# A mineral sputter model in agreement with solar wind ion irradiation experiments

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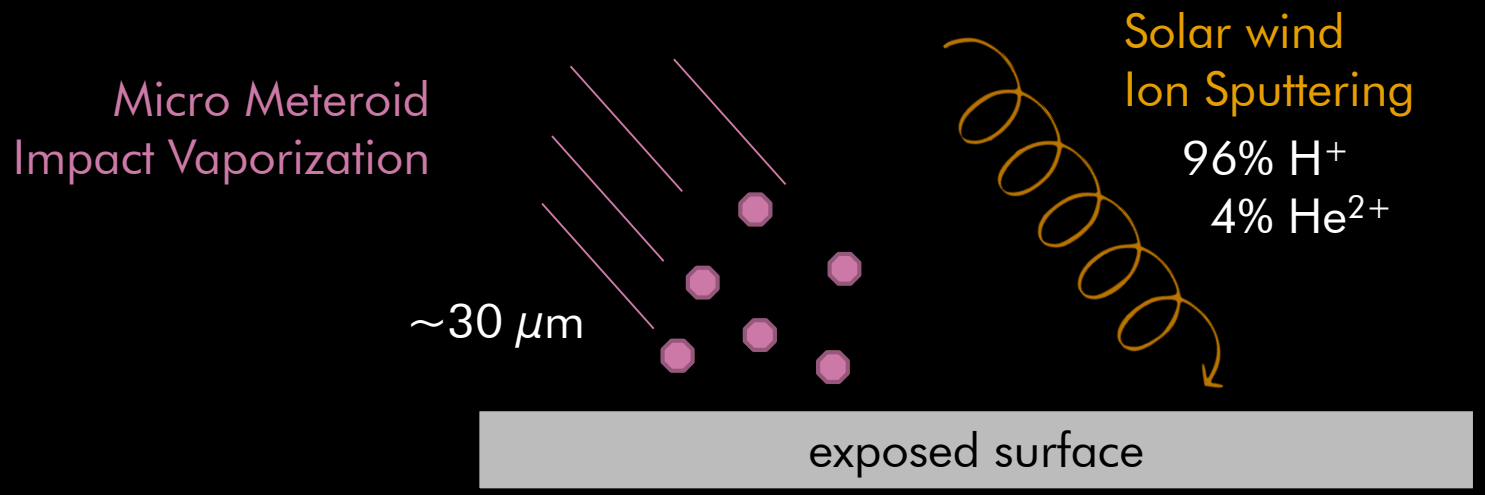
# Refractories in the exosphere

