THE FINAL STAGES OF DISC CLEARING

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MOTIVATION

- Lack of transition discs with large holes and low accretion rates.

- Indicates either 'transition discs' not are transition discs or clearing is fast in the inner disc but even faster in the outer disc.
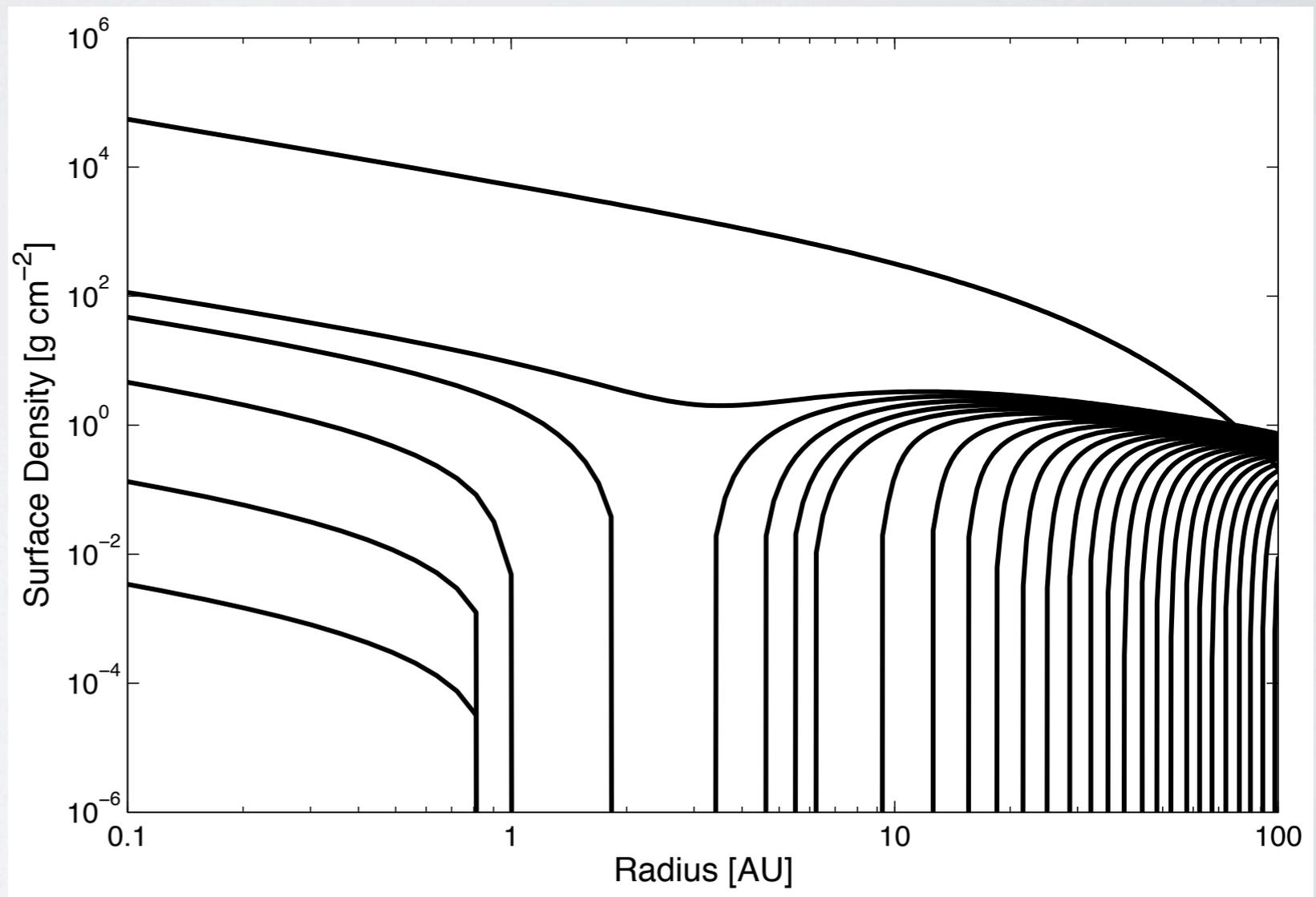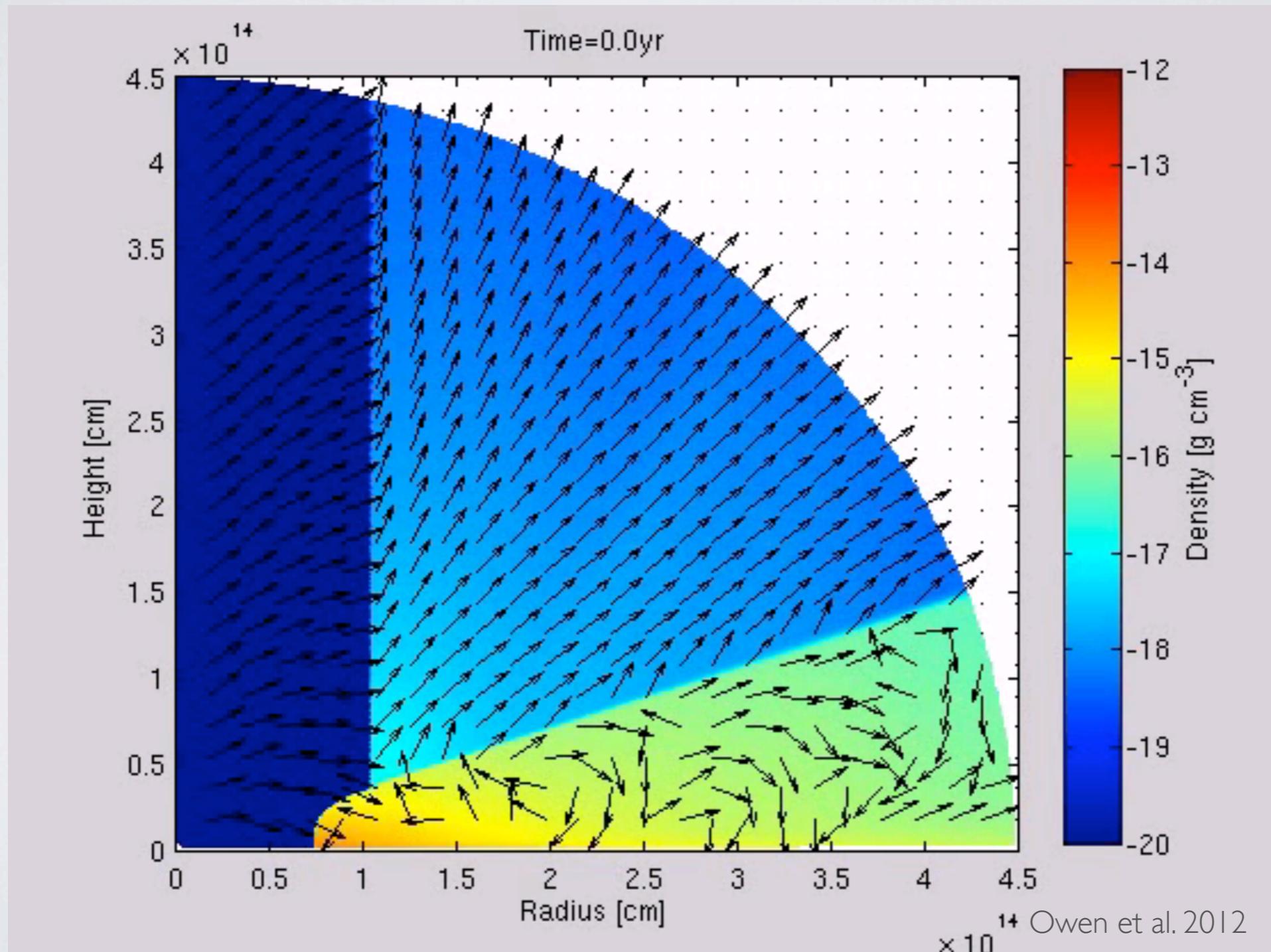
See also Owen & Clarke (2012)
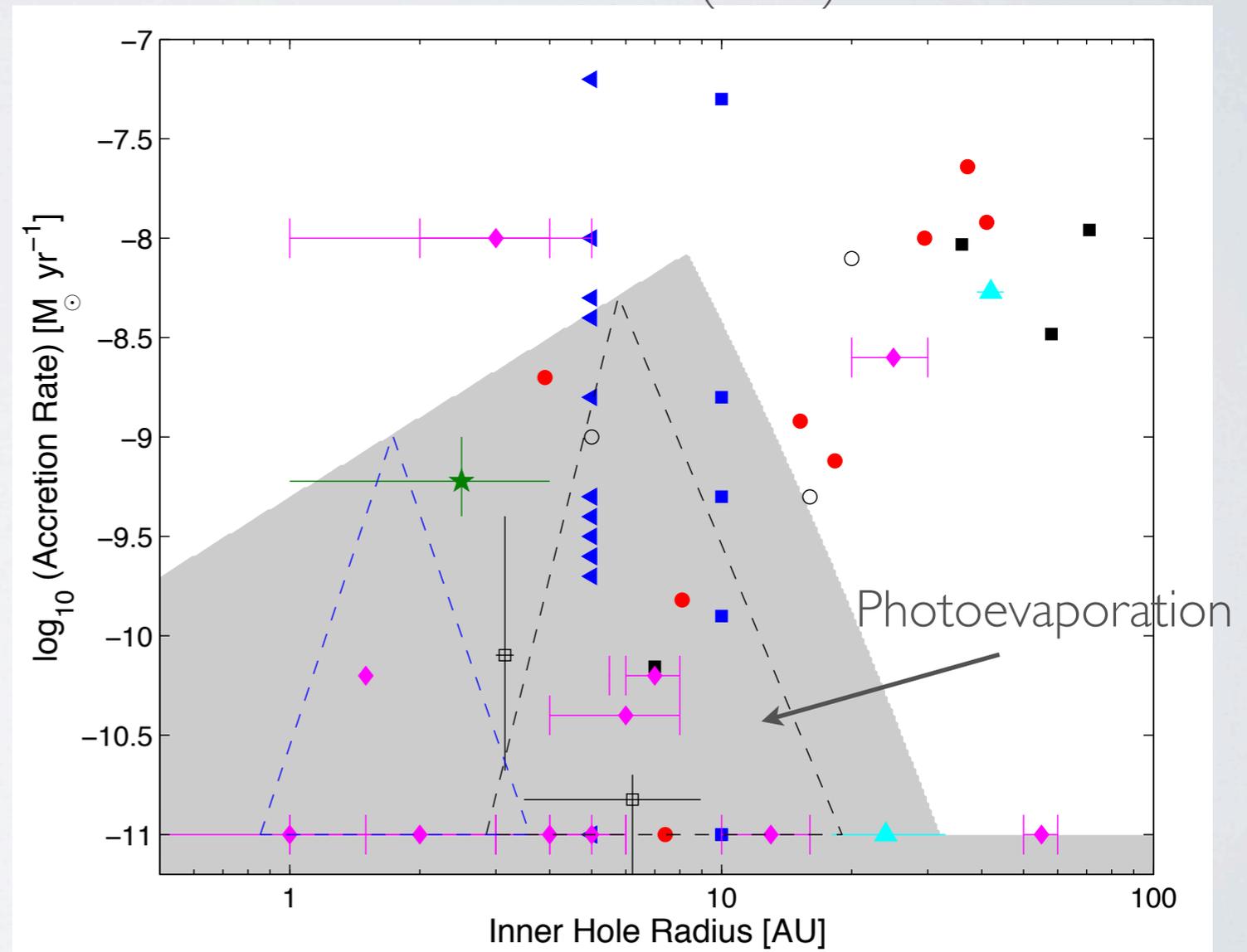
Discs from: Andrews..; Calvet..; Cieza..; Espaillat.., Hughes..; Kim,..;Merin..; Najita..;   Figure from Owen et al. 2011
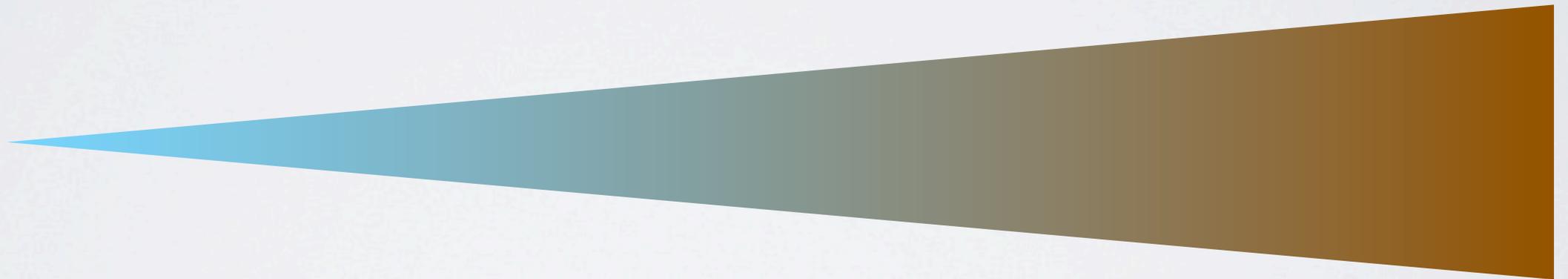
STANDARD PICTURE

