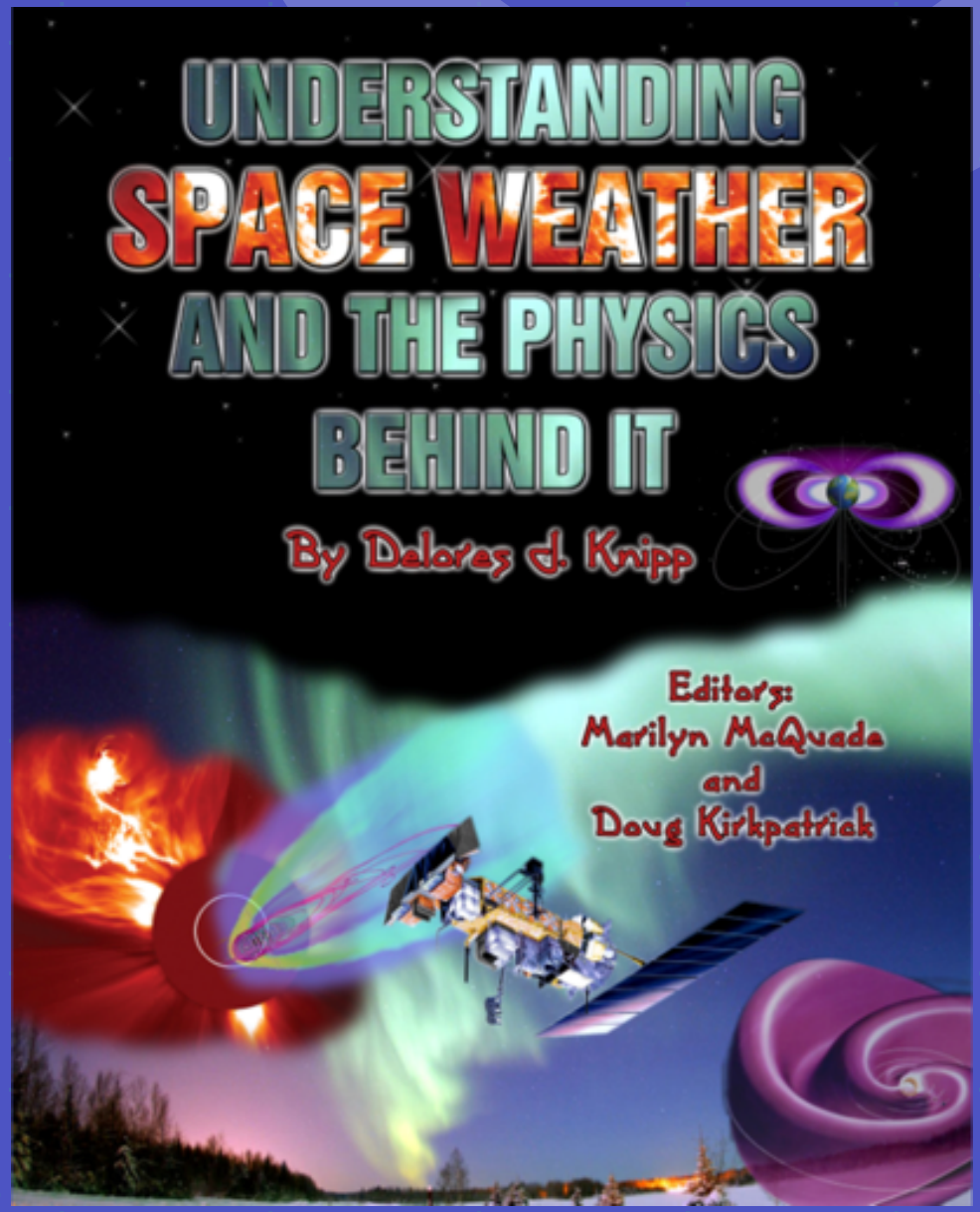
University of Colorado, Boulder

Title:

Deriving column-integrated thermospheric temperature with the N2 Lyman-Birge-Hopfield (2,0) band



1st prize winner will receive an electronic copy of “Understanding Space Weather and the Physics behind it” by CSSC chair Delores Knipp



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