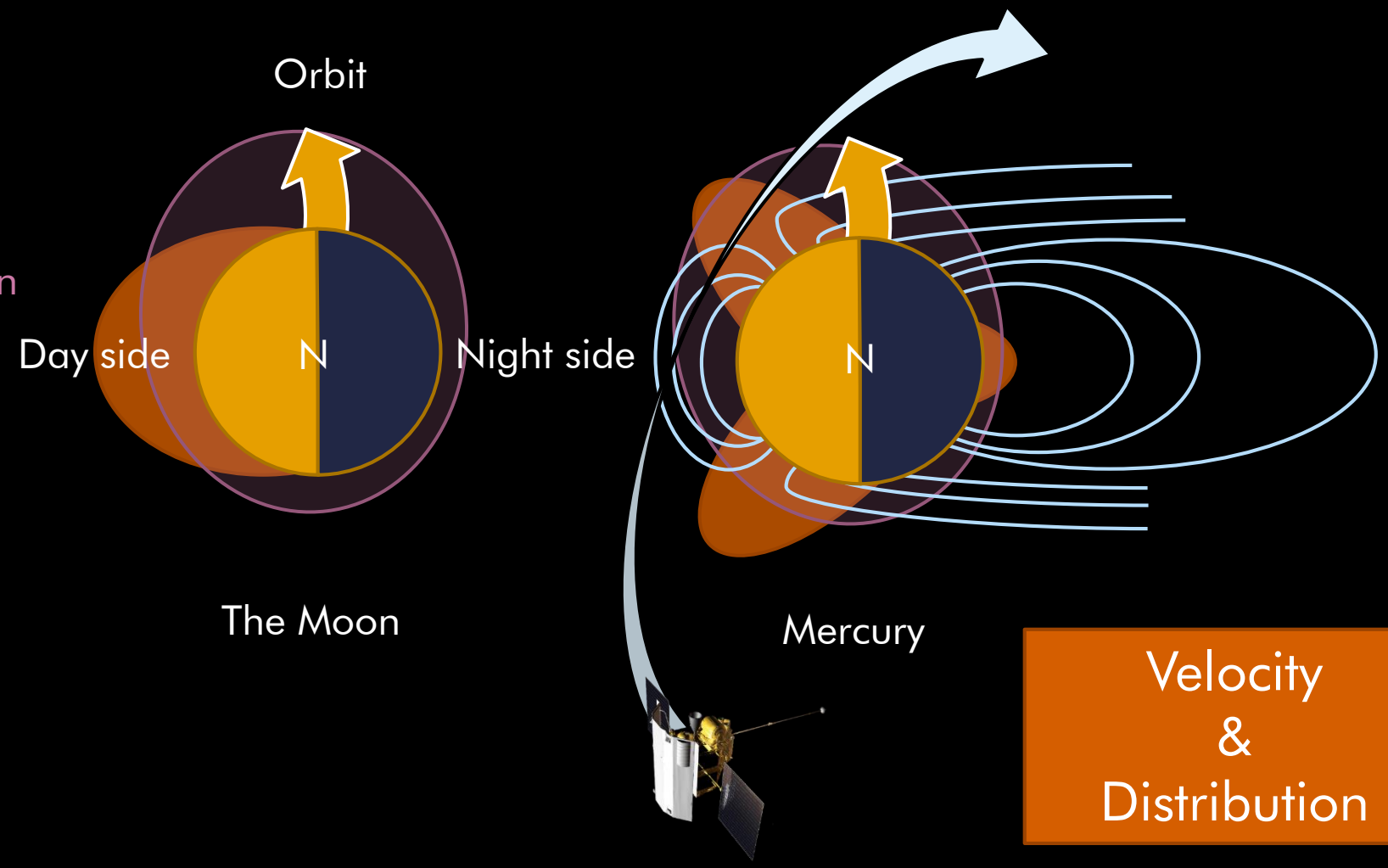
i.e., Ca, Si, Mg, and Fe




# Observations (qualitative)

Micro Meteroid
Impact Vaporization

Ion Sputtering




Velocity
&
Distribution

