

Olivine crystals in the disk of β Pictoris



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more!!

Debris disk

optically thin

main-sequence star ($\sim > 10 \text{ Myr}$)

almost gas free

dust-producing collisions
of planetesimals

dust short lived



β Pictoris introduction

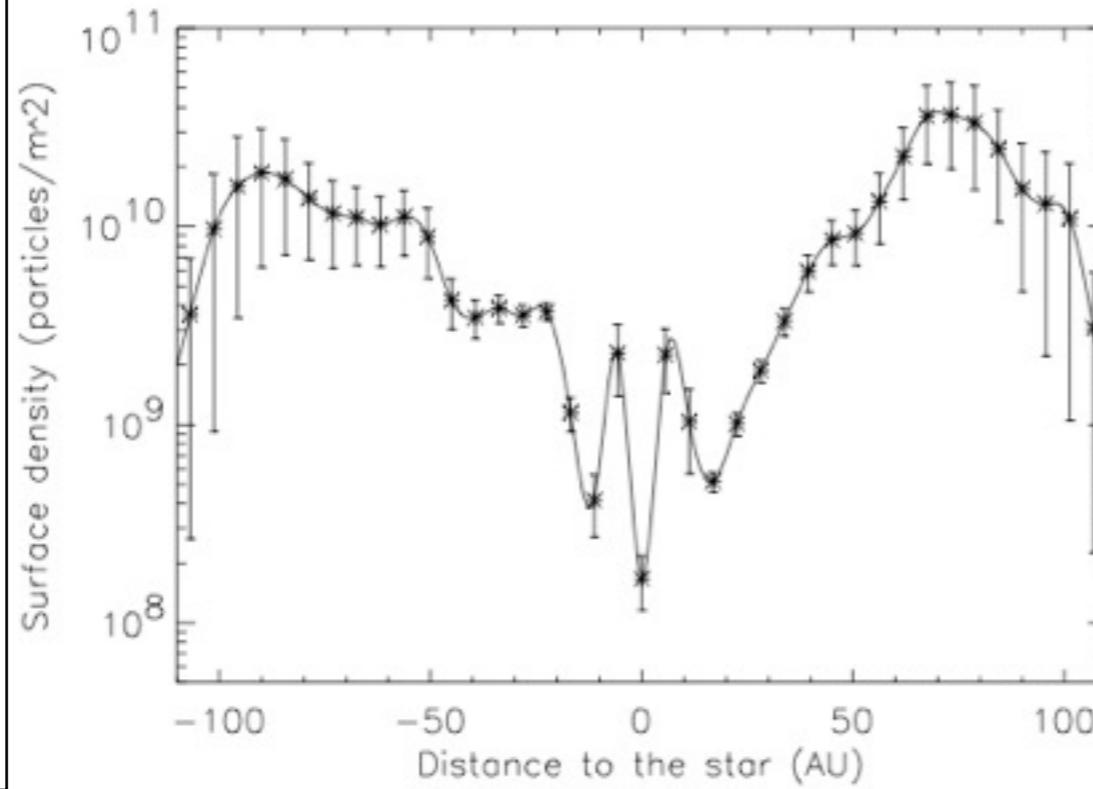


A6V
8-20 Milj
8000K
8.7Ls
1.75 Ms
1.8Rs

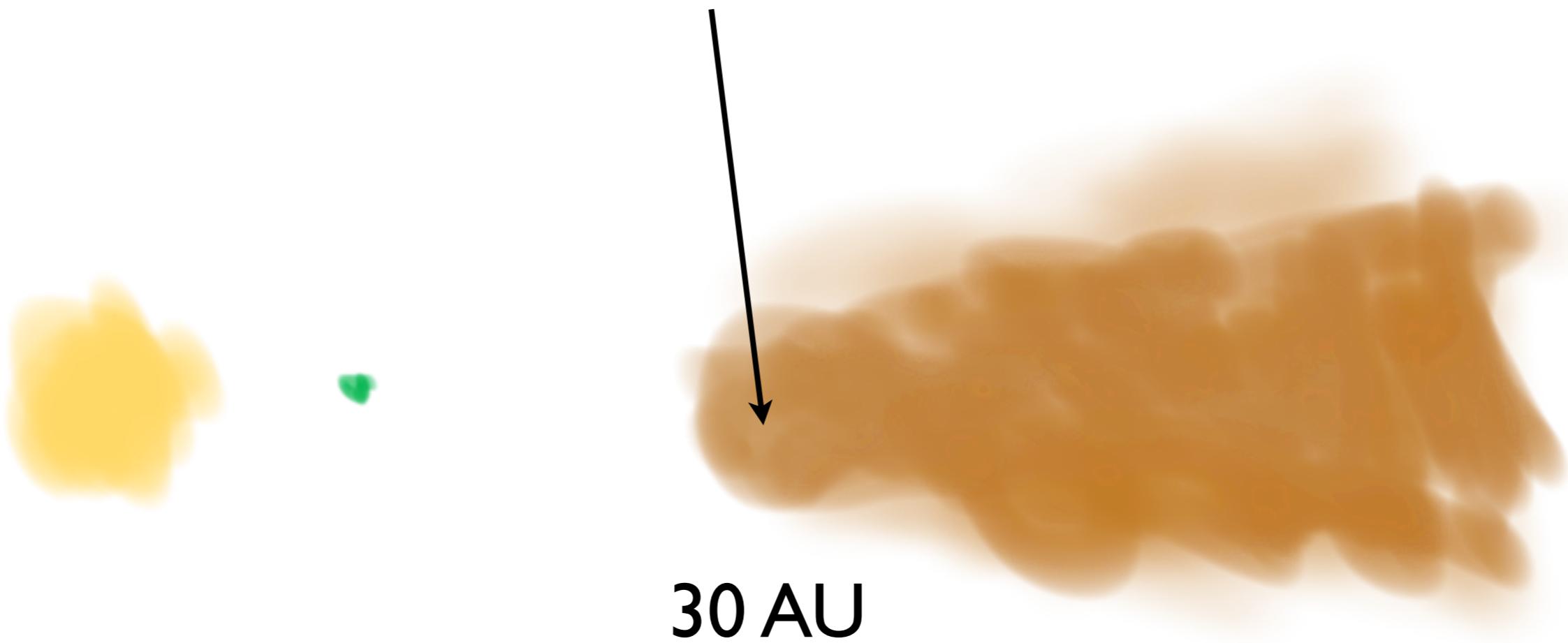
Pictoris introduction



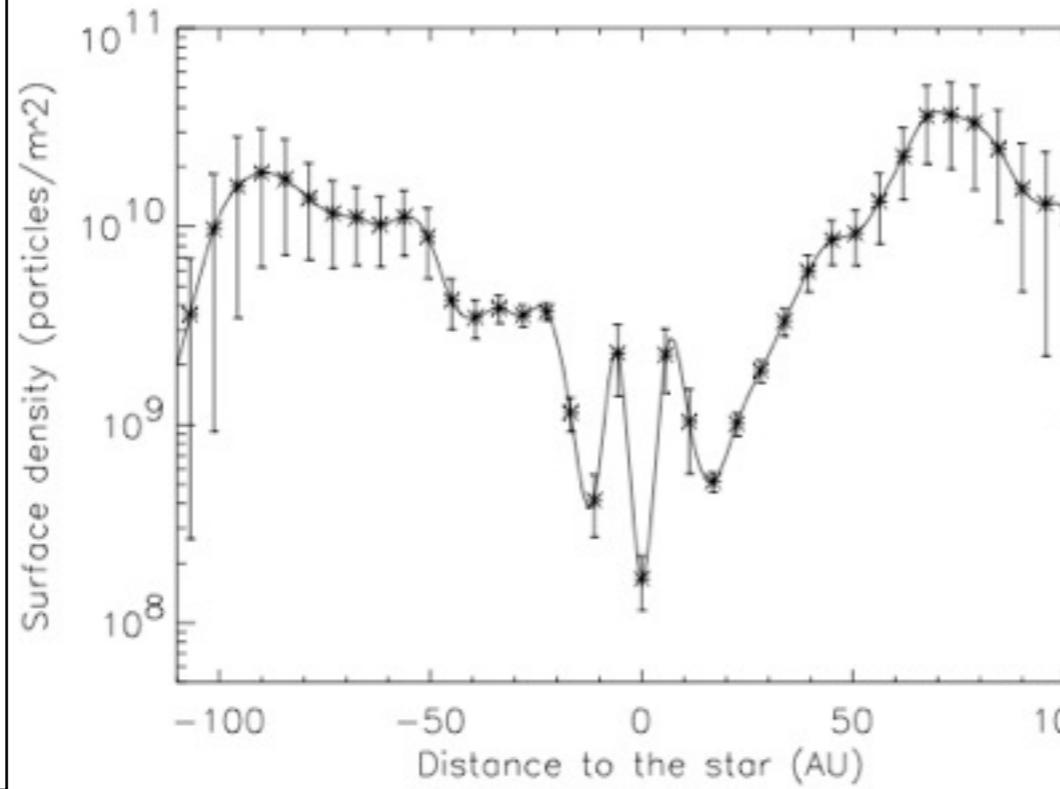
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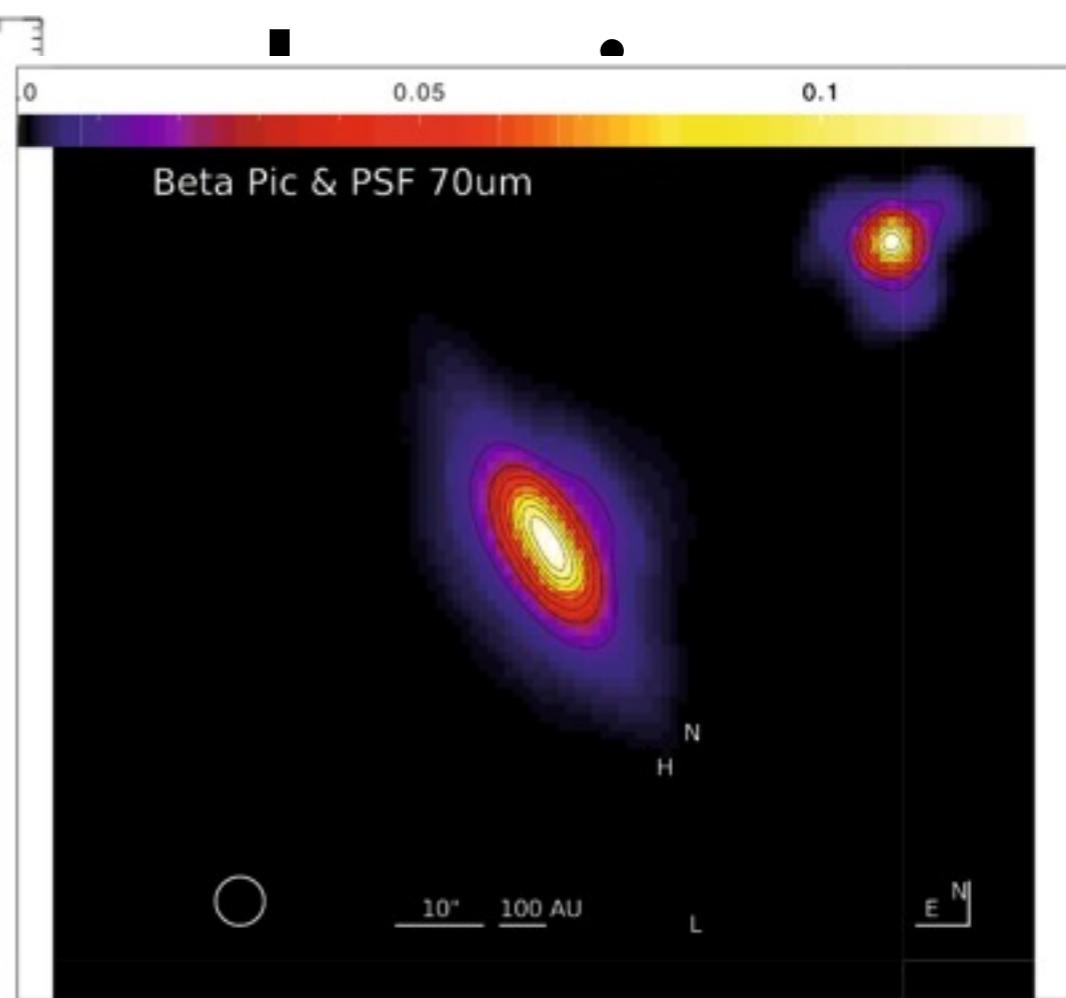
roduction