- Once into the transition disc phase, clearing generally takes longer as the inner edge moves out.

- Need a process to take over to clear the final transition disc remnant rapidly.
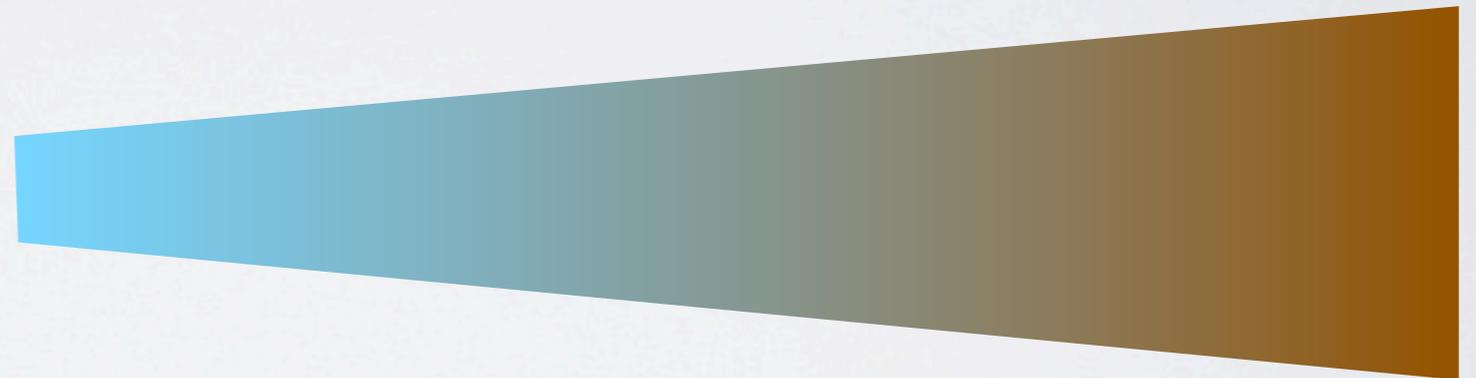