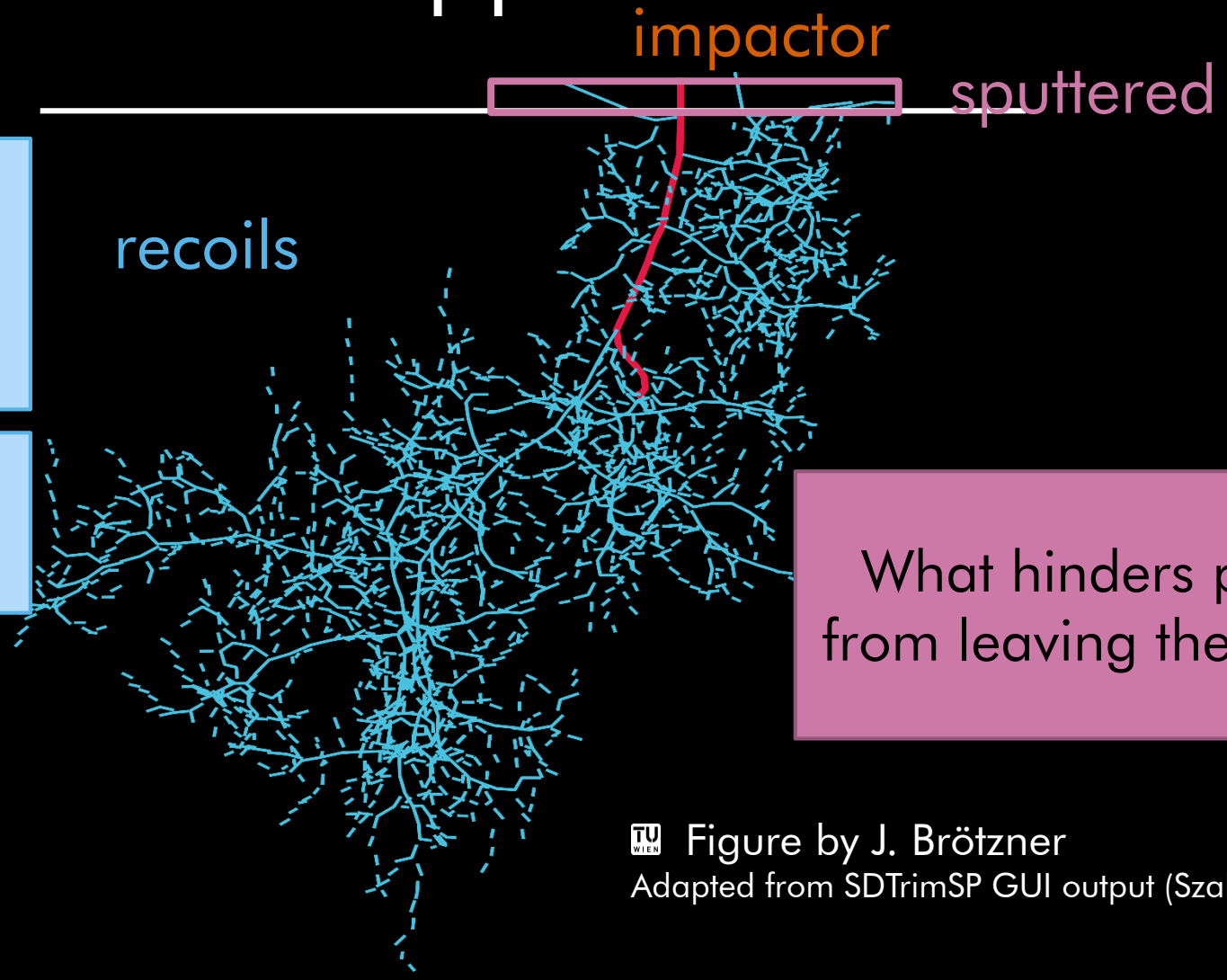
# The model

# Binary Collision Approximation

mean free path

$$\mu = \frac{1}{\sqrt[3]{\rho}}$$

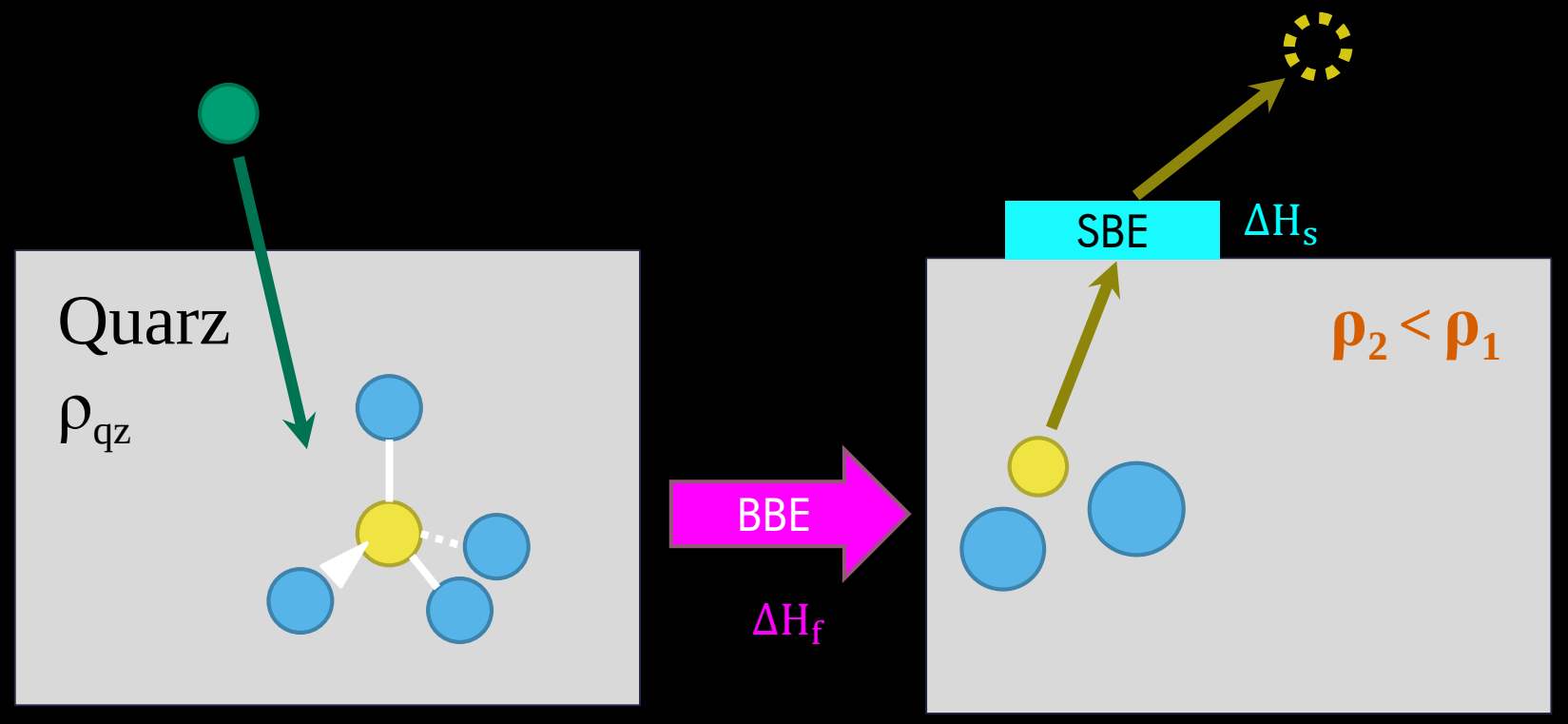
density must be well defined




What hinders particles from leaving the surface?

Figure by J. Brötzner
Adapted from SDTrimSP GUI output (Szabo et al. 2022b)

