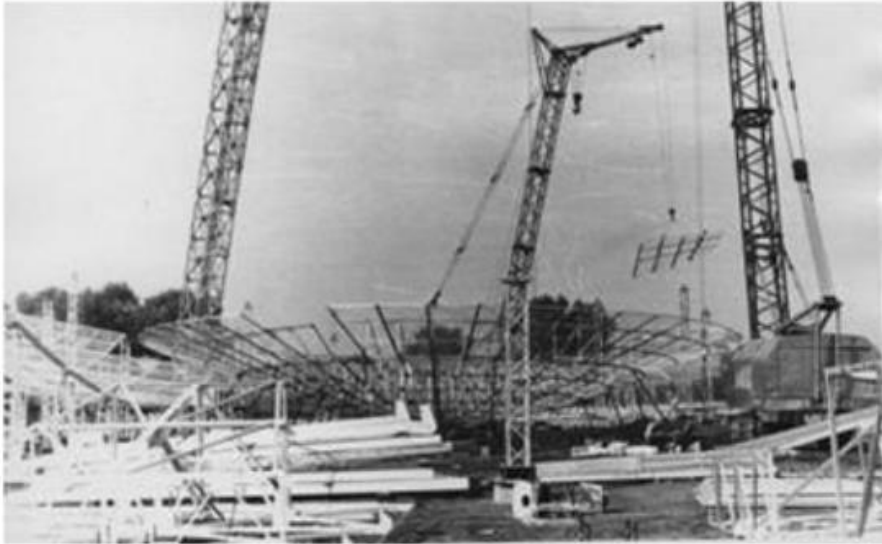
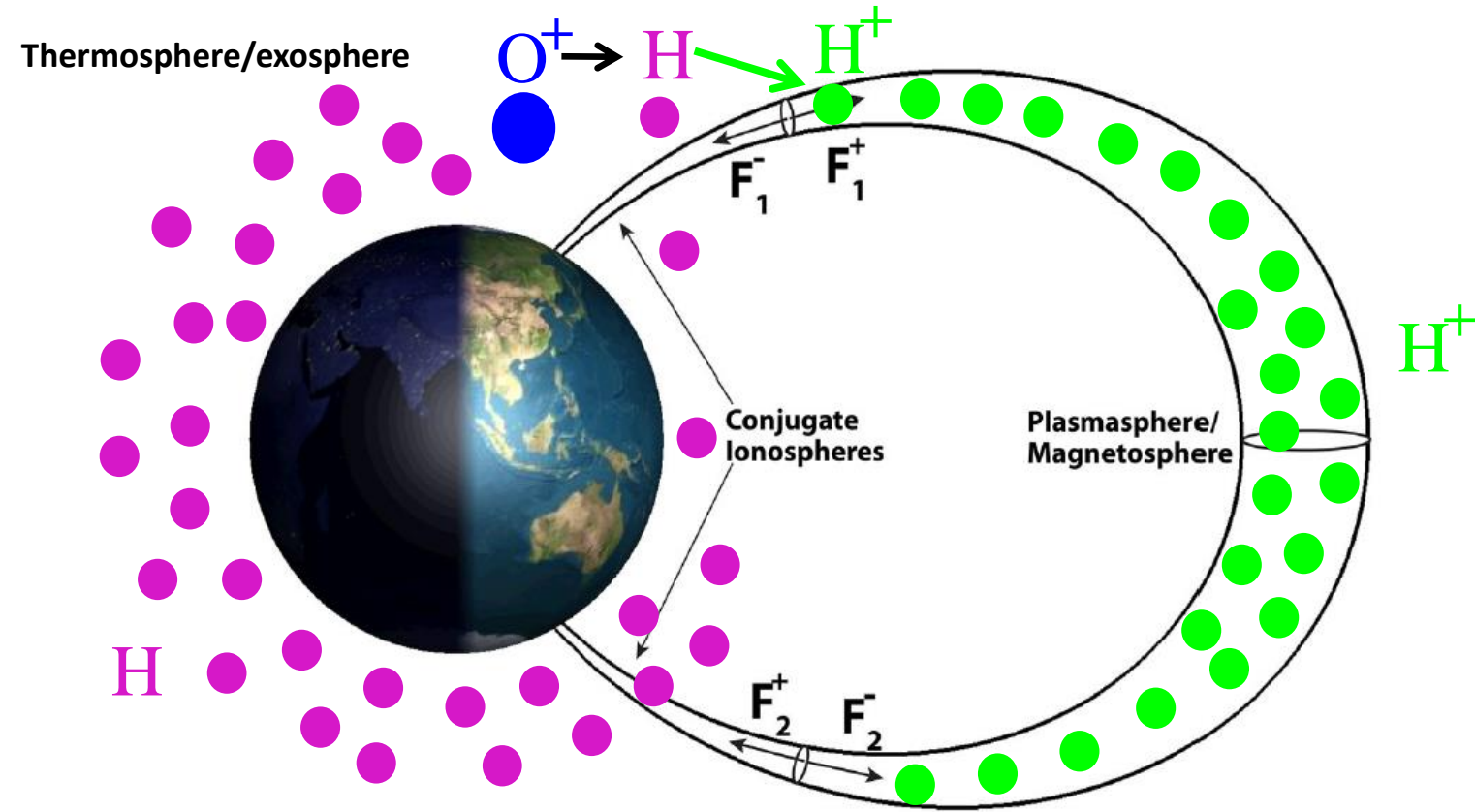