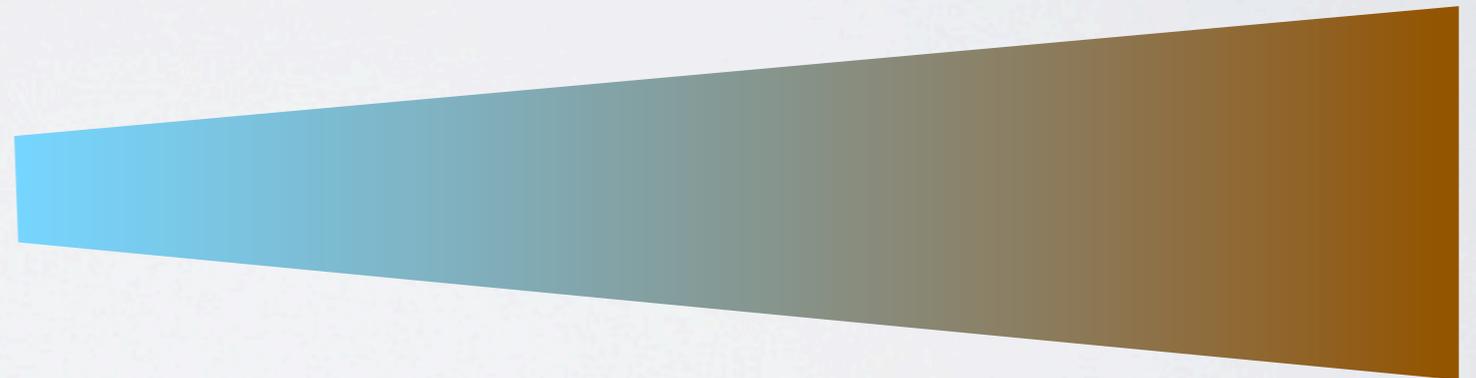
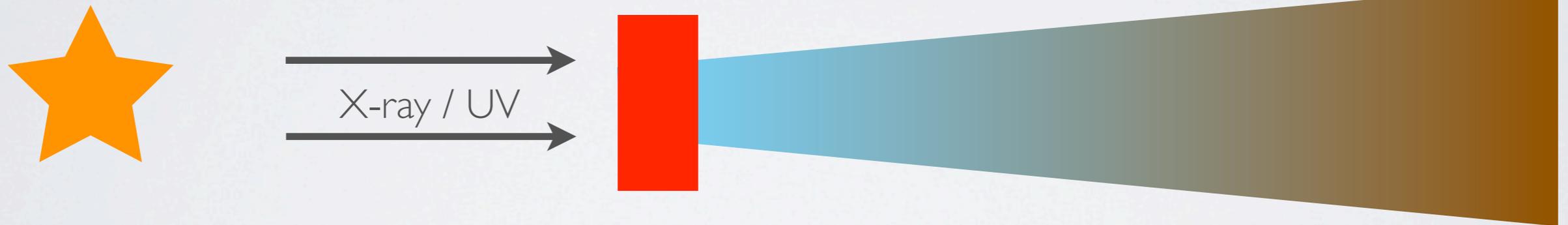# THERMAL SWEEPING: IN ACTION
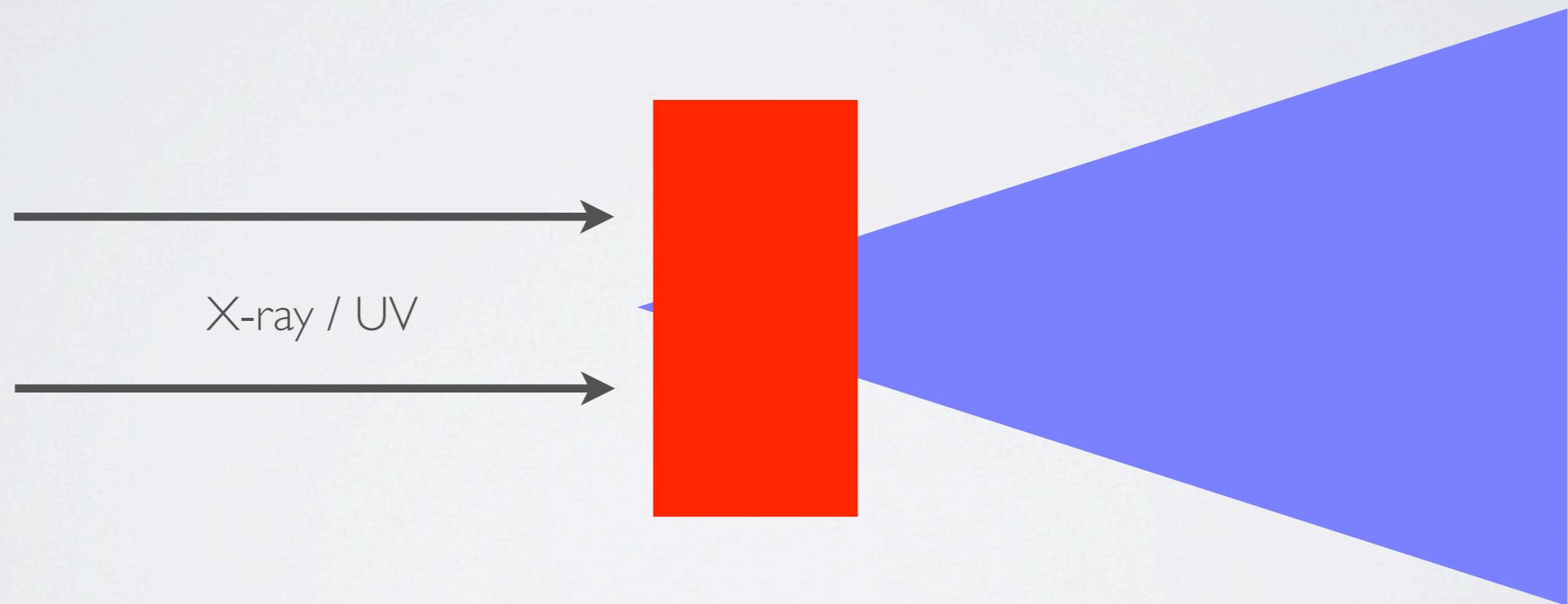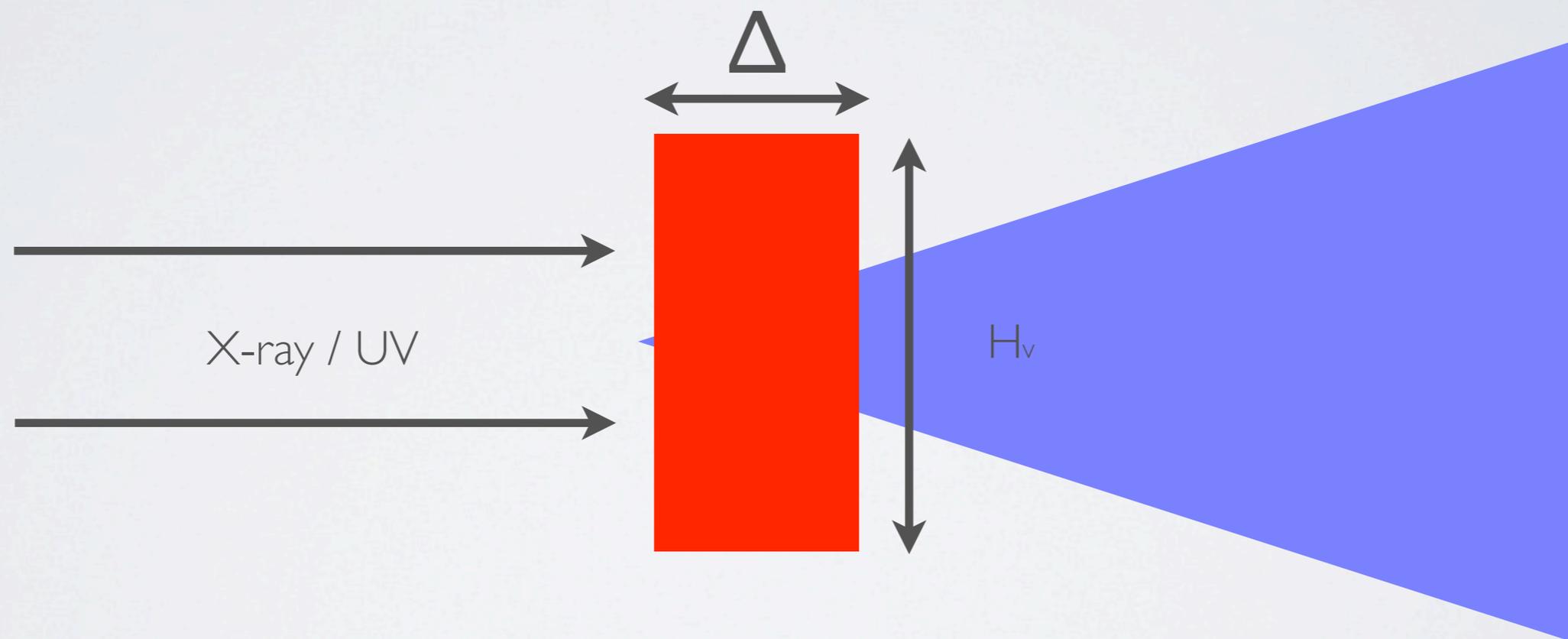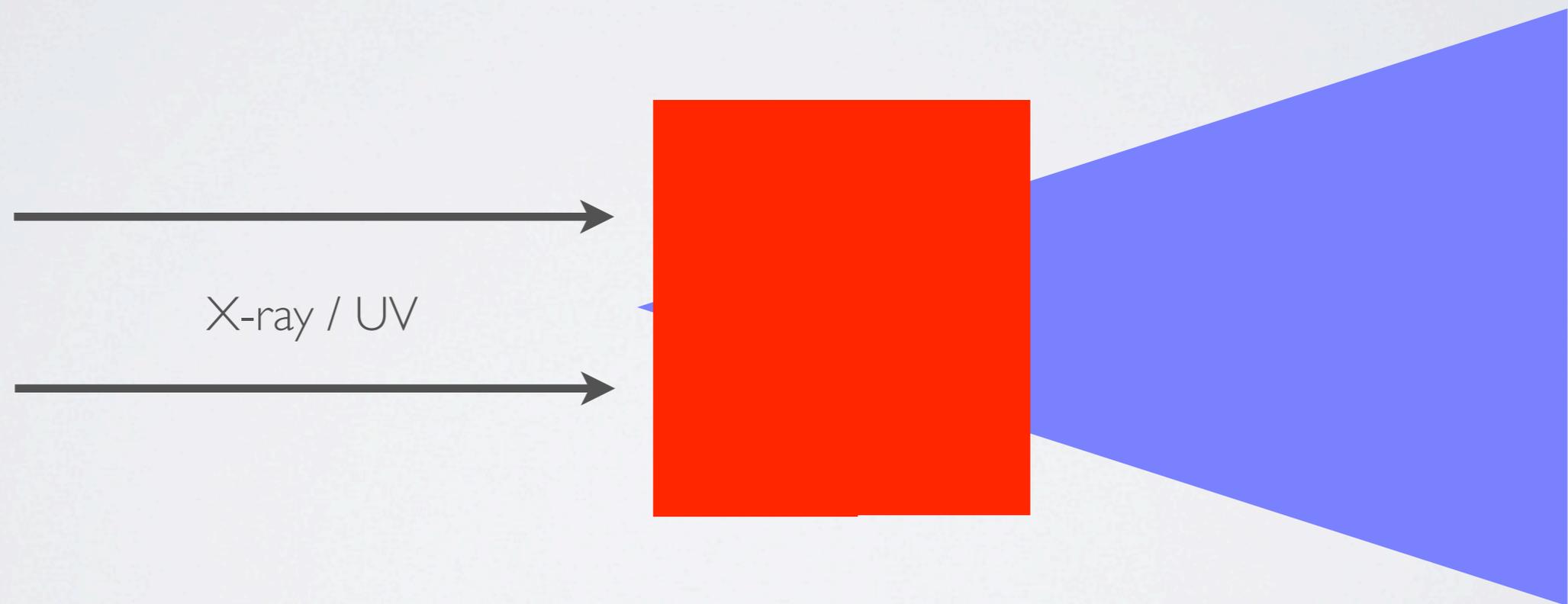