# Hybrid Binding and Compound Model




→ larger binding energies

→ larger initial densities

bound

$\rho(SiO_2)$

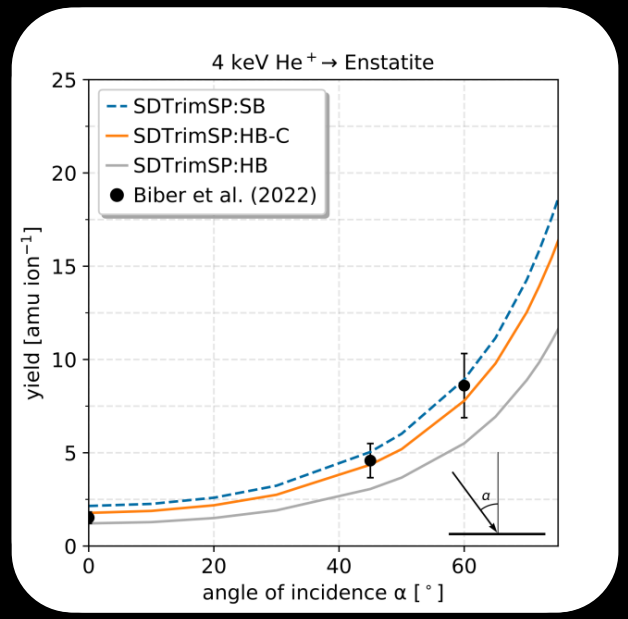
un-bound

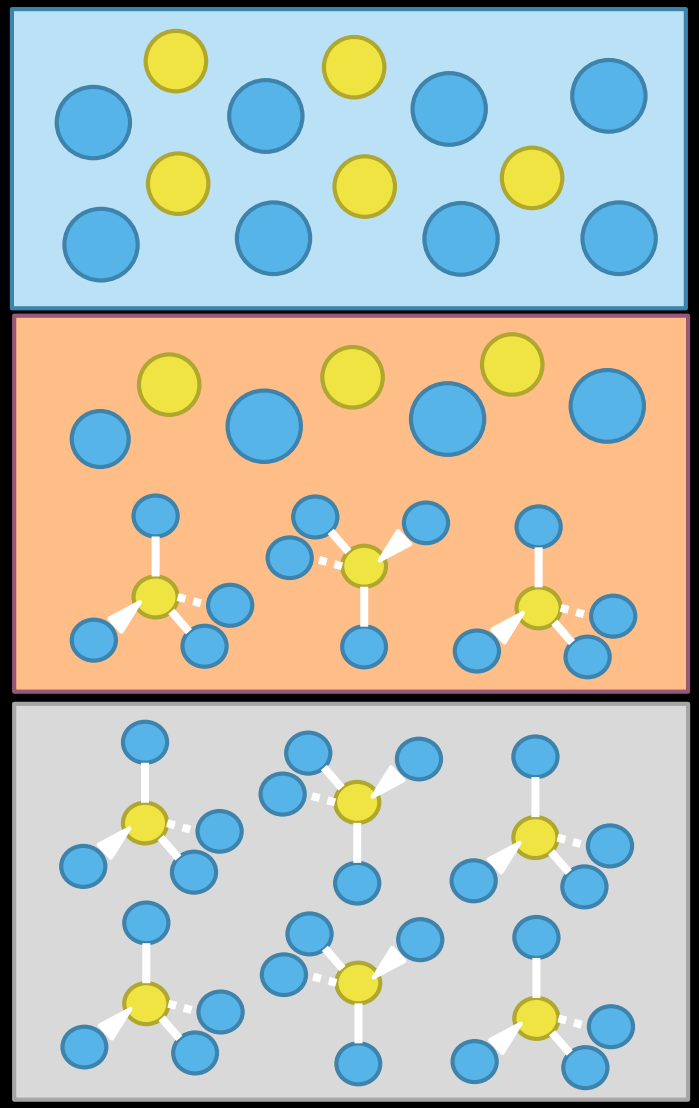
$\rho(Si, O) << \rho(SiO_2)$

New Model