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Pantin et al. 199



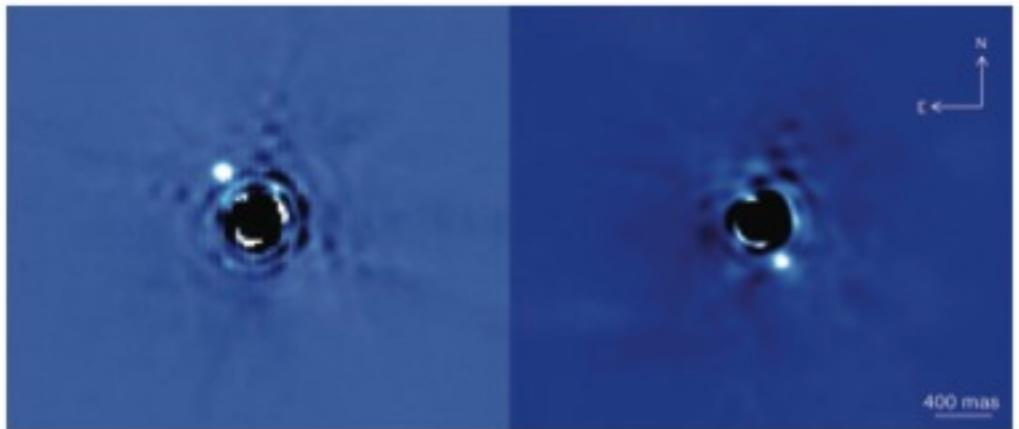
Vandenbussche et al, 2010



30 AU

~ 200 AU

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8-20 Milj
8000K
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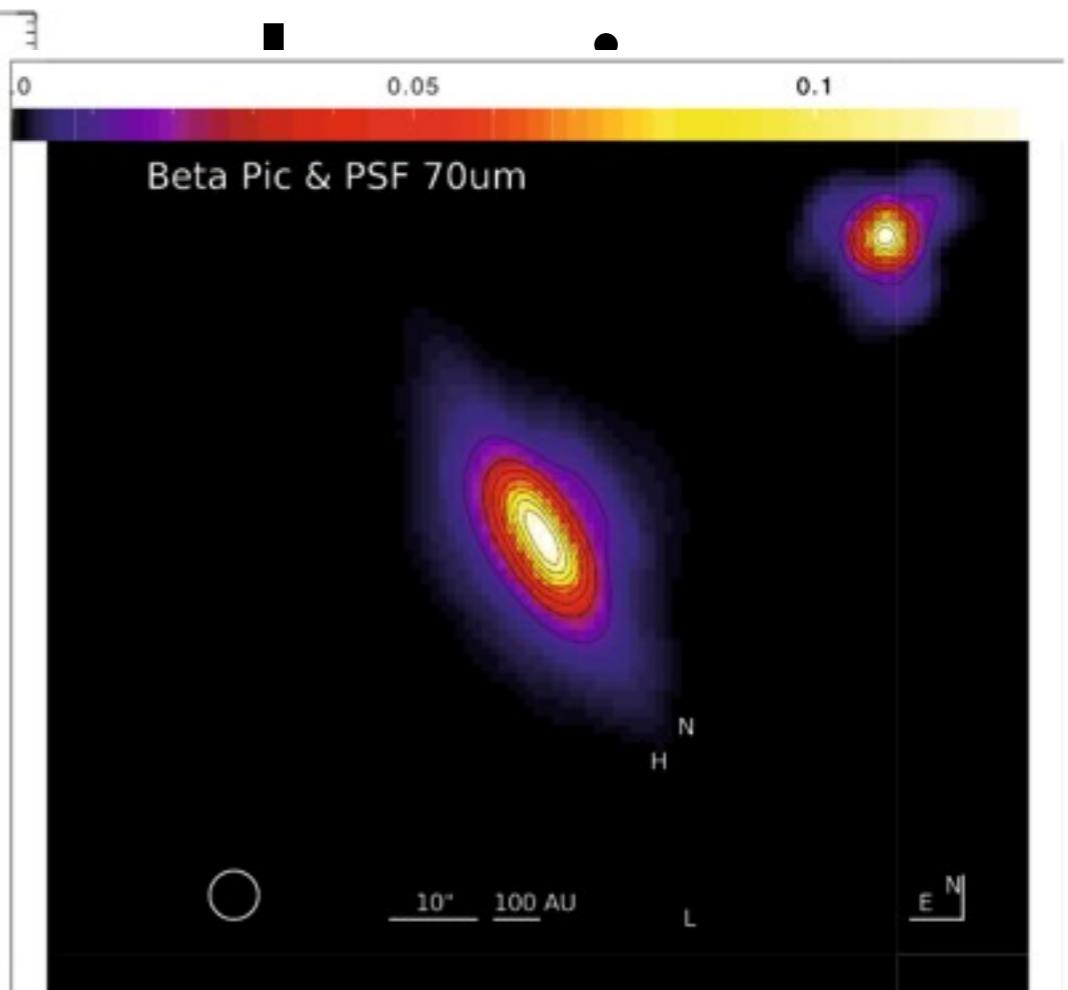
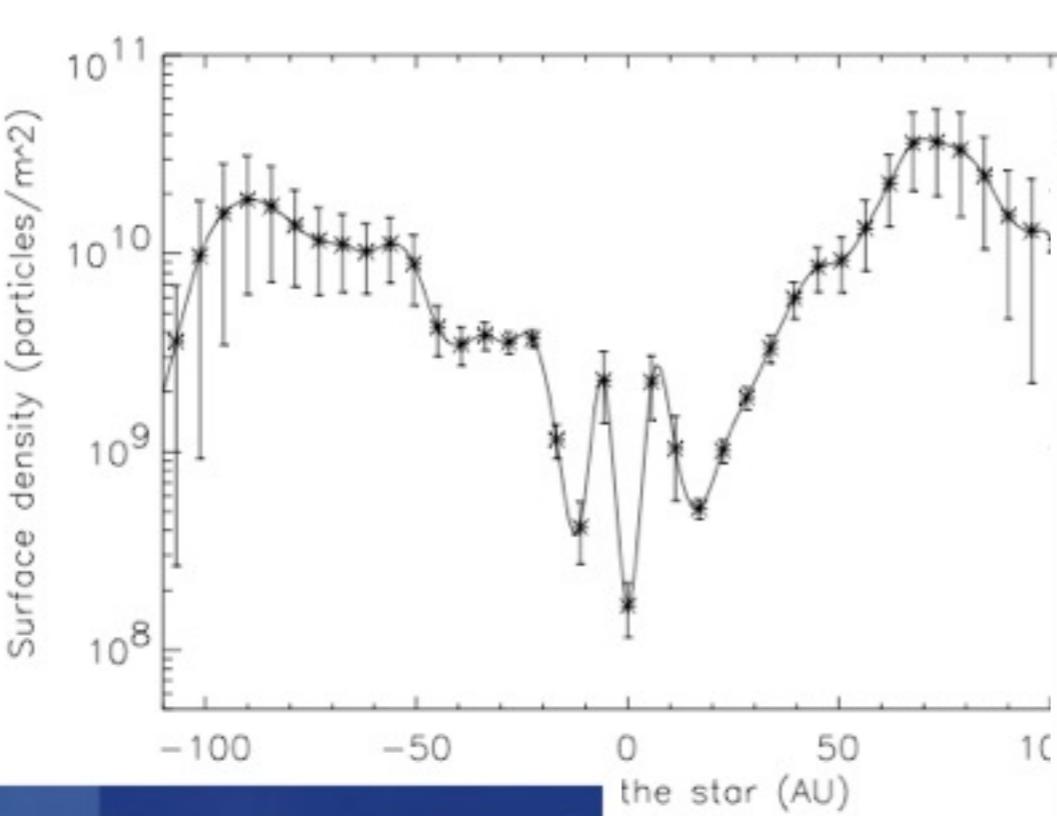


Lagrange et al. 2010

~ 10 AU

30 AU

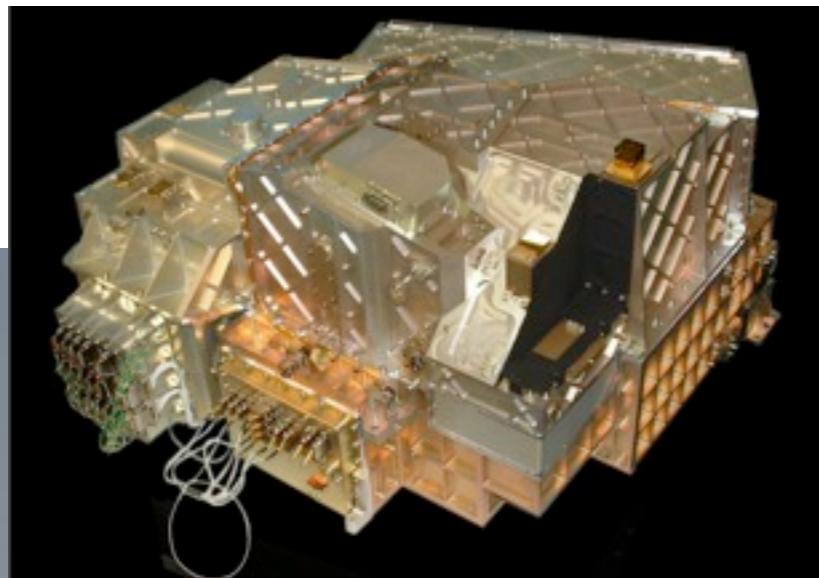
~ 200 AU



Vandenbussche et al, 2010

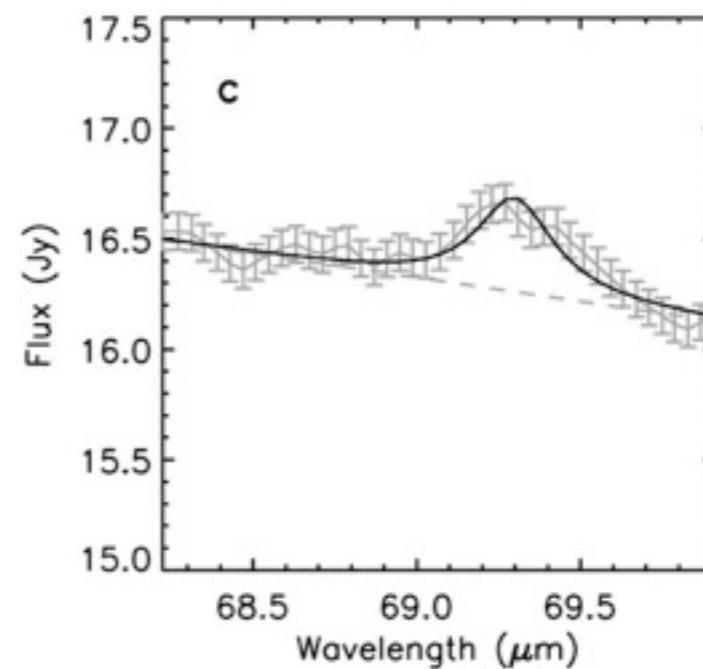
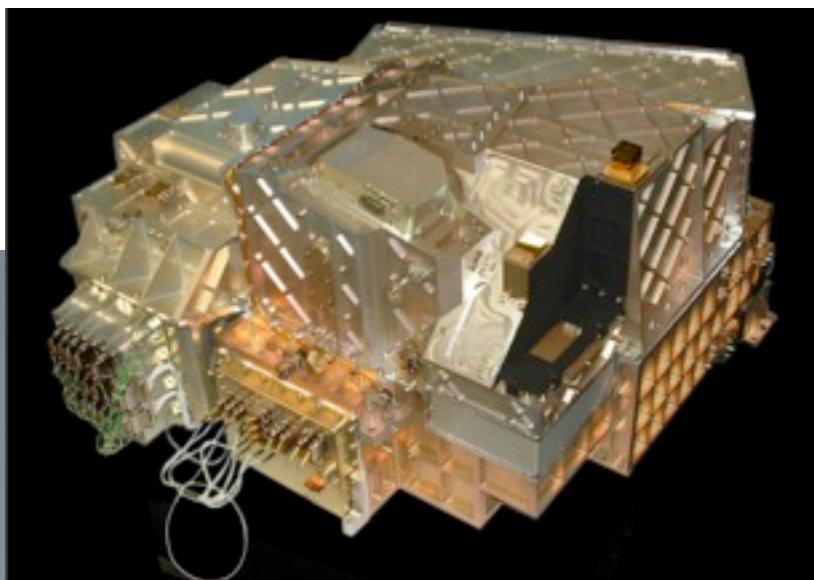
What we measured