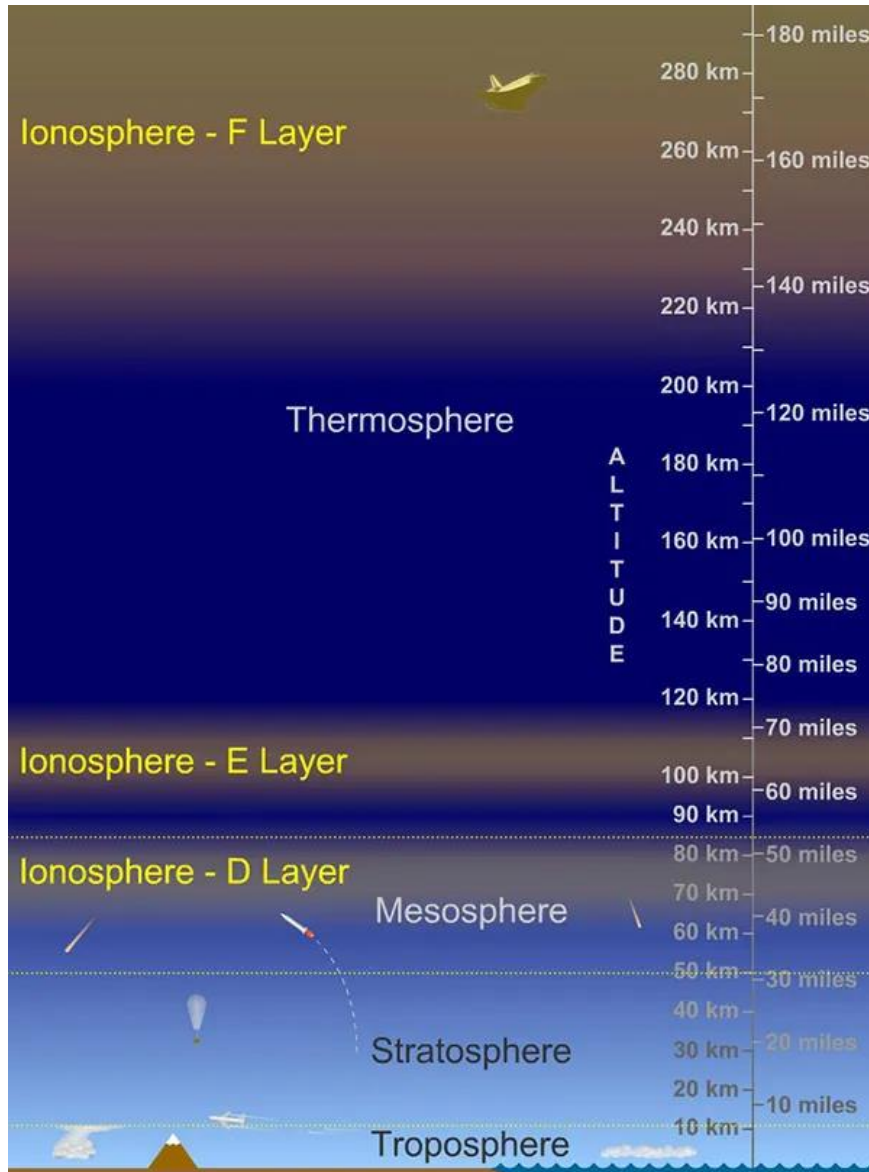