# Model vs. Lab Results

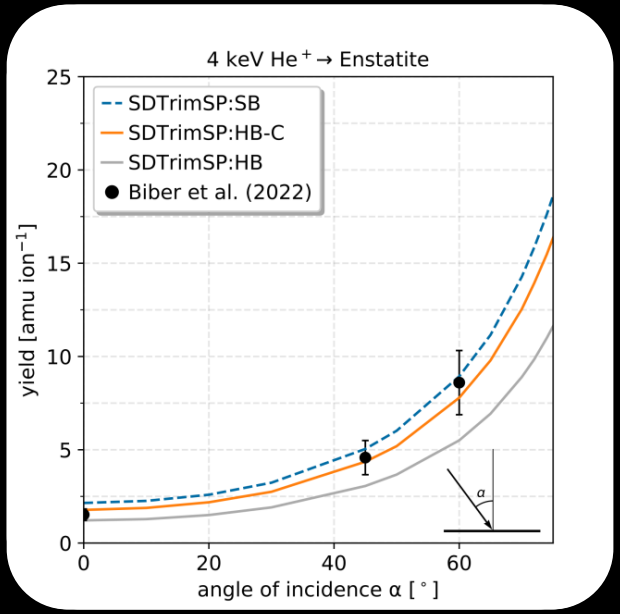
# Model Results

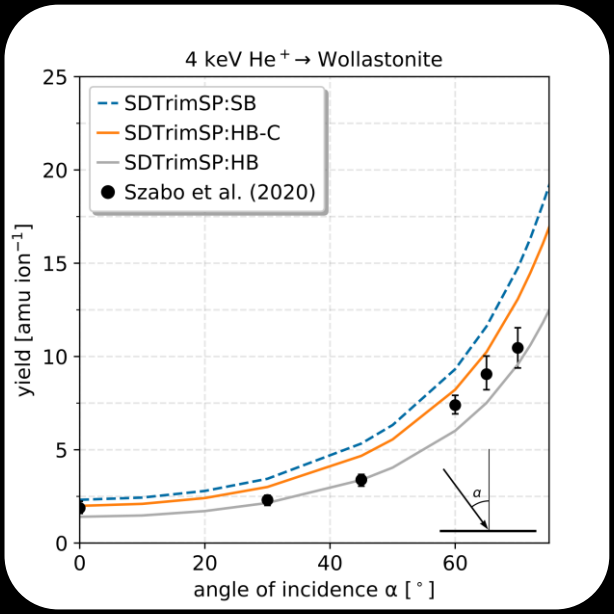


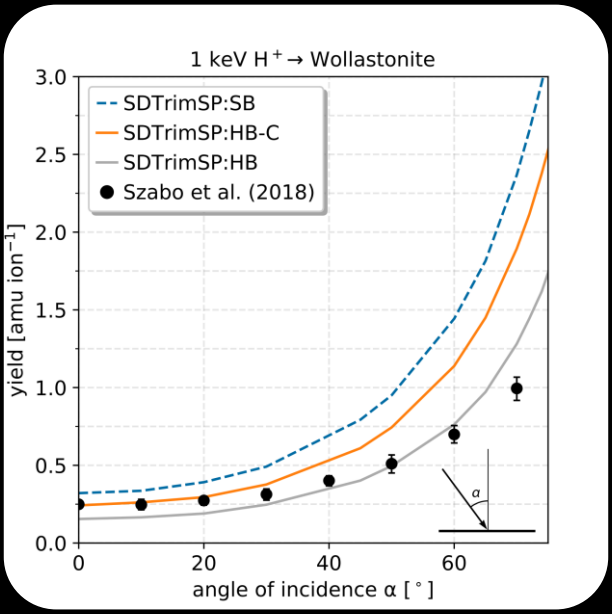



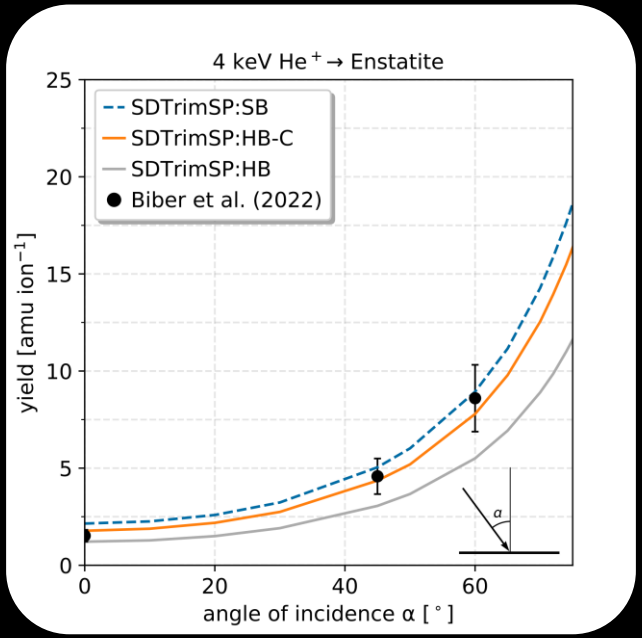
Model vs. Lab