Poglitsch et al 2010, Pilbratt et al 2010



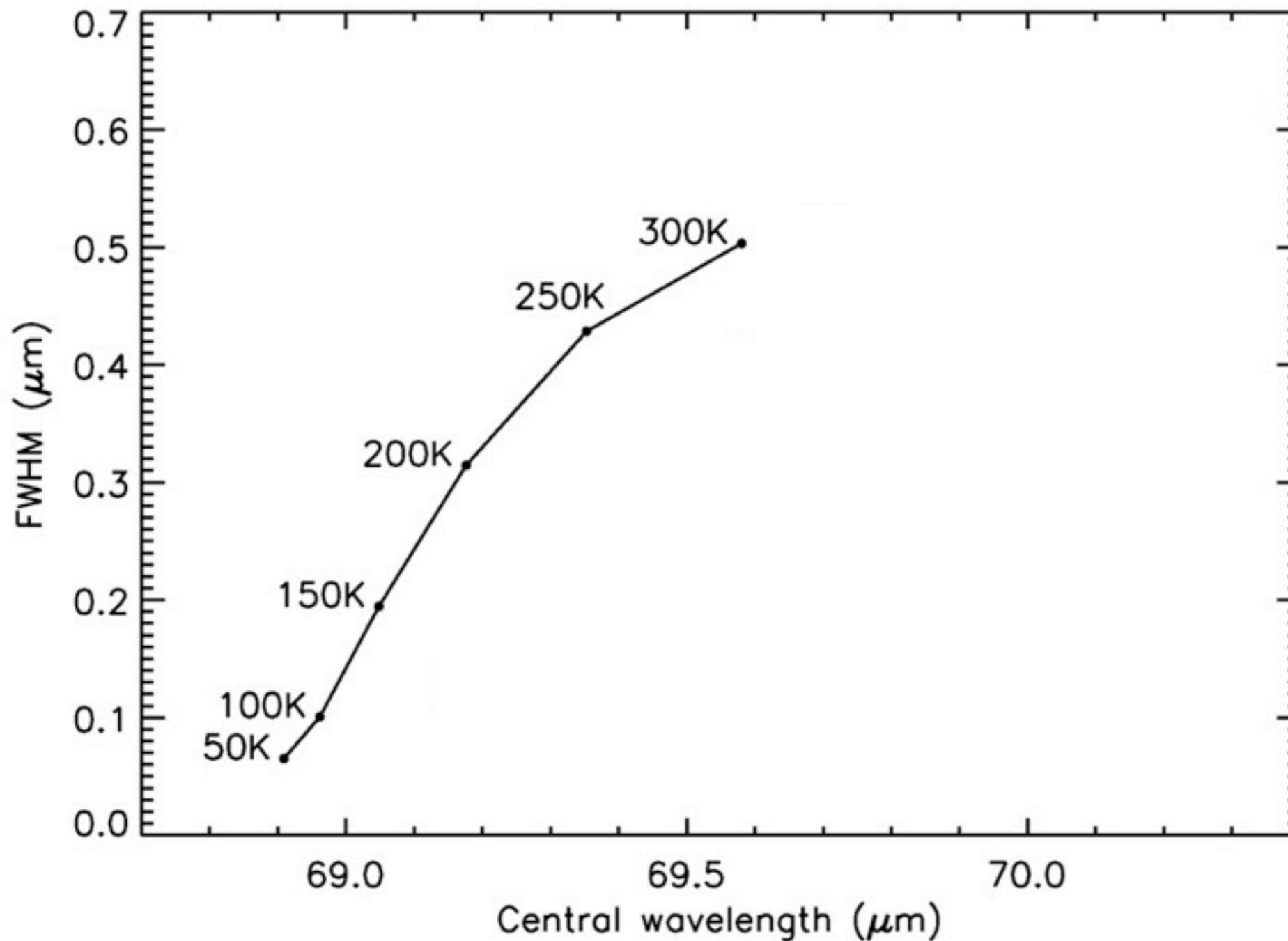
What we measured

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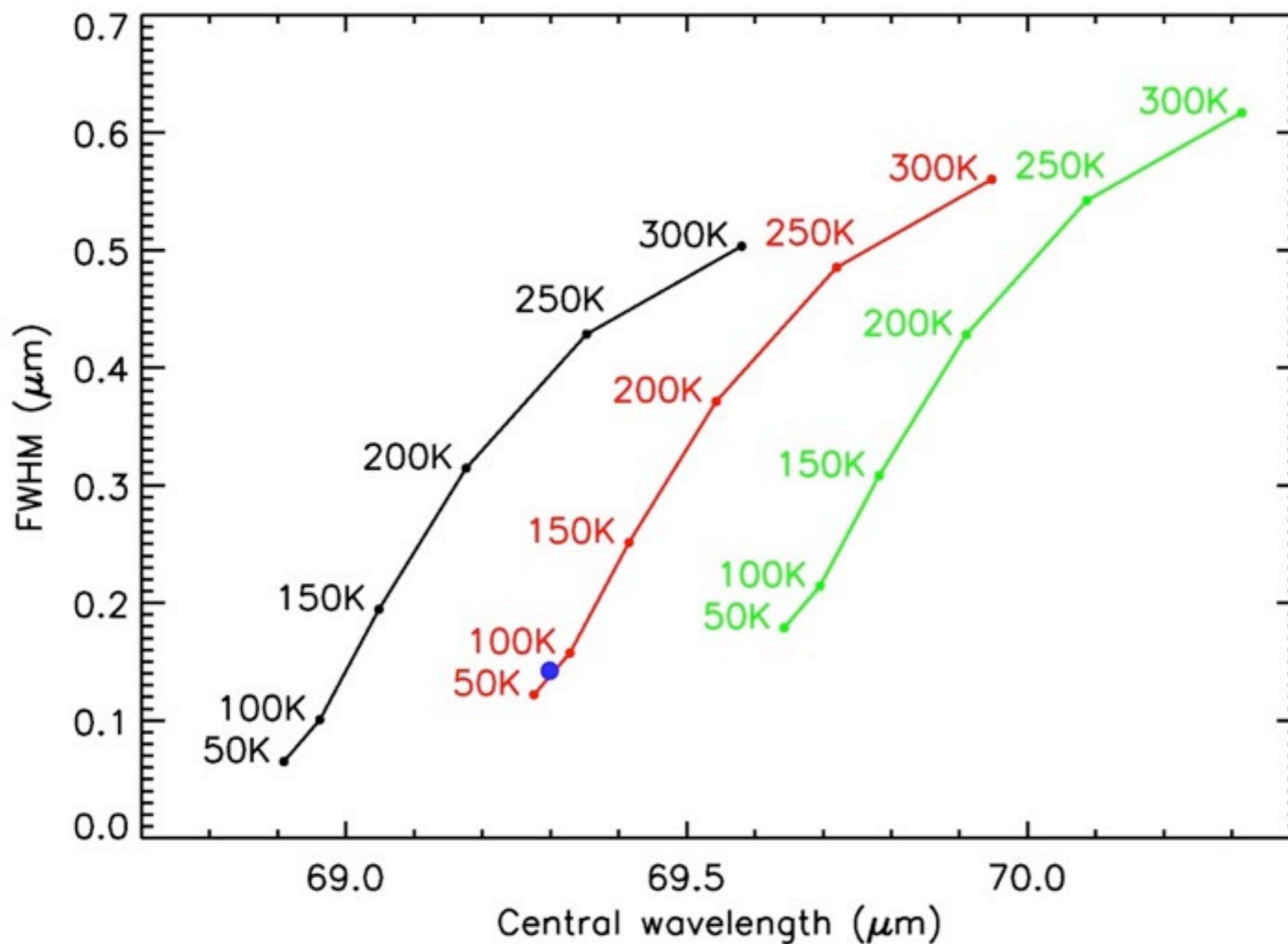
de Vries et al 2012 (submitted)

Crystalline olivine



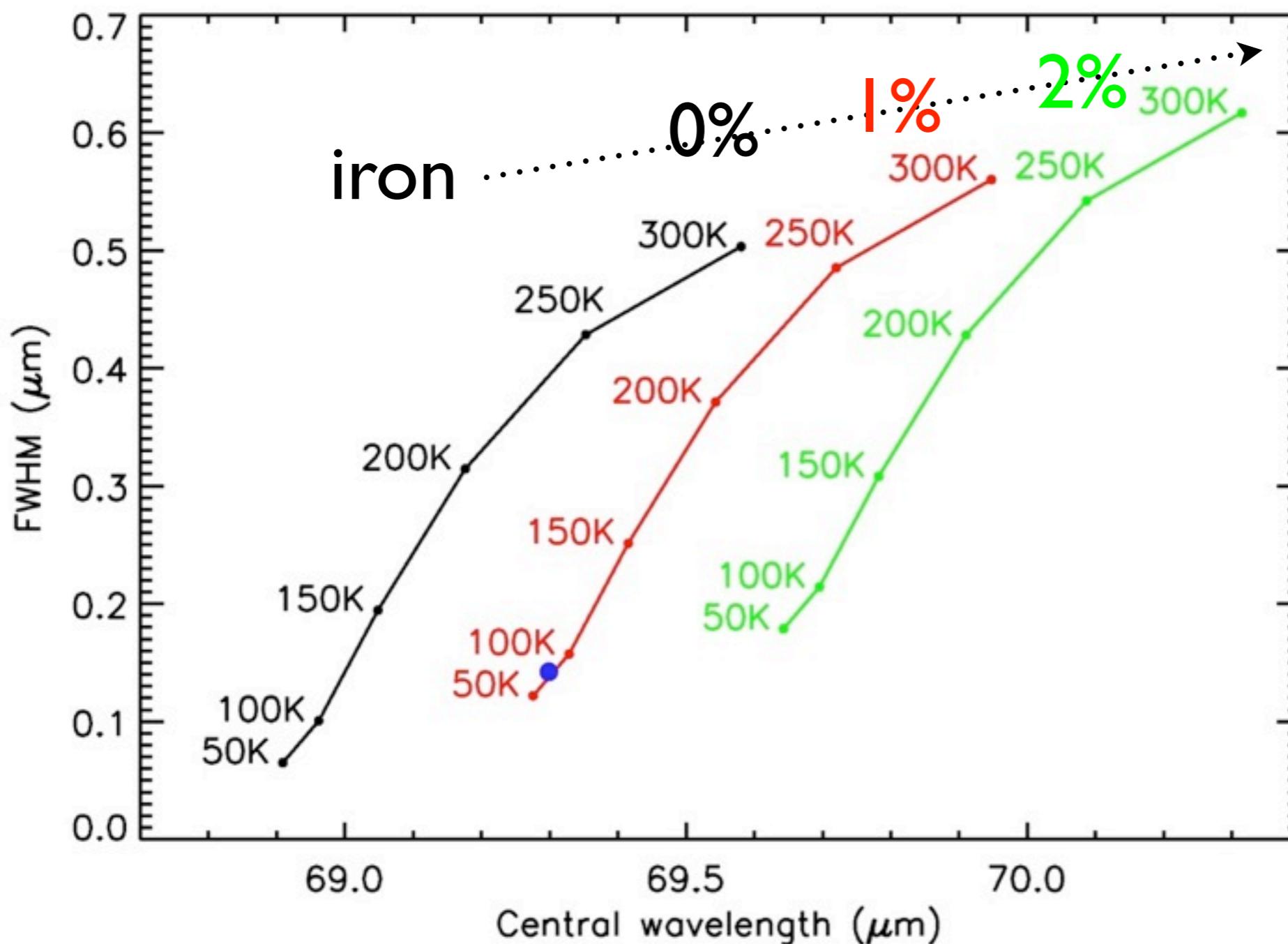
de Vries et al 2012 (submitted), Koike et al 2003, Suto et al 2006