Institute of Ionosphere: 50 years of near-Earth space research



In early 1970s, the KhPI pilot plant manufactured 100-m dual-reflector parabolic antenna, the largest in Europe.

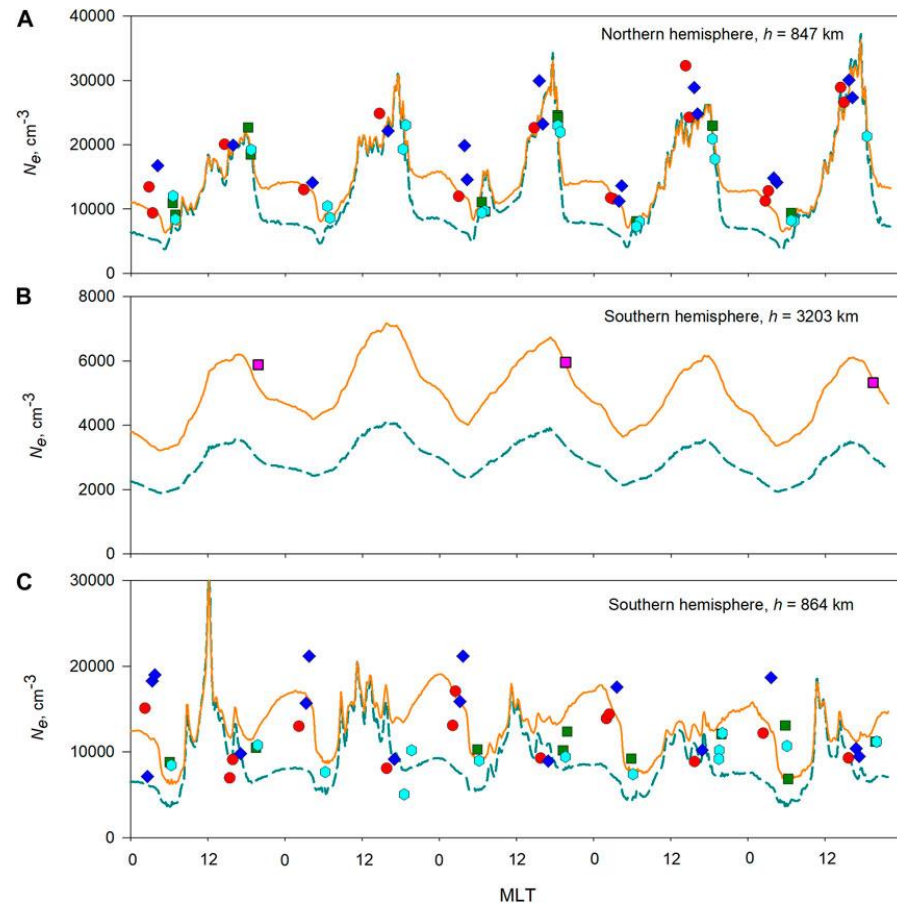
Research goes far beyond the ionosphere



The results advance comprehensive understanding of the ionosphere, plasmasphere, thermosphere, exosphere, magnetosphere, and Van Allen radiation belts as a coupled environments defining solar-terrestrial interaction and space weather.

... providing fundamental discoveries

Diurnal variations of the plasma density in the topside ionosphere at northern (A) and southern (C) ends and in the high-altitude plasmaspheric part (B) of the L = 1.75 flux tube during 27 April—1 May 2017. The dashed dark blue line shows the simulation using the standard NRLMSIS H density while the solid orange line is for the NRLMSIS H density multiplied by a factor of 2.75. In the top and bottom panels, the symbols show DMSP satellites data. Pink squares on the middle panel denote the Arase satellite data.



Kotov D. et al. (2023), *Interhemispheric ionosphere-plasmasphere system shows a high sensitivity to the exospheric neutral hydrogen density: a caution of the global reference atmospheric model hydrogen density*. *Front. Astron. Space Sci.* 10:1113706. doi: 10.3389/fspas.2023.1113706

Interhemispheric ionosphere-plasmasphere system shows a high sensitivity to the exospheric neutral hydrogen density: a caution of the global reference atmospheric model hydrogen density