# Model Results

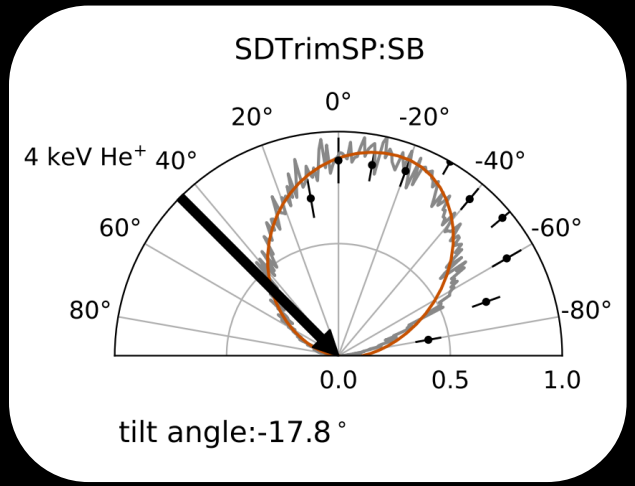





## Angular Distribution

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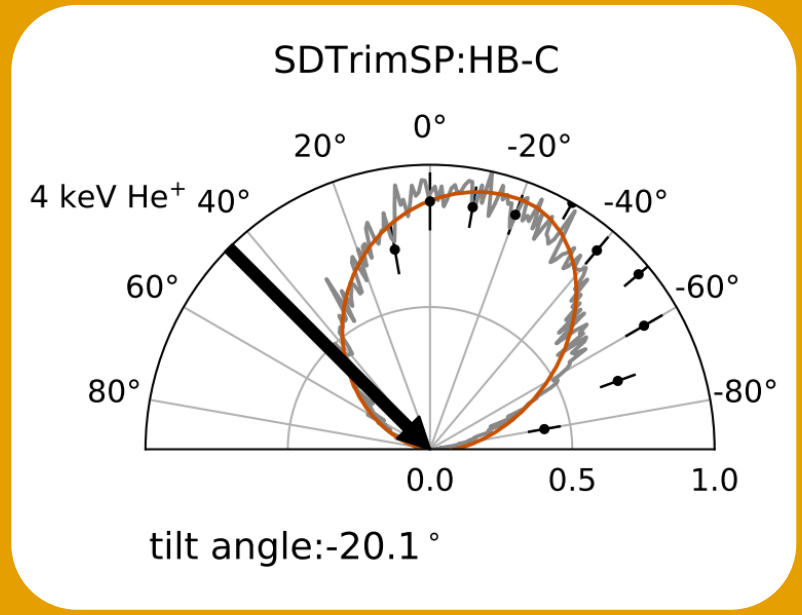
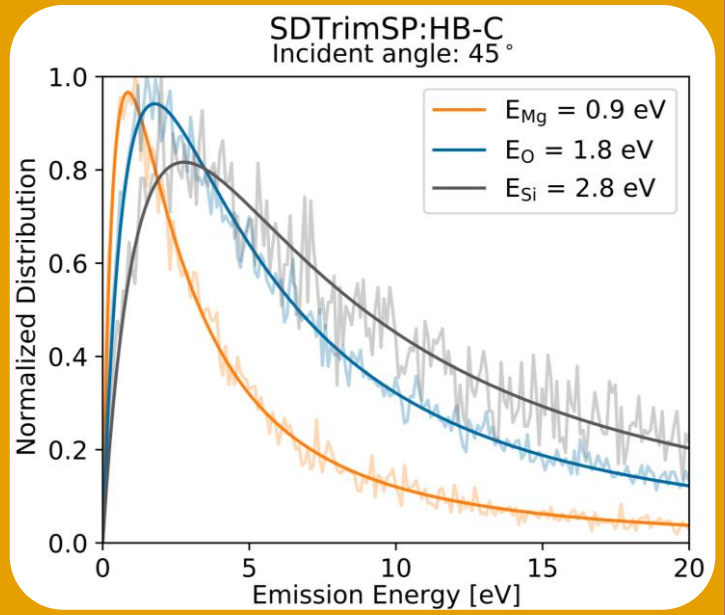
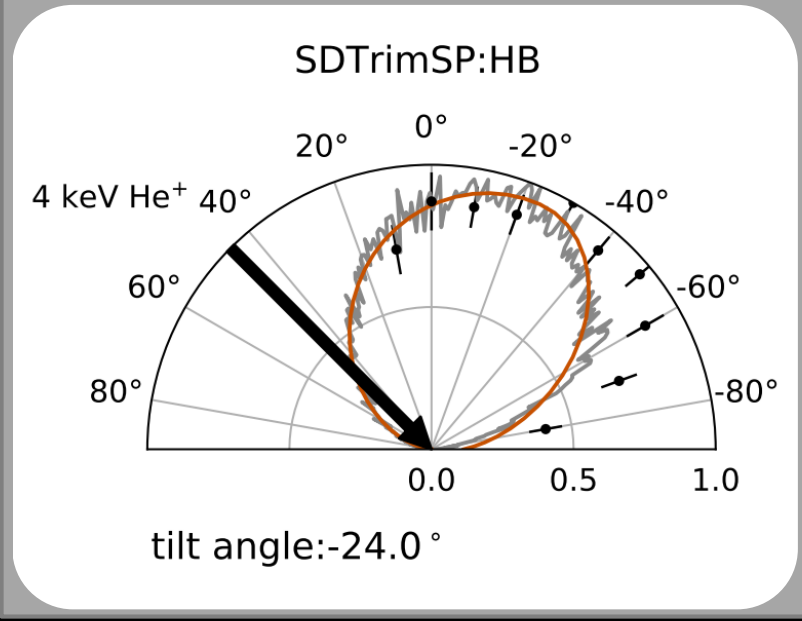