Crystalline olivine



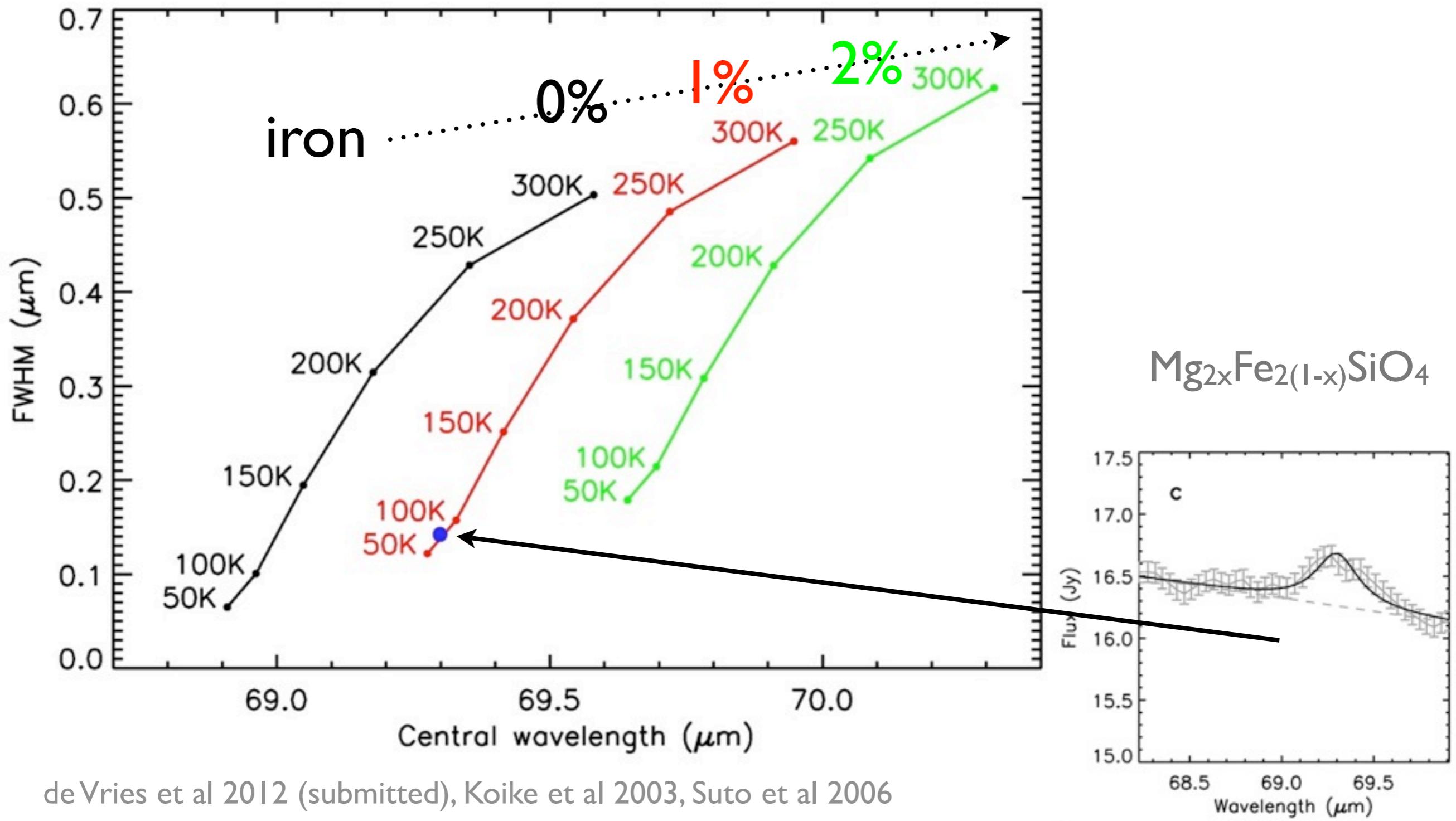
de Vries et al 2012 (submitted), Koike et al 2003, Suto et al 2006

Crystalline olivine

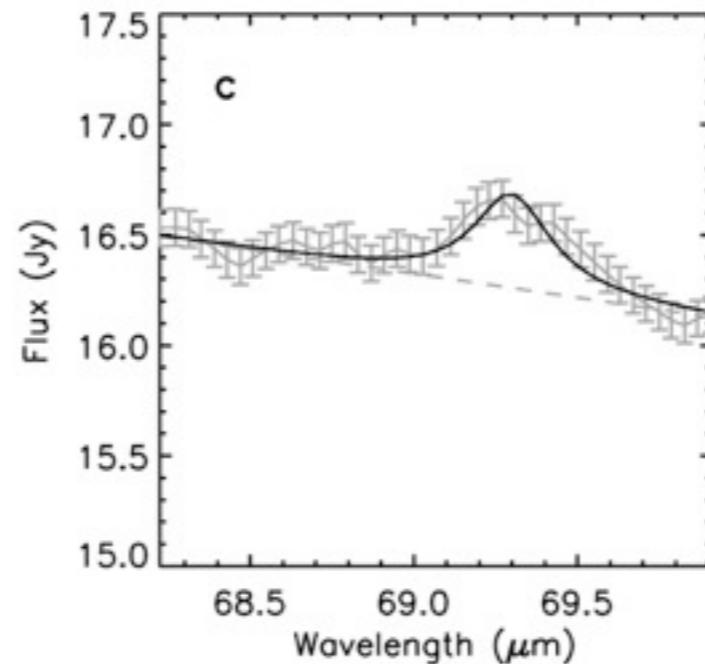
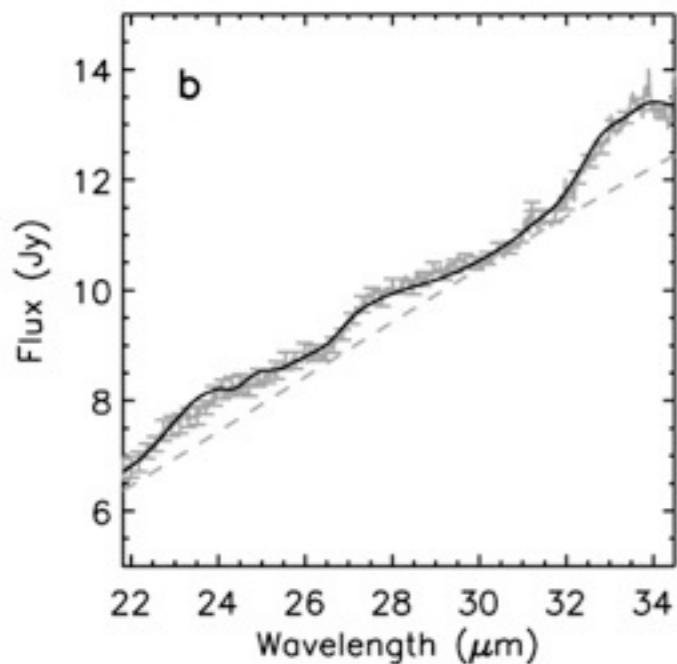


de Vries et al 2012 (submitted), Koike et al 2003, Suto et al 2006

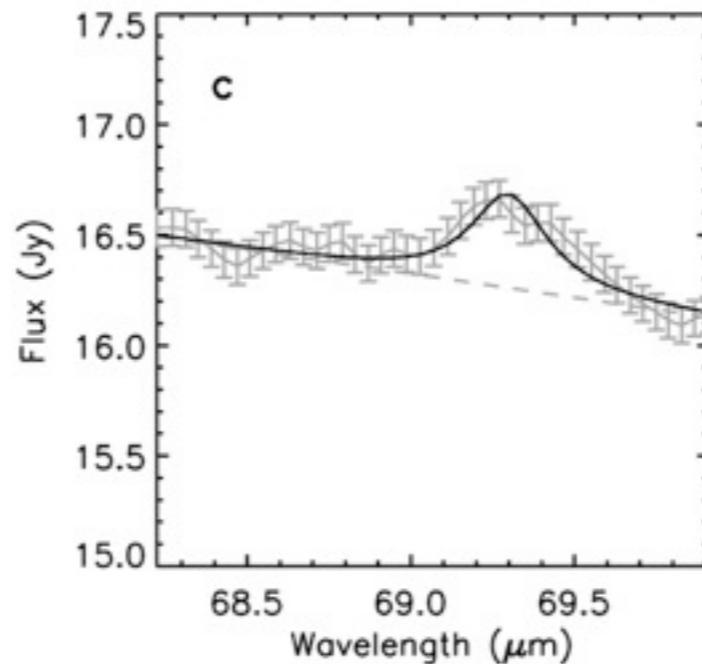
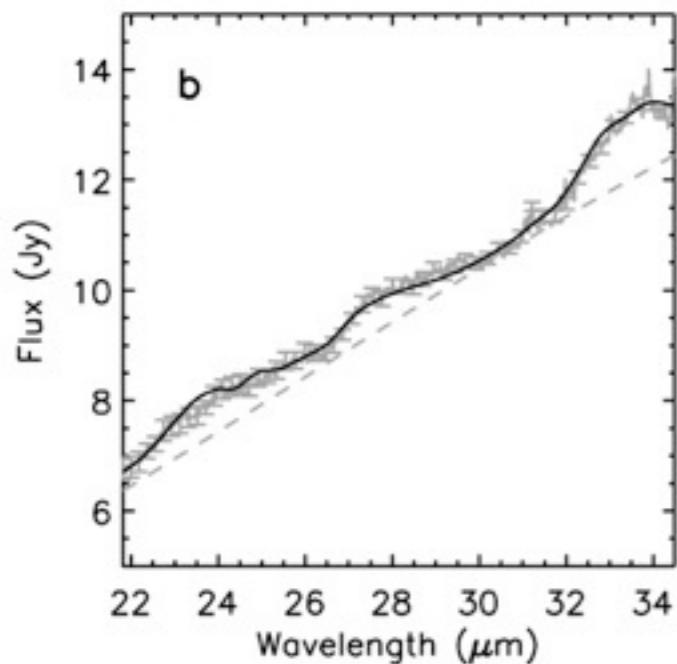
Crystalline olivine



What this means

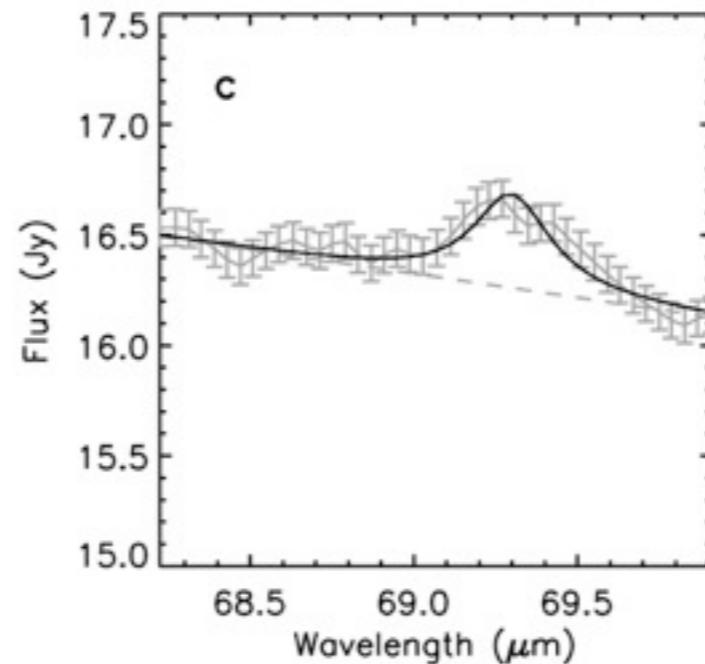
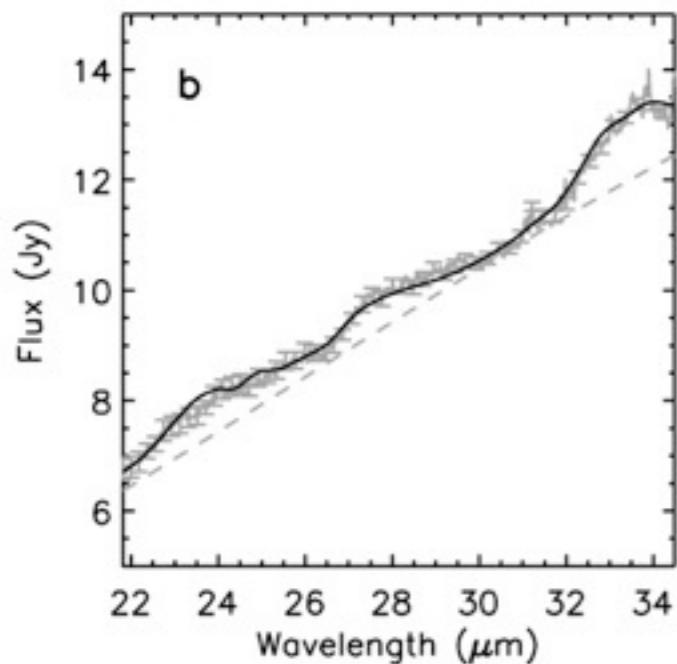