Owen et al. 2012

THERMAL SWEEPING: A NEW RAPID CLEARING PROCESS

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X-ray / UV

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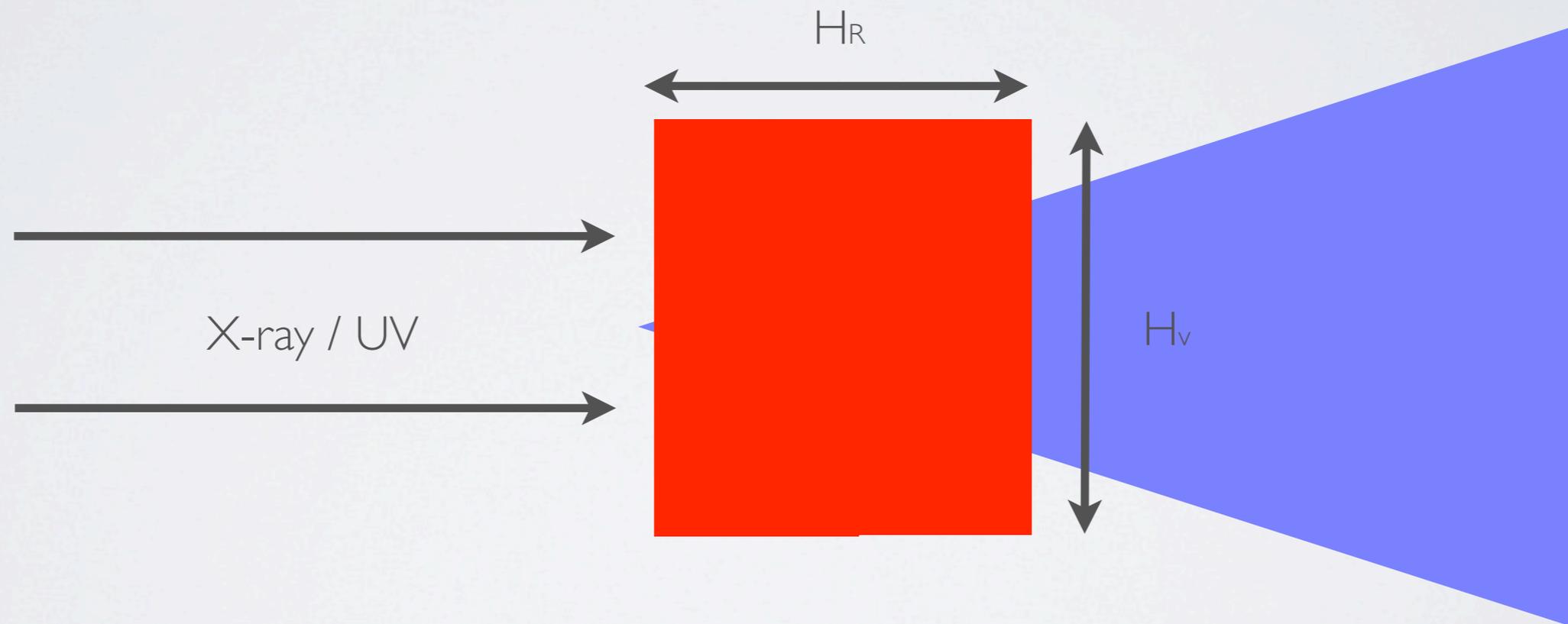# THERMAL SWEEPING: A NEW RAPID CLEARING PROCESS

