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Neutralized solar wind ahead of the Earth's magnetopause as contribution to non-thermal exospheric hydrogen

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In a most recent paper by Qin and Waldrop (2016), it had been found that the scale height of hydrogen in the upper exosphere of the Earth, especially during solar minimum conditions, appears to be surprisingly large. This indicates that just during minimum conditions when exobasic temperatures should be small, large exospheric H-scale heights predominate. They thus seem to indicate the presence of a non-thermal hydrogen component in the upper exosphere. We shall investigate what fraction of such expected hot hydrogen atoms could have their origin from protons of the shocked solar wind ahead of the magnetopause converted into energetic neutral atoms (ENAs) via charge exchange processes with normal atmospheric, i.e. exospheric, hydrogen atoms, that in a first step evaporate from the exobase into the magnetosheath plasma region. As we show here, dependent on the sunward location of the magnetopause, these types of non-thermal hydrogen atoms (H-ENAs) compete the more with exobasic hydrogen by their density, the larger becomes the altitude. At low exobasic heights, however, their contribution is negligible. We finally study the question whether the H-ENA population could even be understood as a self-consistency phenomenon of the H-ENA population, especially during solar activity minimum conditions, i.e. H-ENAs leaving the exosphere being replaced by H-ENAs injected into the exosphere.