What this means

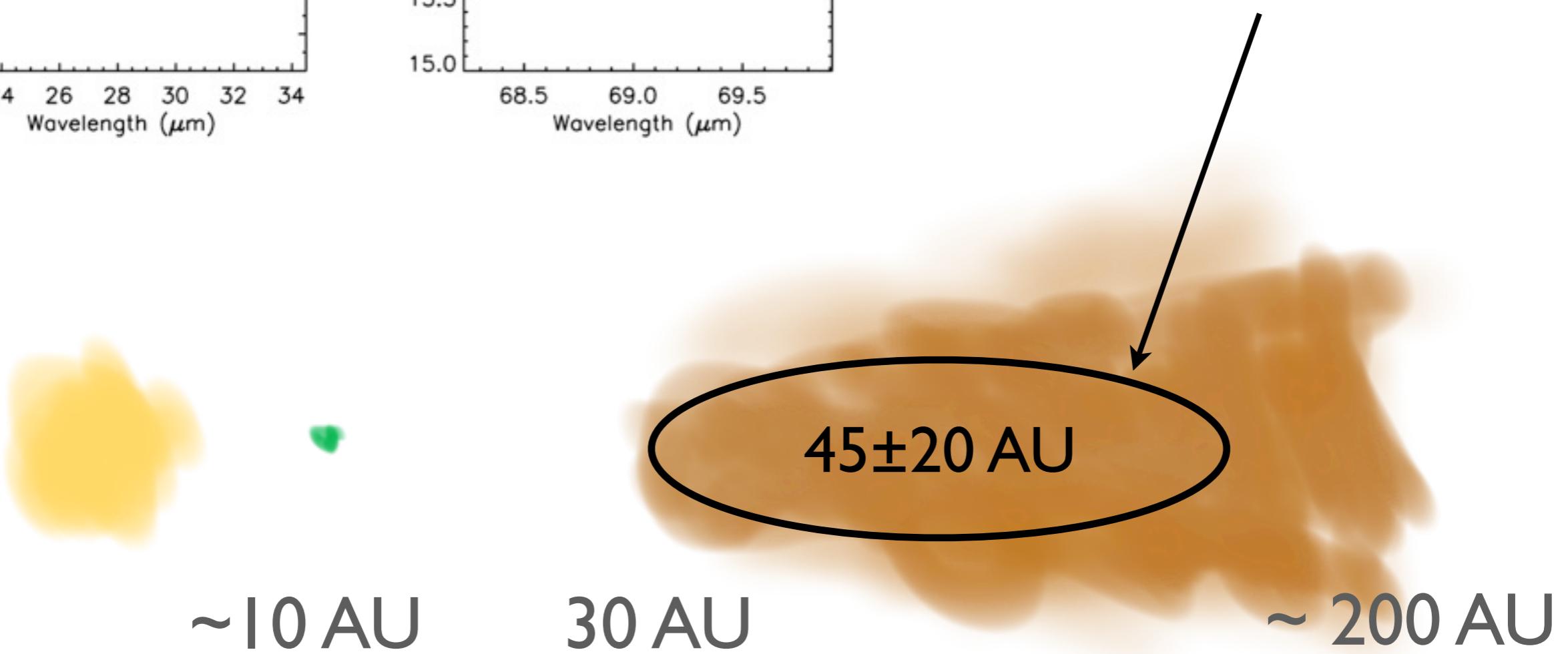


$1.0 \pm 0.1\% \text{ Fe}$
→
 $85 \pm 6.0 \text{ K}$

What this means



$1.0 \pm 0.1\% \text{ Fe}$
 $85 \pm 6.0 \text{ K}$



Solar System

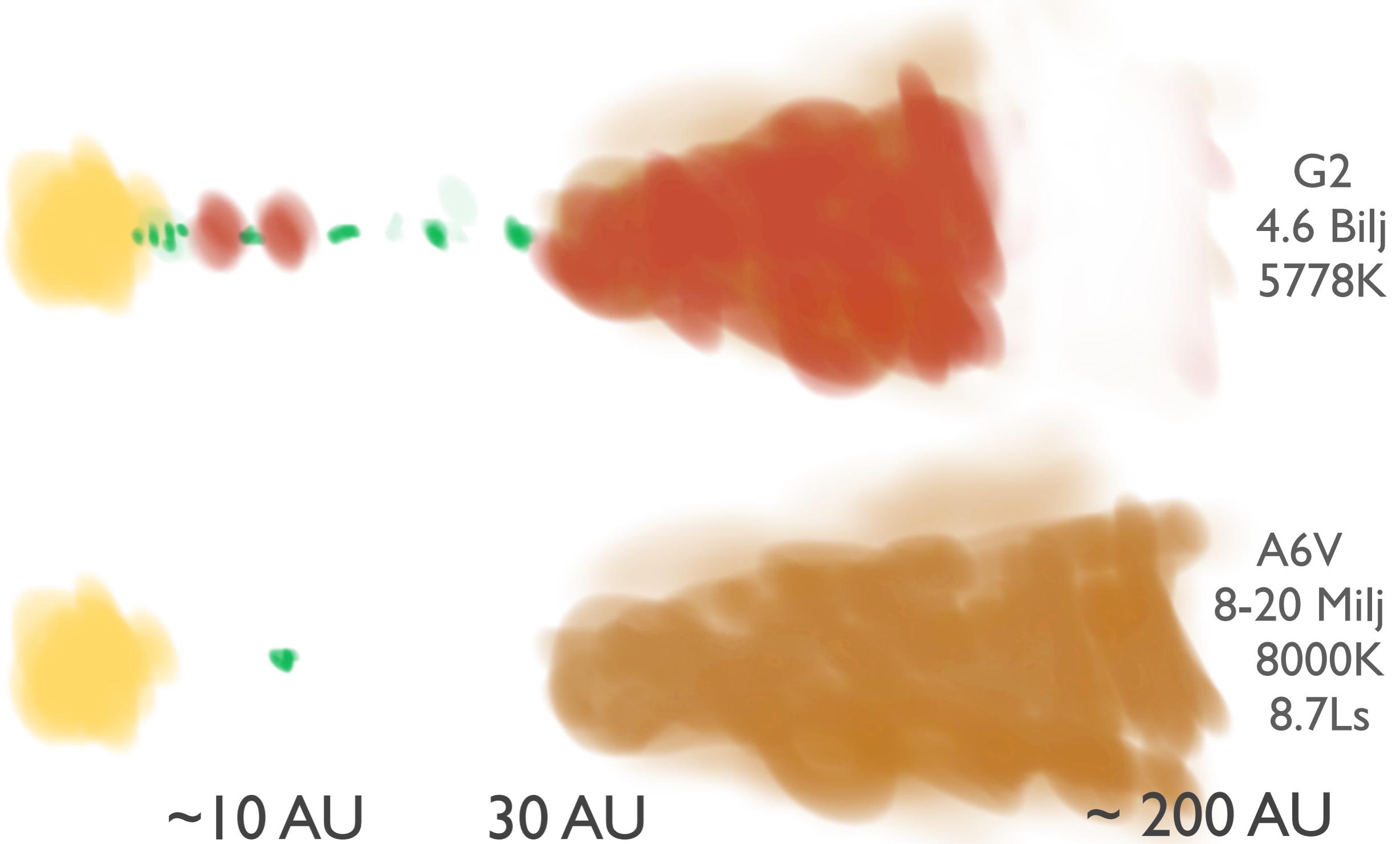


G2
4.6 Bilj
5778K

The Solar System

The Solar System

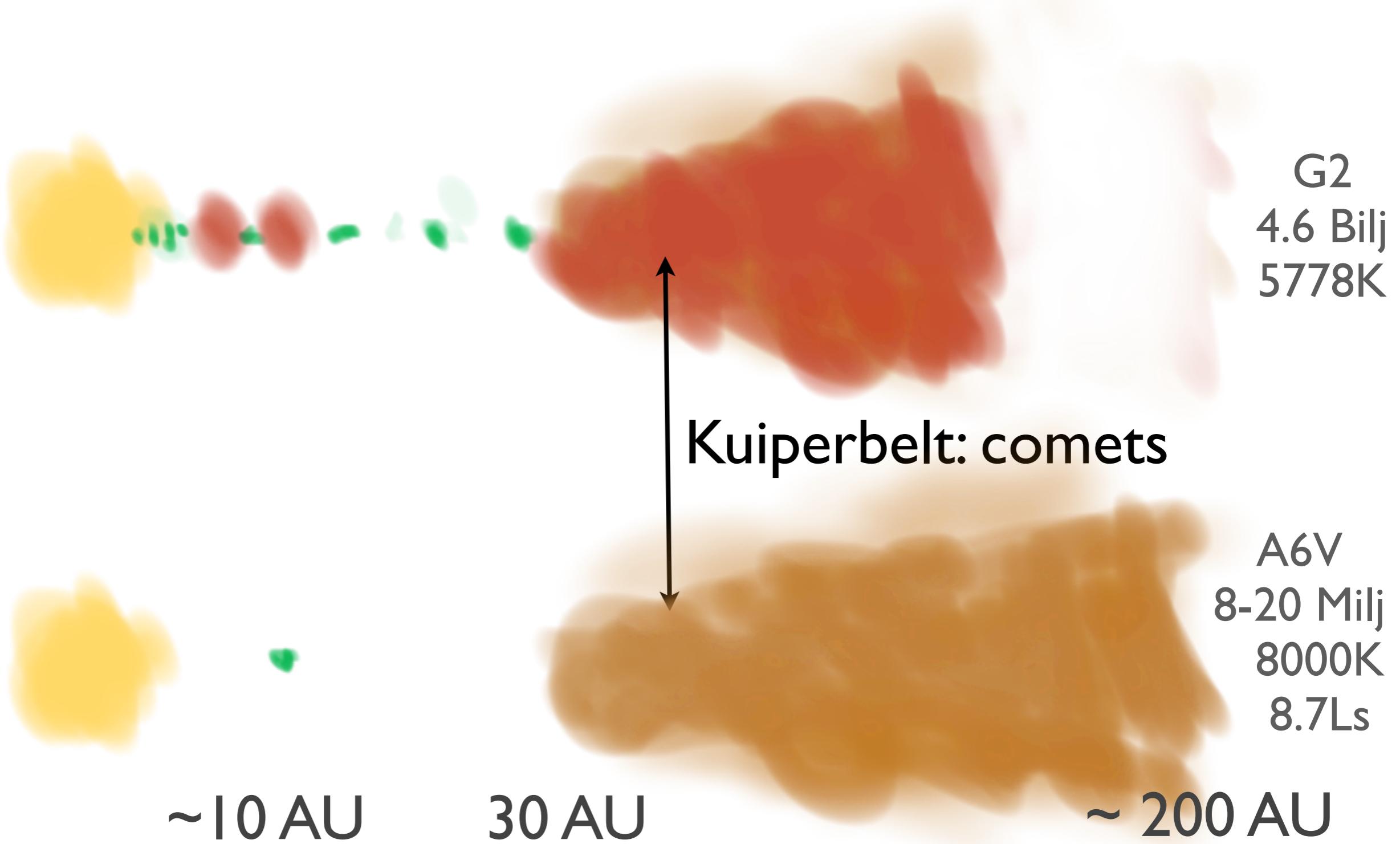
Solar System



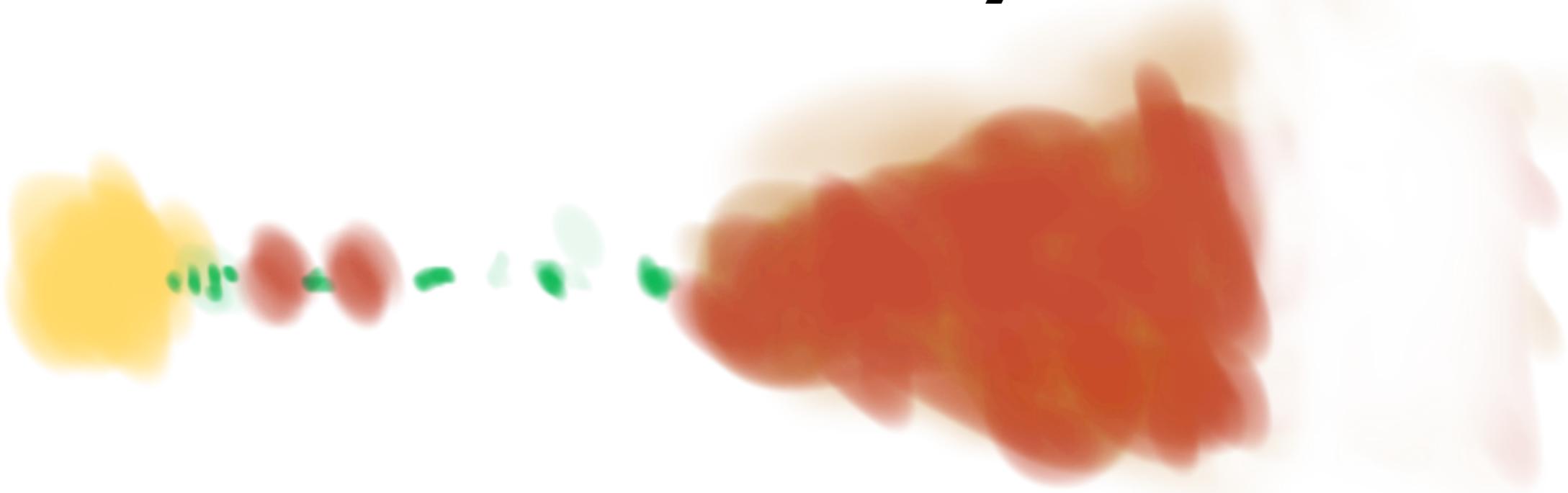
The Solar System

Solar System

β Picoris

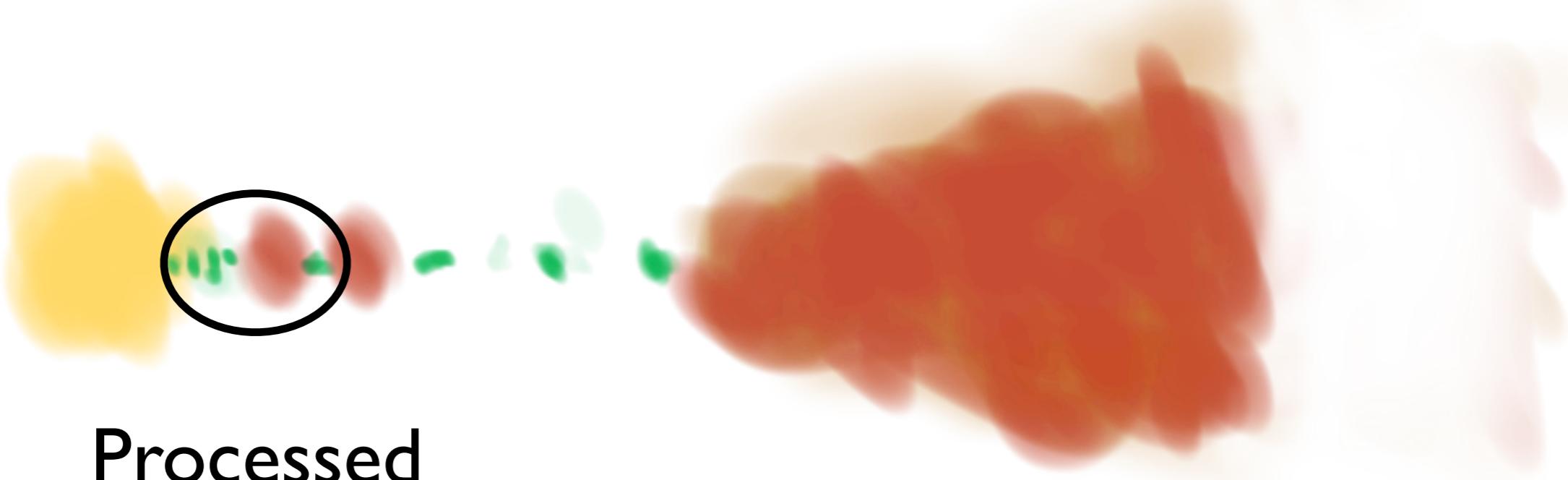


Solar System



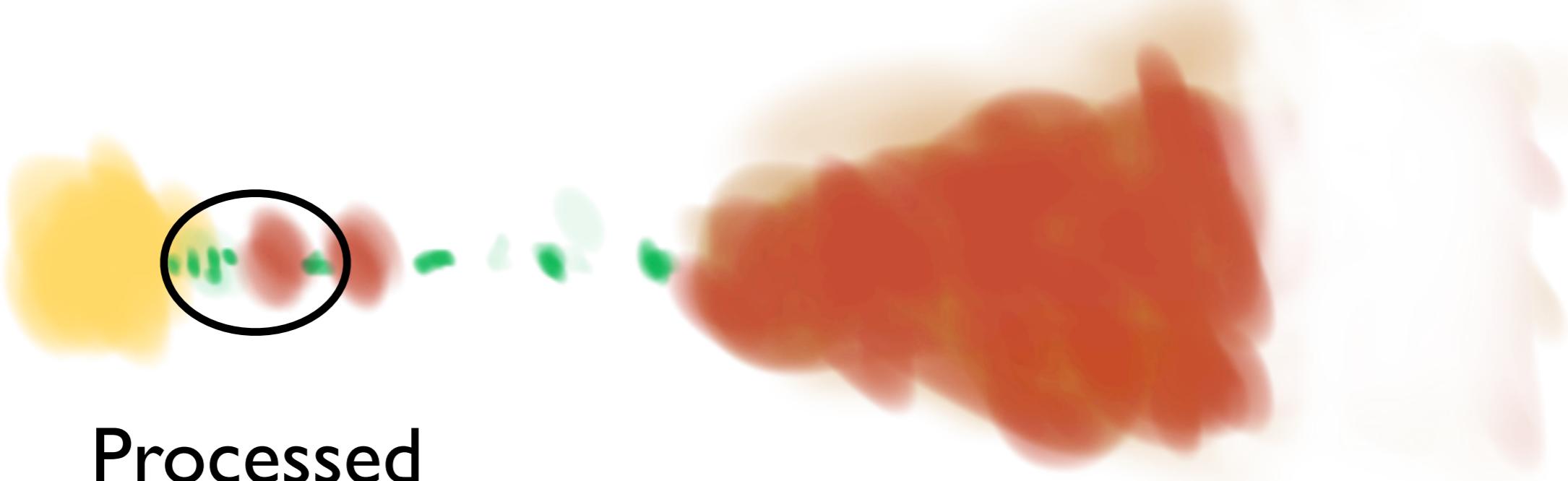
The Solar System

Solar System



Processed
asteroid/LL chondrite
crystalline olivine
~30 % iron

Solar System