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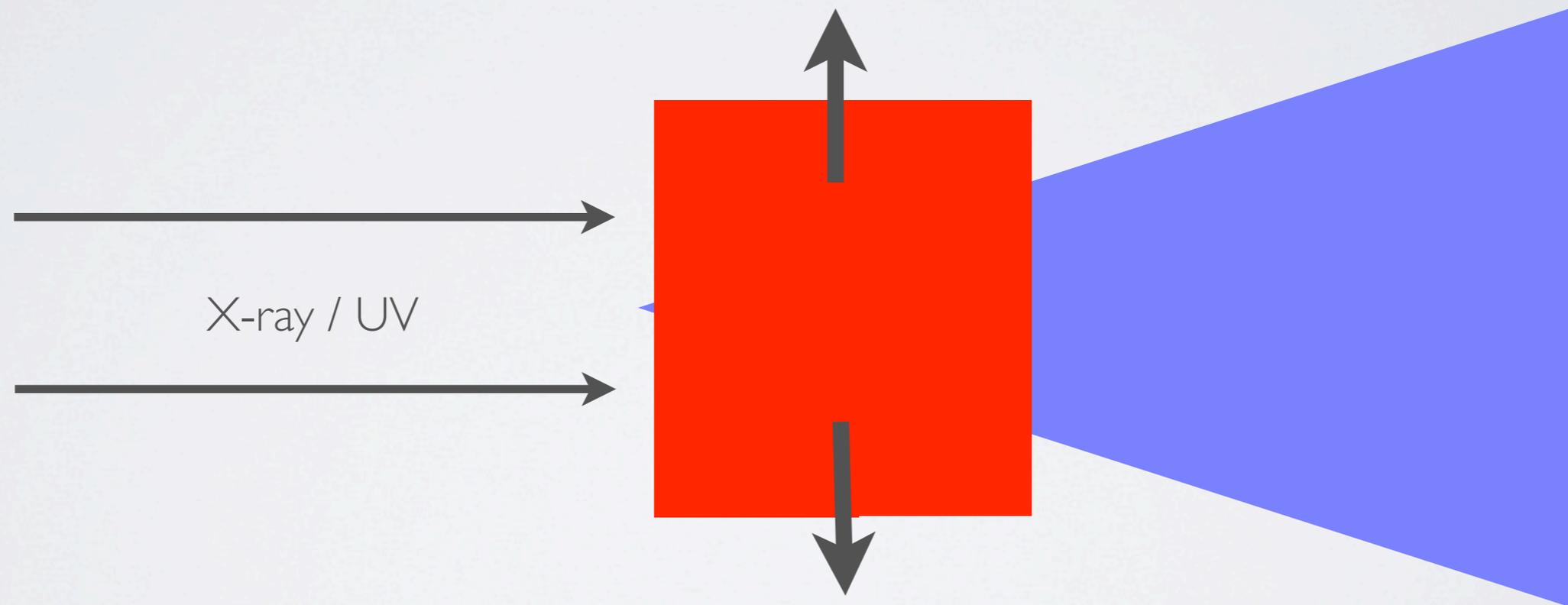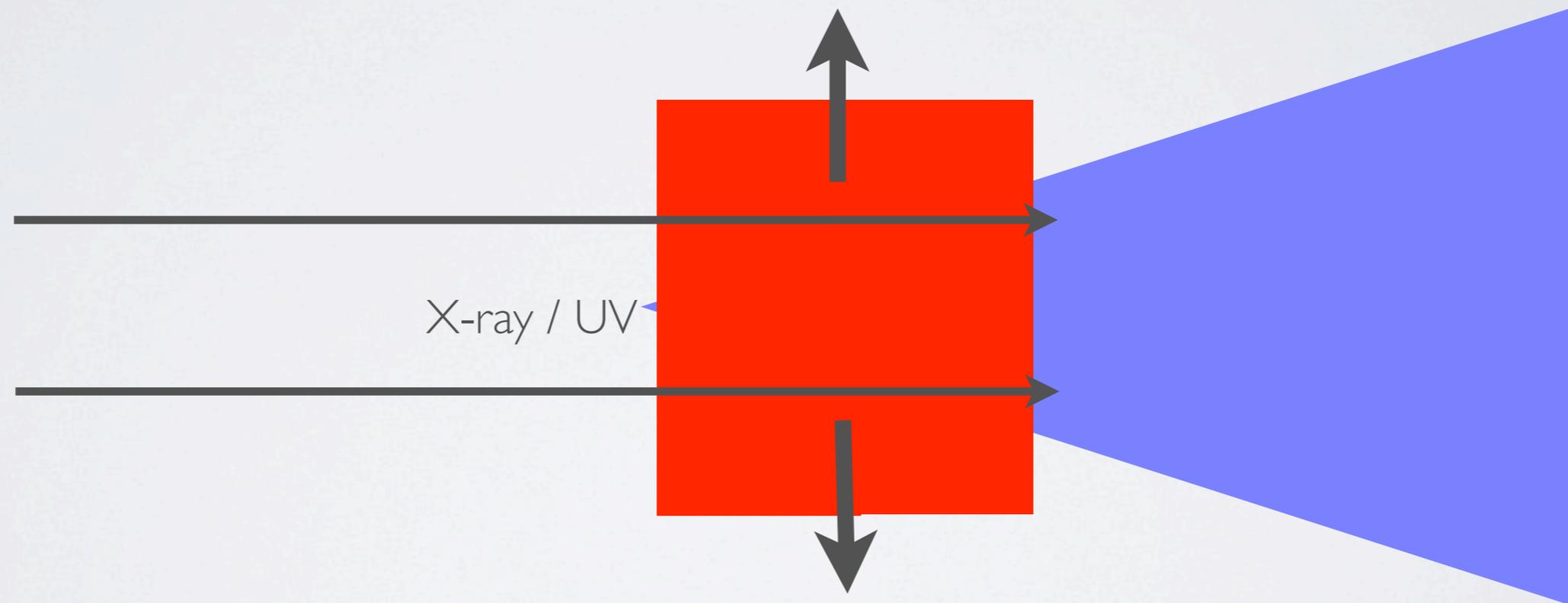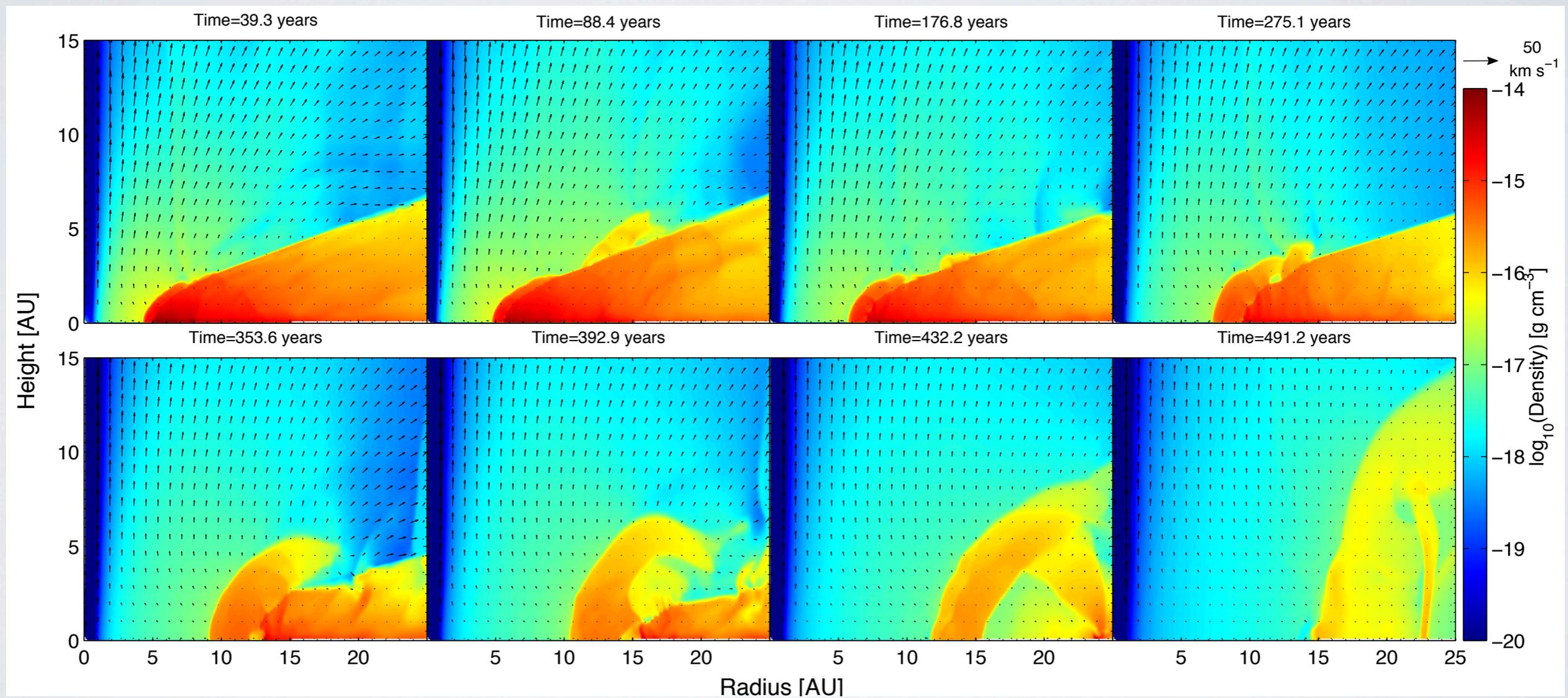# THERMAL SWEEPING: A NEW RAPID CLEARING PROCESS
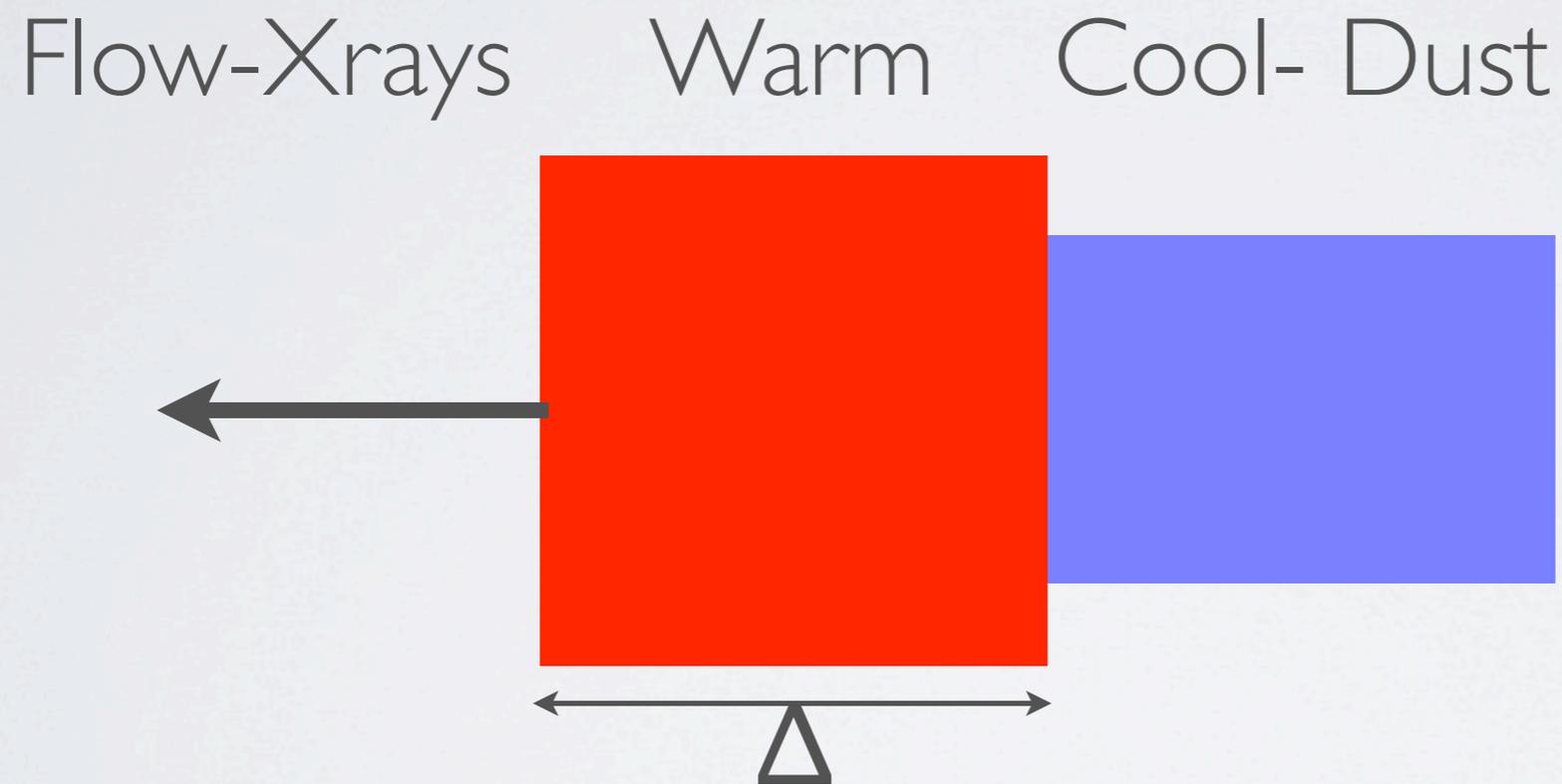