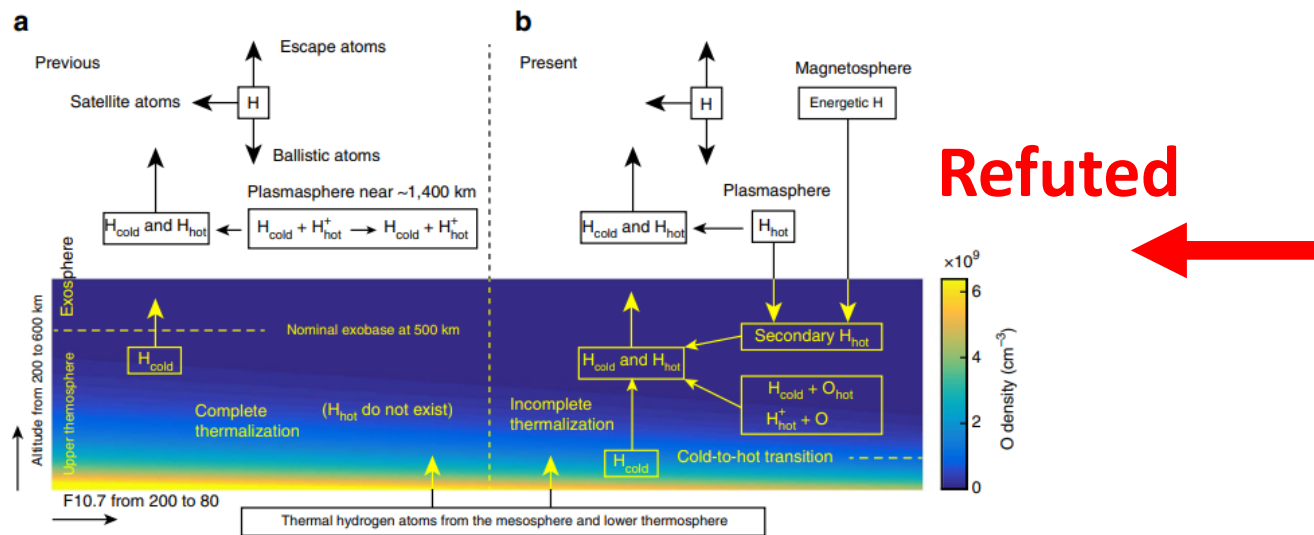
Dmytro Kotov^{1*}, Phil G. Richards², Maryna Reznichenko¹, Oleksandr Bogomaz^{1,3}, Vladimír Truhlík⁴, Susan Nossal⁵, Edwin Mierkiewicz⁶, Taras Zhivolup¹, Igor Domnin¹, Yoshizumi Miyoshi⁷, Fuminori Tsuchiya⁸, Atsushi Kumamoto⁸, Yoshiya Kasahara⁹, Masahiro Kitahara⁸, Satoko Nakamura¹⁰, Ayako Matsuoka¹¹, Iku Shinohara¹² and Marc Hairston¹³

¹Institute of Ionosphere, Kharkiv, Ukraine, ²Department of Computer Science, University of Alabama in Huntsville, Huntsville, AL, United States, ³State Institution National Antarctic Scientific Center of the Ministry of Education and Science of Ukraine, Kharkiv, Kyiv, Ukraine, ⁴Institute of Atmospheric Physics of the Czech Academy of Sciences, Prague, Czechia, ⁵Physics Department, University of Wisconsin-Madison, Madison, WI, United States, ⁶Department of Physical Sciences, Embry-Riddle Aeronautical University, Daytona Beach, FL, United States, ⁷Institute for Space-Earth Environmental Research, Nagoya University, Nagoya, Japan, ⁸Planetary Plasma and Atmospheric Research Center, Graduate School of Science, Tohoku University, Sendai, Japan, ⁹Graduate School of Natural Science and Technology, Kanazawa University, Kanazawa, Japan, ¹⁰Institute for Space-Earth Environmental Research, Nagoya University, Nagoya, Japan, ¹¹Data Analysis Center for Geomagnetism and Space Magnetism, Graduate School of Science, Kyoto University, Kyoto, Japan, ¹²Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, Sagami, Japan, ¹³William B. Hanson Center for Space Sciences, The University of Texas at Dallas, Richardson, TX, United States

... refuting wrong theories

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ARTICLE



Refuted

Hydrogen atoms near the exobase are cold: independent observations do not support the hot exosphere concept

Dmytro Kotov^{1*} and Oleksandr Bogomaz^{1,2}

¹Institute of Ionosphere, Kharkiv, Ukraine, ²State Institution National Antarctic Scientific Center of the Ministry of Education and Science of Ukraine, Kyiv, Ukraine

Figure 3 | The previous geocorona theory and the new physics implied in this study. (a) Only cold hydrogen atoms, with a Maxwellian kinetic distribution determined by the ambient oxygen temperature, are present in the upper thermosphere, since complete thermalization is assumed. (b) Incomplete thermalization, due to low oxygen density especially under solar minimum condition, allows the presence of hot hydrogen atoms in the upper thermosphere. Variation of the atomic oxygen density in the upper thermosphere with solar activity is calculated using the NRLMSISE-00 model¹⁹. We emphasize that in the present work the cold atoms refer to those atoms that diffuse upward from the lower thermosphere (that is, the thermal atoms), and the hot atoms are the ones that are kinetically energized through processes such as charge exchange and momentum transfer.