Processed
asteroid/LL chondrite
crystalline olivine
~30 % iron

=

Parent-body
process

The Solar System

Solar System



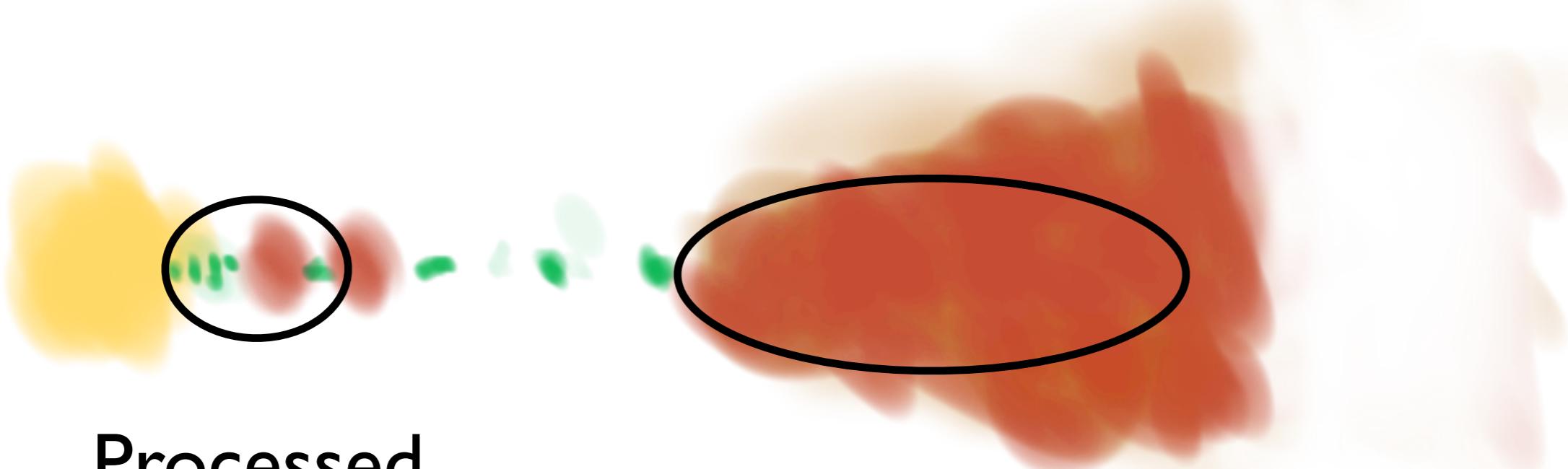
Processed
asteroid/LL chondrite
crystalline olivine
~30 % iron

Cometary
crystalline olivine
~1 % iron

=
Parent-body
process

The Solar System

Solar System



Processed
asteroid/LL chondrite
crystalline olivine
~30 % iron

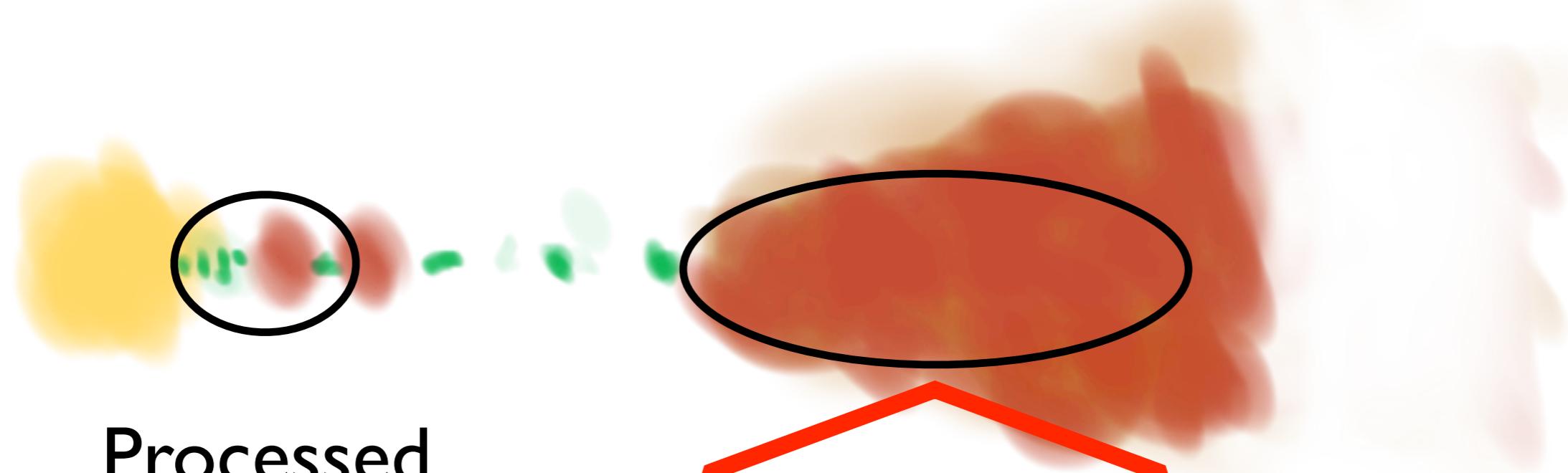
=
Parent-body
process

Cometary
crystalline olivine
~1 % iron

=
No parent-body
processes

The Solar System

Solar System



Processed
asteroid/LL chondrite
crystalline olivine
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=