X-ray / UV

THERMAL SWEEPING: IN ACTION

THERMAL SWEEPING IN MORE DETAIL

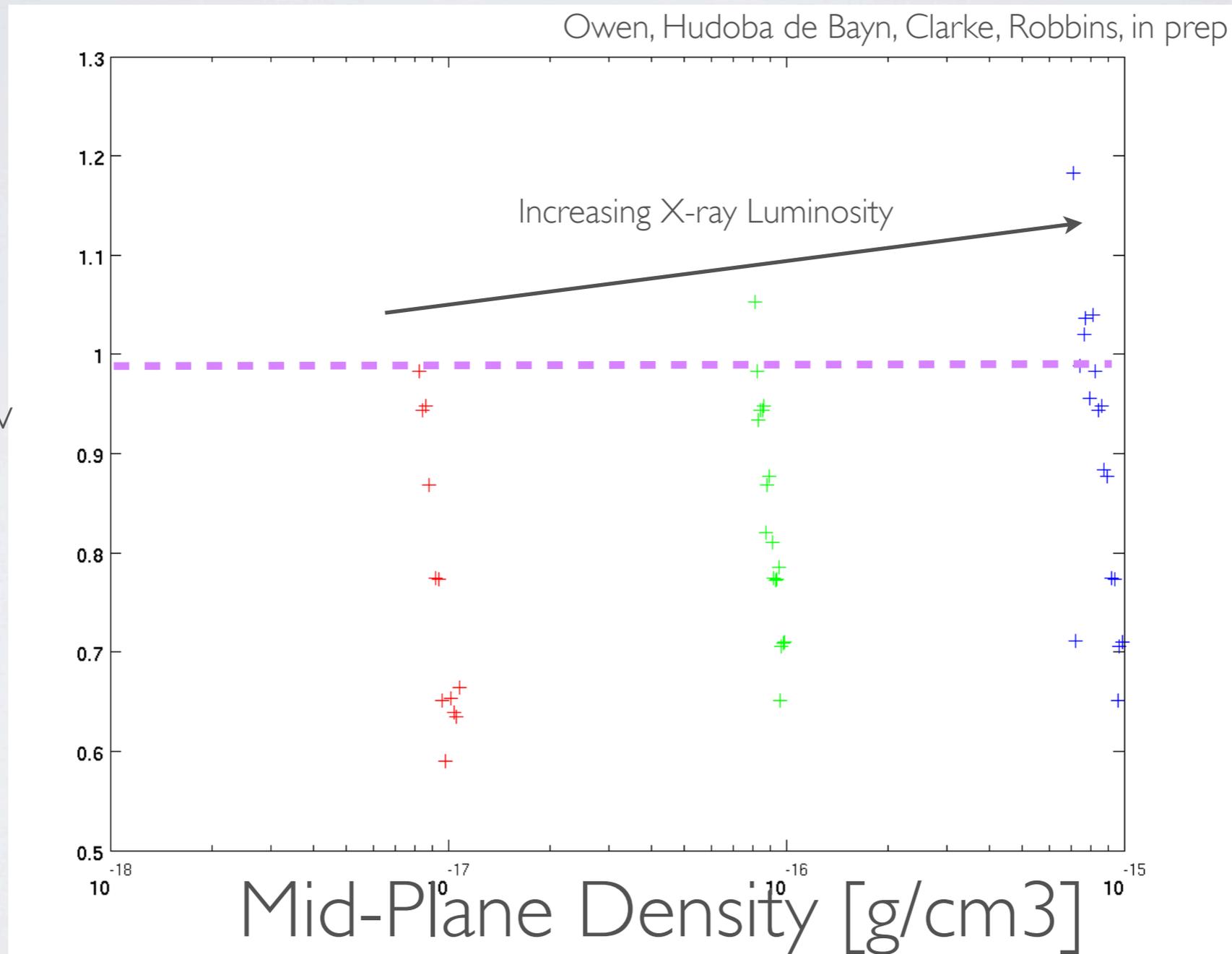Flow-Xrays   Warm   Cool- Dust

- Must maintain dynamical balance across dust heated region.