Qin, J., Waldrop, L. Non-thermal hydrogen atoms in the terrestrial upper thermosphere. *Nat Commun* **7**, 13655 (2016). <https://doi.org/10.1038/ncomms13655>

Kotov D and Bogomaz O (2023) Hydrogen atoms near the exobase are cold: independent observations do not support the hot exosphere concept. *Front. Astron. Space Sci.* 10:1200959. doi: 10.3389/fspas.2023.1200959

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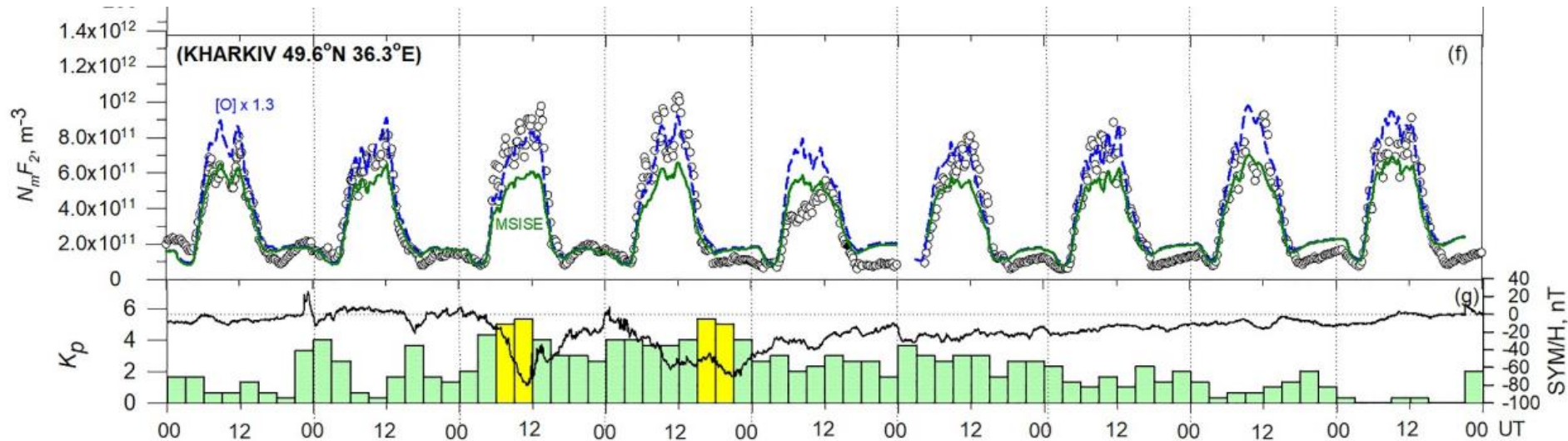
Key Points:

- For magnetically quiet days, the observed daytime $N_m F_2$ values were ~50% larger than those simulated using the NRLMSISE-00 model
- This implies ~30% larger neutral O density comparing with the NRLMSISE-00 model prediction or the density underestimation by the model
- Similar problem with the O density prediction happens for some periods for different years

The Thermosphere Was Poorly Predictable Not Only During but Also Before and After the Starlink Storm on 3–4 February 2022

M. O. Reznichenko^{1,2} , D. V. Kotov¹ , P. G. Richards³ , O. V. Bogomaz^{1,4} ,
A. I. Reznichenko^{2,5} , L. P. Goncharenko⁶ , T. G. Zhivolup¹, and I. F. Domnin¹ 

¹Institute of Ionosphere, National Technical University “Kharkiv Polytechnic Institute”, Kharkiv, Ukraine, ²Space Research Centre of Polish Academy of Sciences, Warsaw, Poland, ³Department of Computer Science, University of Alabama in Huntsville, Huntsville, AL, USA, ⁴State Institution National Antarctic Scientific Center, Ministry of Education and Science of Ukraine, Kyiv, Ukraine, ⁵Institute of Radio Astronomy, National Academy of Sciences of Ukraine, Kharkiv, Ukraine, ⁶Massachusetts Institute of Technology, Haystack Observatory, Westford, MA, USA



Diurnal variations of the ionosphere F2-layer peak height hmF_2 and density NmF_2 at Kharkiv, 3-hr K_p and SYM/H indices during 1–9 February 2022. The circles show observations. All the colored lines are from the Field Line Interhemispheric Plasma model simulations with the hmF_2 constraint. The solid green line is with the standard NRLMSISE-00 densities, the dashed blue line is with a multiplier of 1.3 for the O density