Parent-body
process

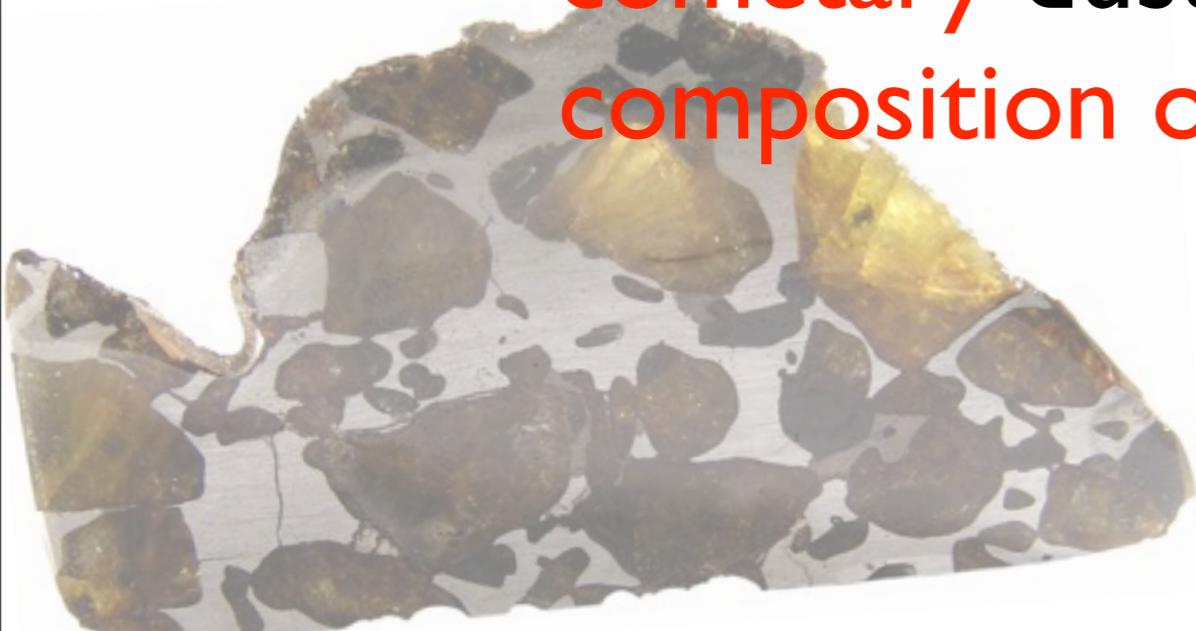
Cometary
crystalline olivine
~1 % iron

=

No parent-body
processes

β Pictoris' olivine crystals:

- Both in composition and location
similar to the Solar System Kuiperbelt
- Crystalline olivine is un-equilibrated and
cometary dust and therefore reflects the
composition of proto-planetary dust

