Studies of the solar He II line have shown a large discrepancy between the observed quiet sun intensity and the intensity predicted by plane-parallel, non-LTE models with the models failing to account for the observed intensity by a factor of 3-10^{10}. Observation of TR lines other than helium results in small filling factors (< 0.01). Low filling factor (< 0.01) helium model, nearly flat density, and low optical depth.

For our model we created a thin slab of emitting material representing the TR. In the slab we placed randomly distributed cylindrical spicules to act as our absorbers, constrained by a parameter we call the spicule fraction (f_{s})—the ratio of spicule-occupied volume to slab volume. If we assume that He II is formed at low filling factor we can neglect absorption by helium in the emission region of the slab.

The intensity of this slab is obtained by integrating along the line of sight, which begins normal to the surface. The spicules are totally opaque. To simulate a center to limb profile we rotated the slab through 90° relative to the original line of sight.

The slab was constructed such that the model pixel size was 400 km, matching the resolution of the Multi-Order Solar EUV Spectrograph (MOSES) data (1.2° per two pixels). We performed simulations with R = 300 km – 800 km and f_{s} = 0.05 – 0.2. One limitation of the choice of pixel size was a practical constraint on the thickness T, which was set for T = 2 Mm.

Below are the mean intensity and quartiles for the center to limb variation from MOSES. We see an approximately 15% increase at the limb that corresponds well with the 10-20% brightening from the R = 300 km, f_{s} = 0.2 model. Qualitatively, we see a generally flat curve that is matched best by smaller width spicules filling about 20% of the slab.

As a comparison for the center to limb profile, we use the results of the MOSES sounding rocket mission, which imaged at 304 Å on 02/08/06 18:45:54 UTC. The image below is a 1024 x 2048, 24 s exposure with corrections for oversaturation. The yellow dot marks sun center, while the rings denote regions of 10° rotation from normal incidence at sun center.

We propose a model of the solar transition region with He II formation at low filling factor (< 0.01), high density (10-100 times greater), and low optical depth.

- Formation at low filling factor and high densities resolves the discrepancy with observed He II brightness.
- Opaque chromospheric structures interspersed with this dense, transparent emitting material reproduces the observed center to limb variation of the He II line.

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