$$P_{\text{dust}}(R) \leqslant \frac{N_X k_B T_X}{H(R)}$$

CRITICAL SURFACE DENSITY FOR THERMAL SWEEPING

Owen, Hudoba de Bayn, Clarke, Robbins, in prep

Δ/H_v

Mid-Plane Density [g/cm3]

Increasing X-ray Luminosity

Rc = 5.67e14 cm

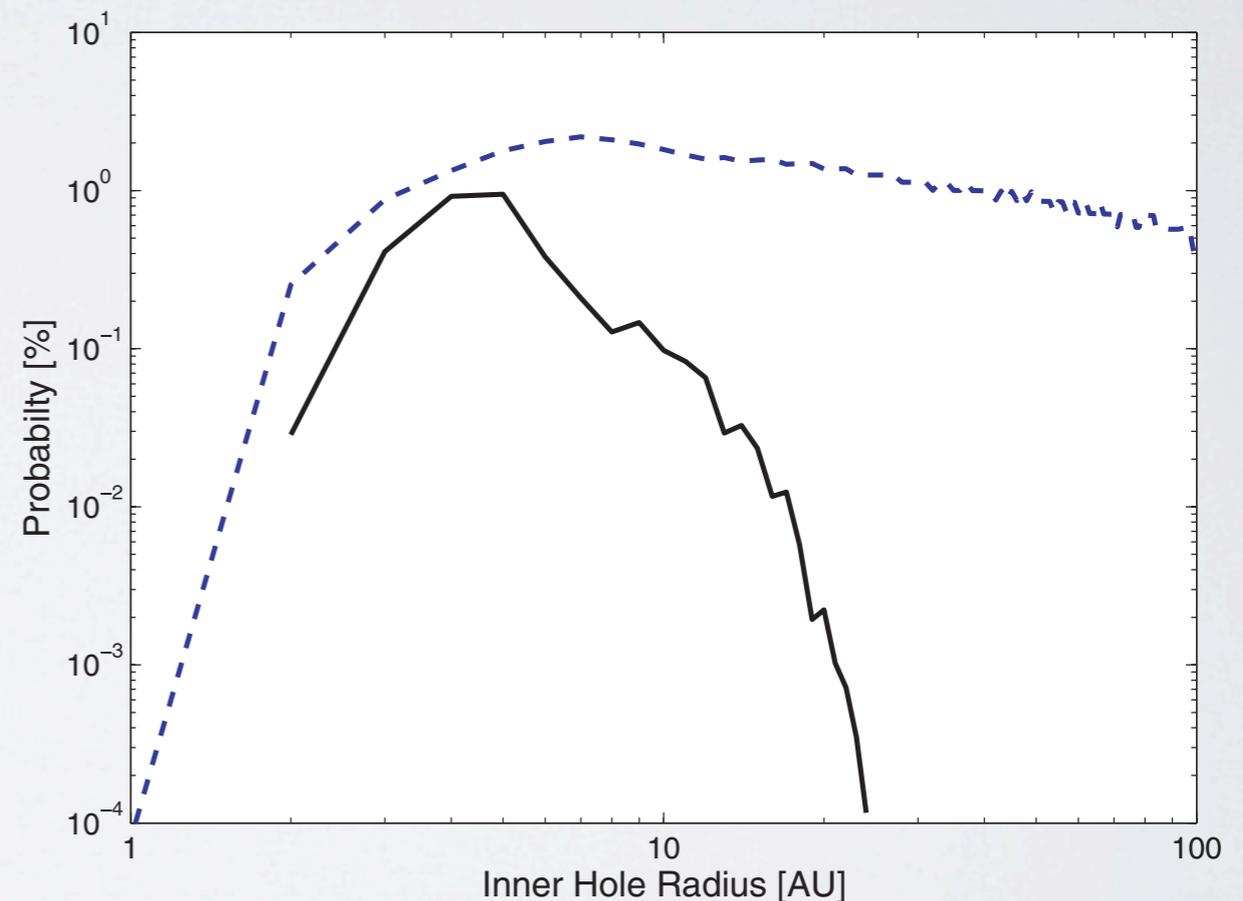# CRITICAL SURFACE DENSITY FOR THERMAL SWEEPING
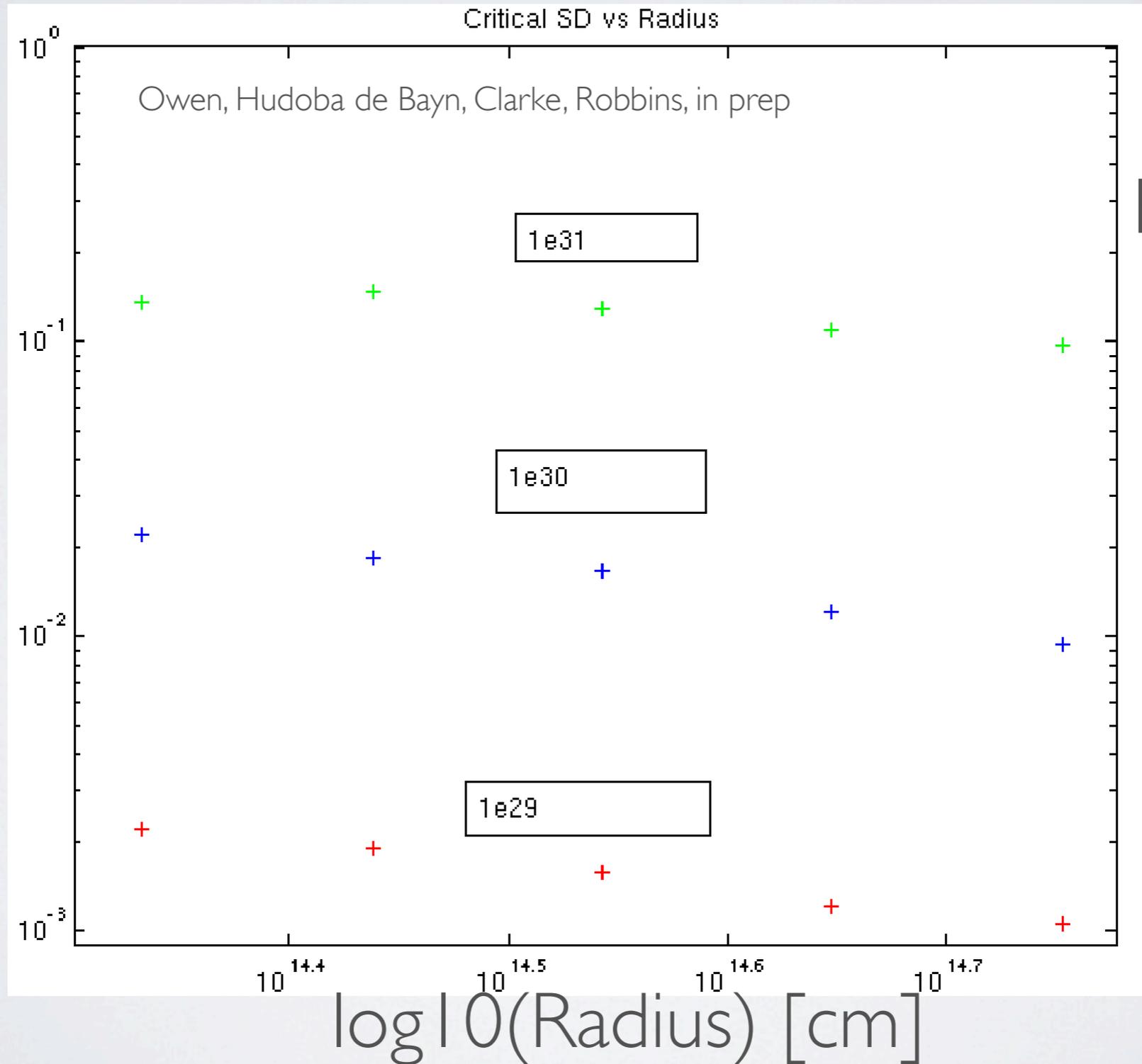
Happens at a few Jupiter masses or less

IMPLICATIONS FOR TRANSITION DISCS

- Without thermal sweeping transition discs dominated at large radii.