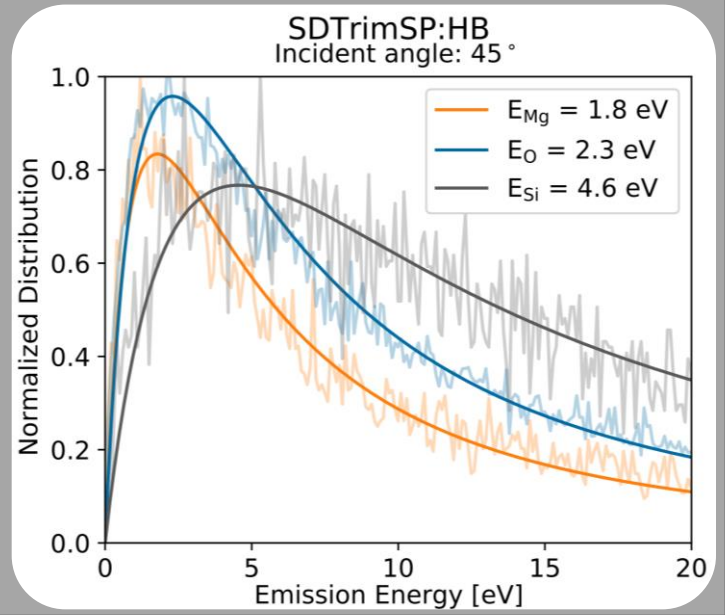

## Energy Distribution




## Angular Distribution




## Energy Distribution

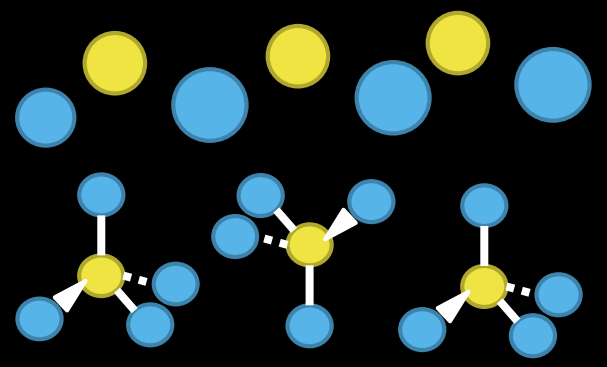



# Model vs. Lab

# Summary

arXiv.org
2304.12048

The hybrid model combines oxide densities with surface binding energies ($\Delta H_s$) and bulk binding energies ($\Delta H_f$).



Larger surface binding energies are achieved based solely on tabulated data.

Hybrid model reproduces existing mineral lab data exceptionally well.

Energy distribution data necessary for validation, but tendency is according to lab data of oxidized metal.