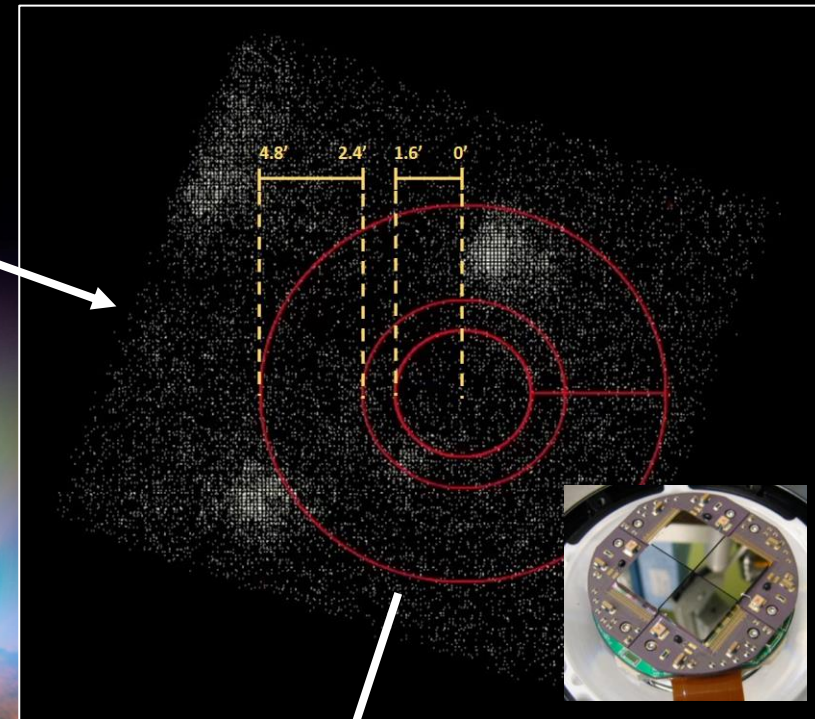
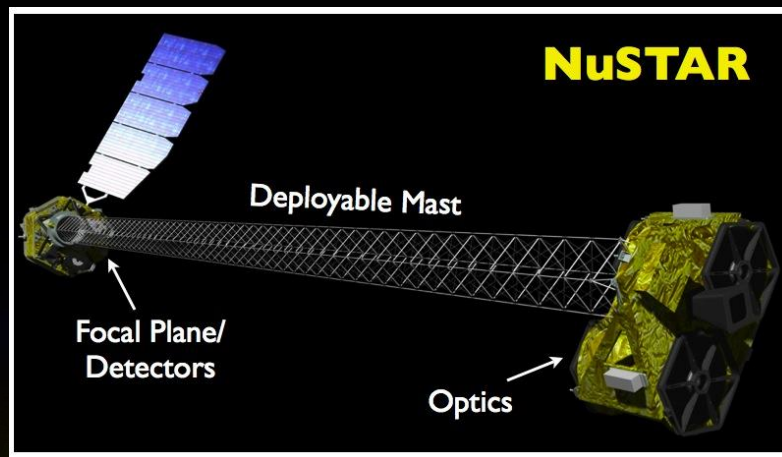


# NuSTAR limits on the solar axion

No axion signal detected.

Next step:  
solar atmosphere &  
constraints on parameters.



Key attributes of research:

- ❑ NuSTAR much more sensitive than predecessors in HXR range
- ❑ Varying solar atmospheric model from VAL-C (1981ApJS...45..635V)
  - Several orders of magnitude between lower and upper atmosphere

$$P_{a \rightarrow \gamma}(z) = \frac{\kappa^2(z)}{4M^2} \left[ \left( \int_{h_0}^{\infty} \frac{B(z')}{\kappa(z')} \cos(\phi(z')) dz' \right)^2 + \left( \int_{h_0}^{\infty} \frac{B(z')}{\kappa(z')} \sin(\phi(z')) dz' \right)^2 \right]$$

$$\kappa(z) = \exp\left(-\int_0^z \frac{\Gamma(z')}{2} dz'\right), \quad \phi(z') = \int_0^{z'} \left[ \frac{m_\gamma^2(z'') - m_a^2}{2\omega} \right] dz'', \quad m_\gamma(z) = \sqrt{\frac{4\pi\alpha n_e(z)}{m_e}}$$

derived from van Bibber et al. (1989PhRvD..39.2089V)