- Now accreting transition discs dominates, and get no non accreting transition discs at radii ~<40 AU

Owen et al. (2012)

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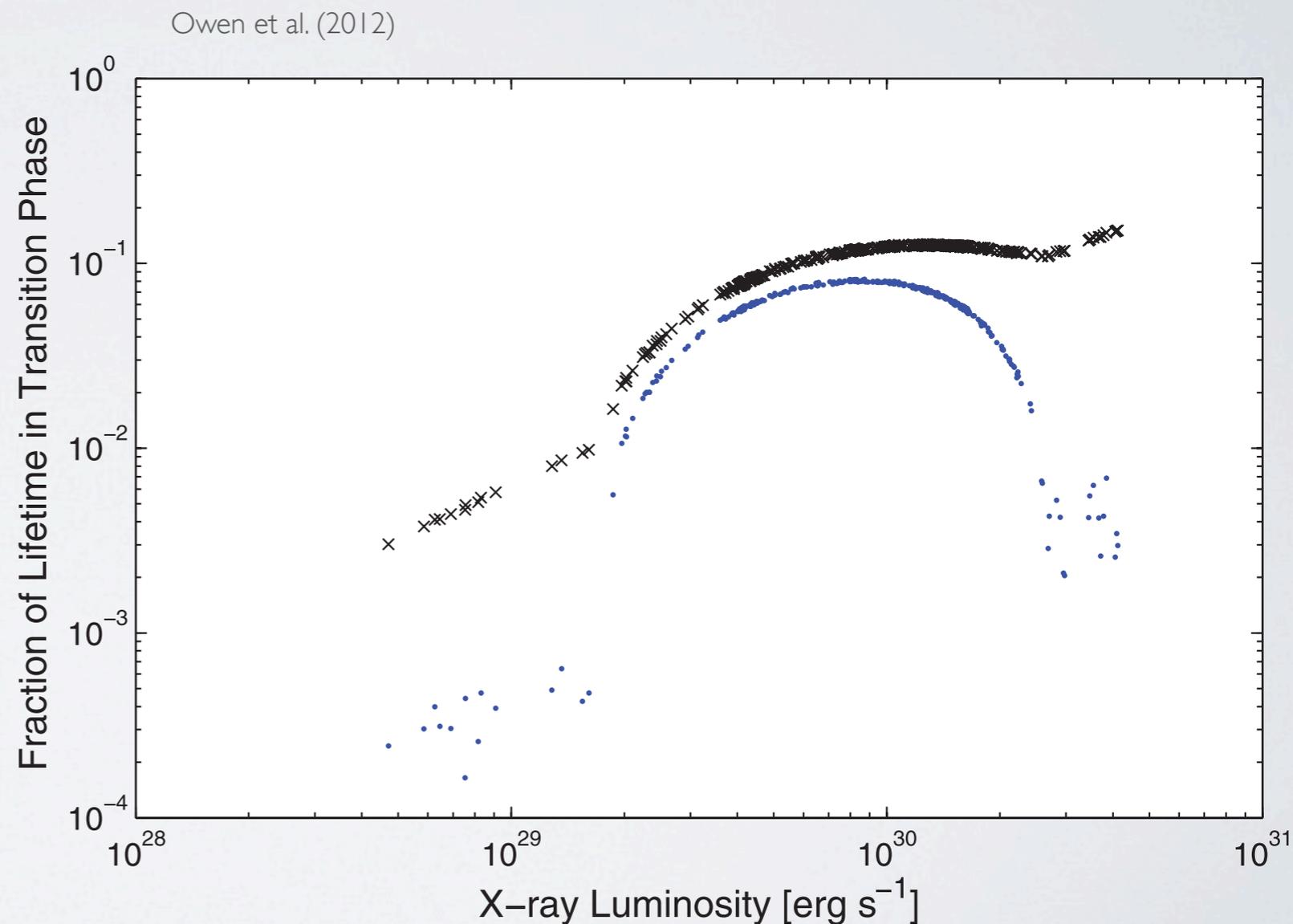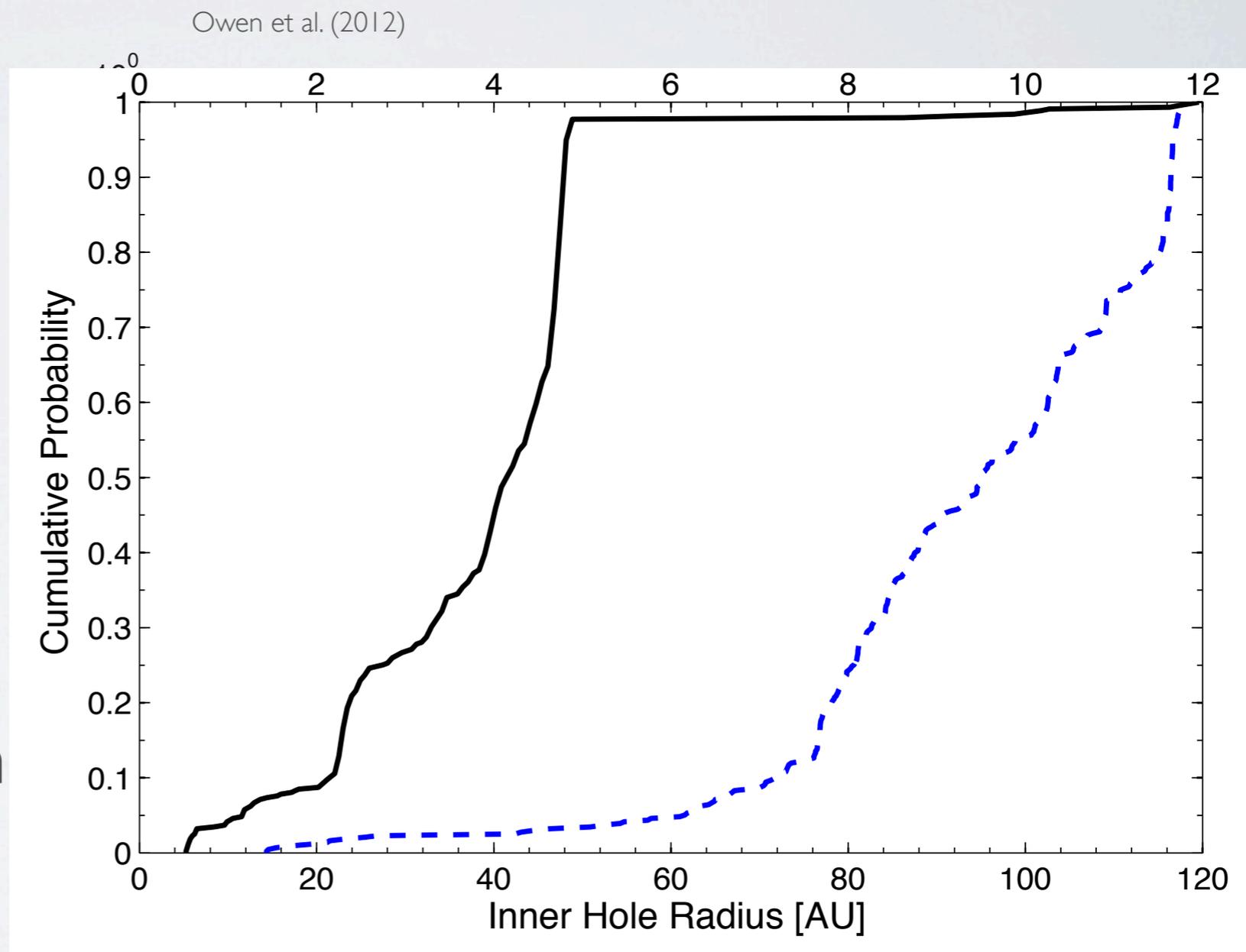
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CONCLUSIONS

- Thermal sweeping provides a mechanism to rapidly clear the outer disc.

- High energy radiation causes the inner edge of the disc to become dynamically unstable, allowing the disc to be entirely penetrated by the high energy radiation.

- Critical surface density a weak function of inner hole radius.

- Most transition discs created by photoevaportion will be accreting rather than non-accreting.