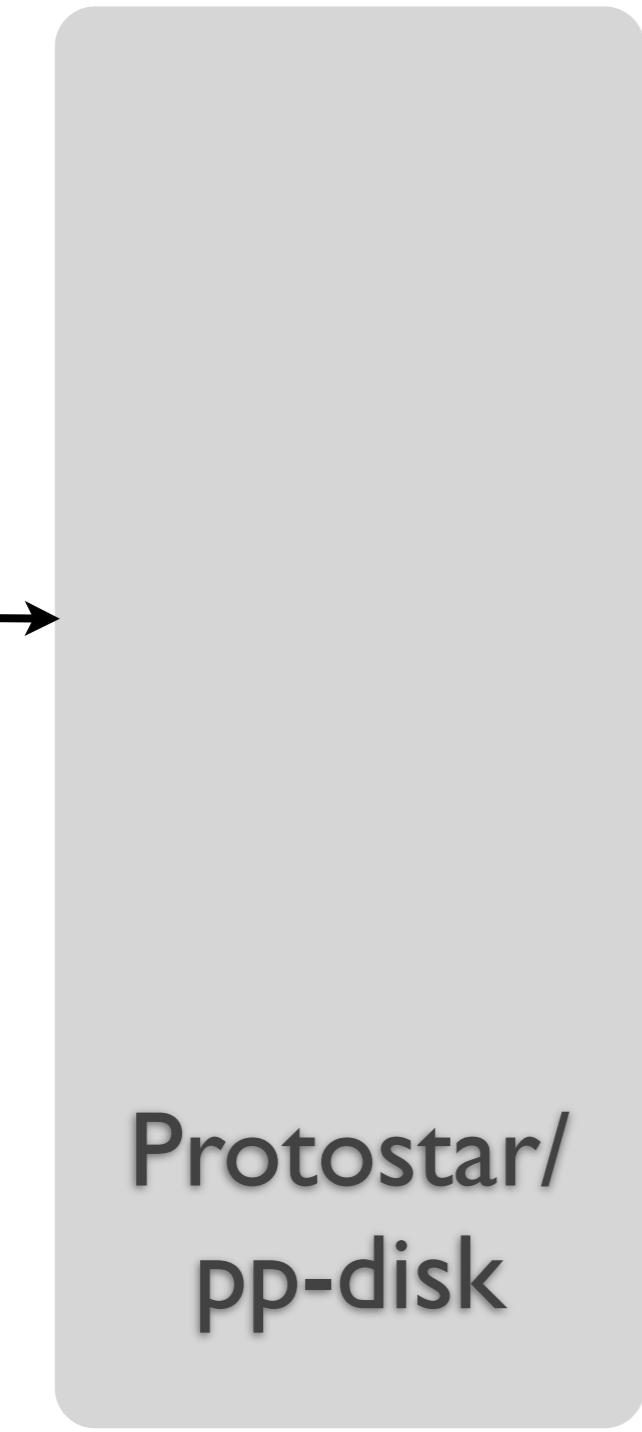


What happens to crystalline olivine

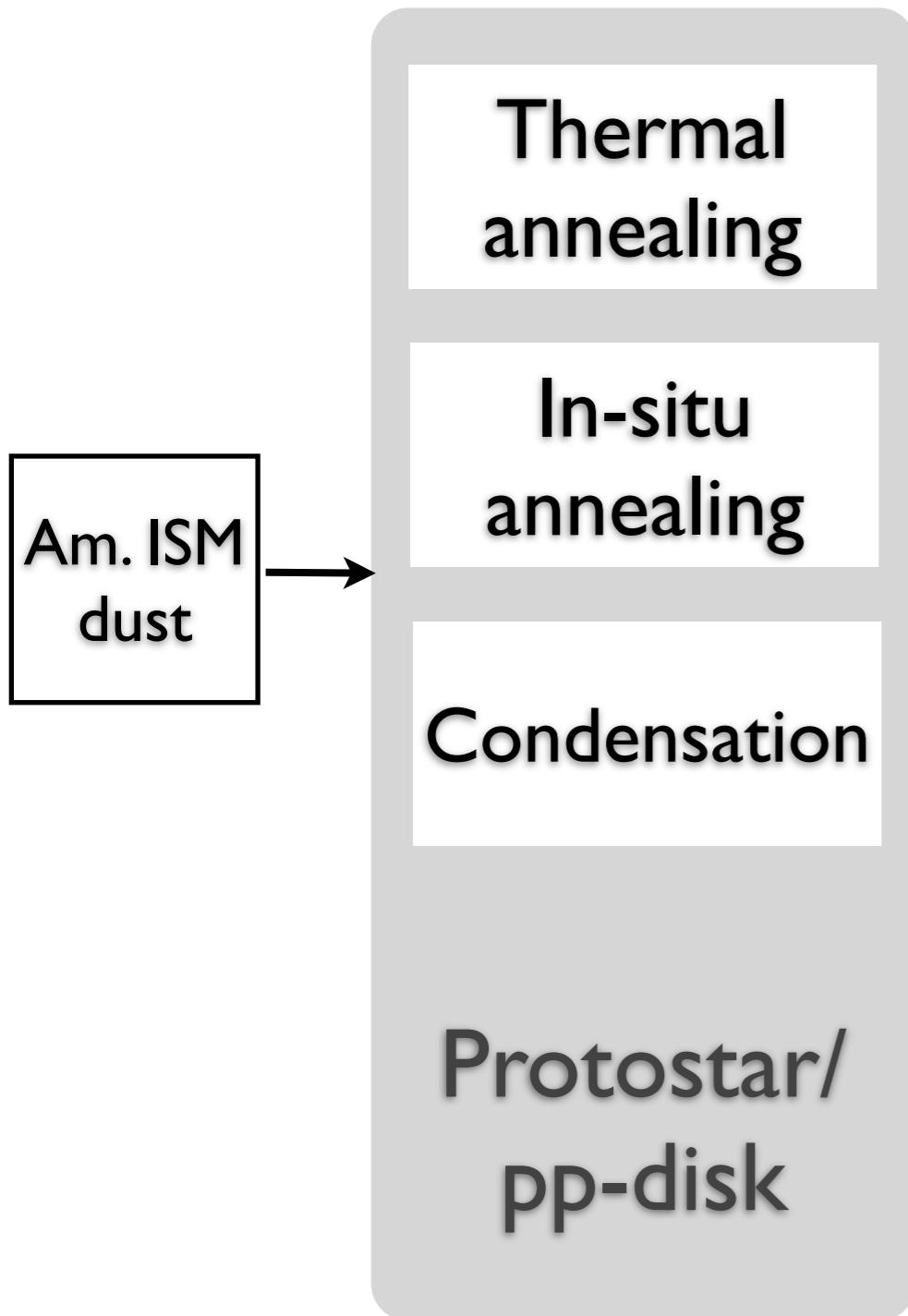
Am. ISM
dust

What happens to crystalline olivine

Am. ISM
dust

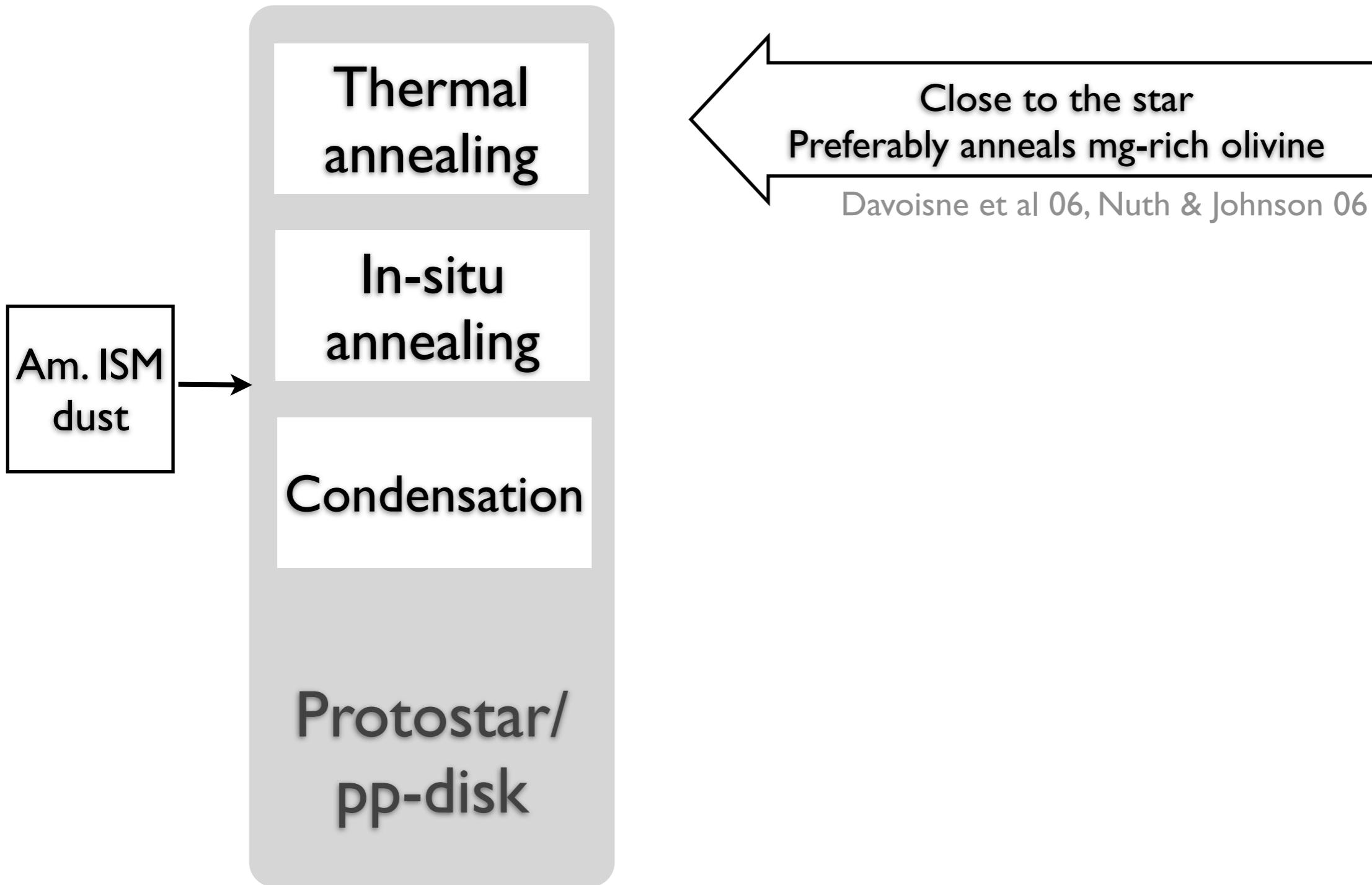


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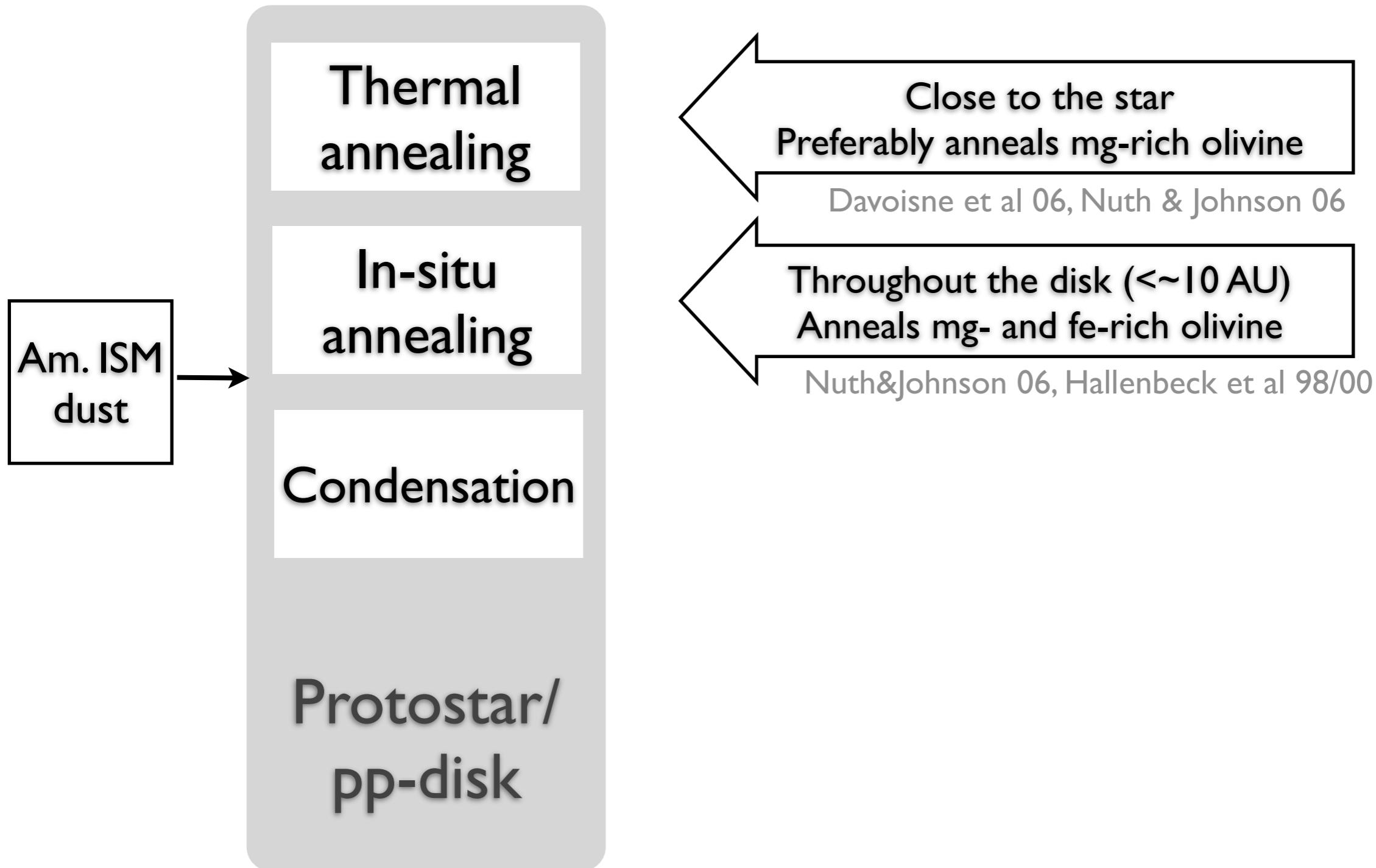
Gail 04, Tanaka et al 10, Mulders et al. 11, Sturm et al 10

What happens to crystalline olivine



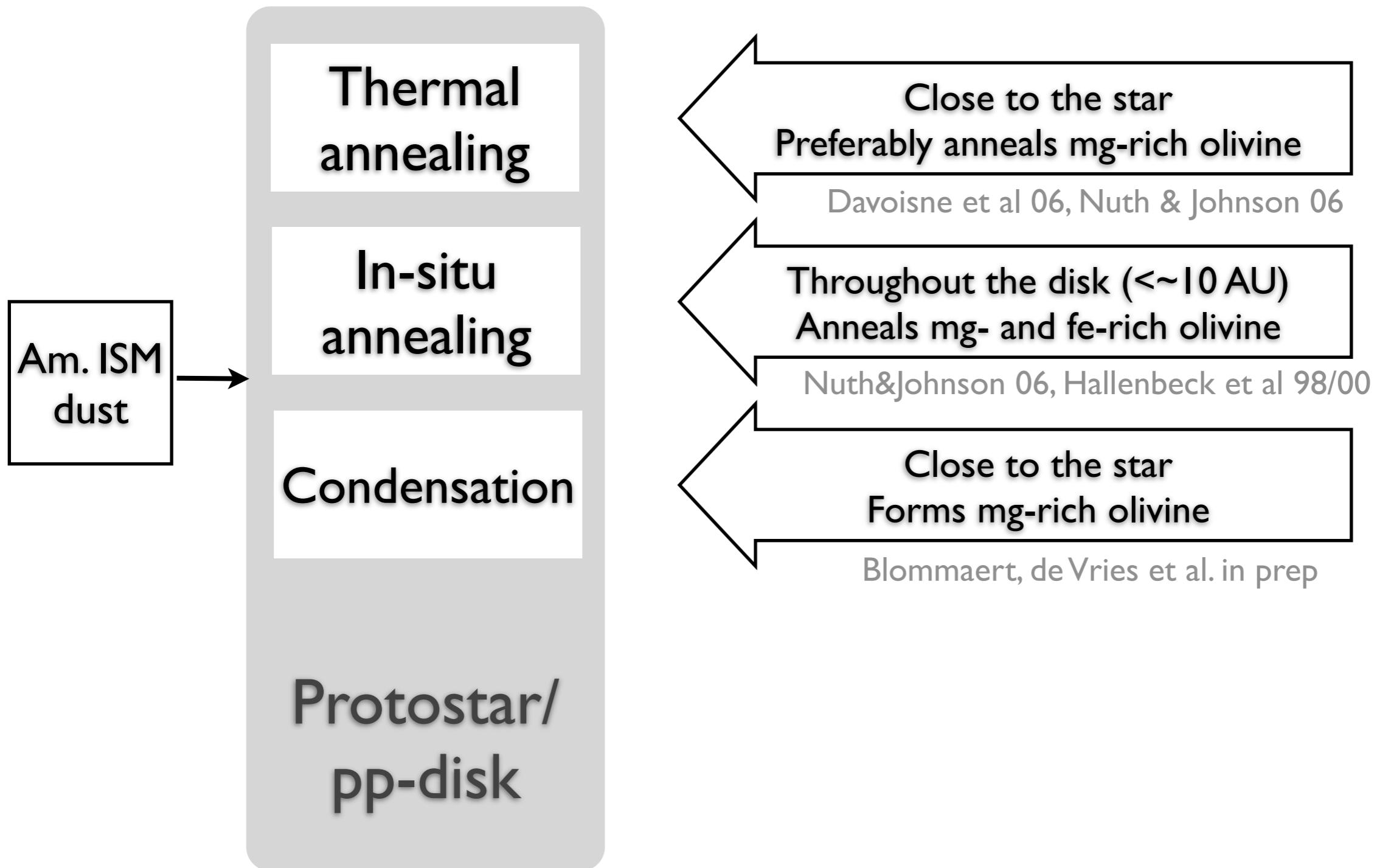
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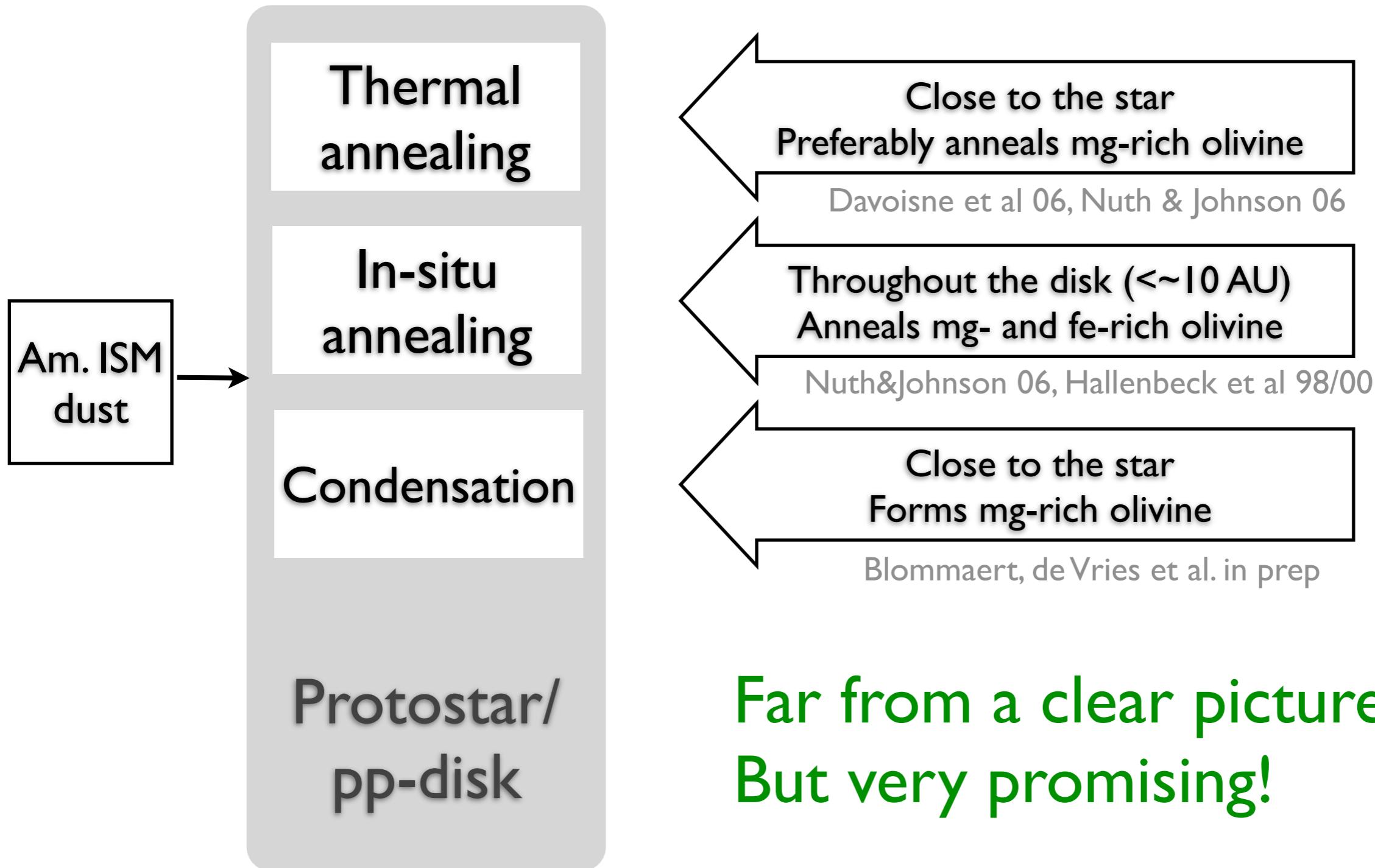
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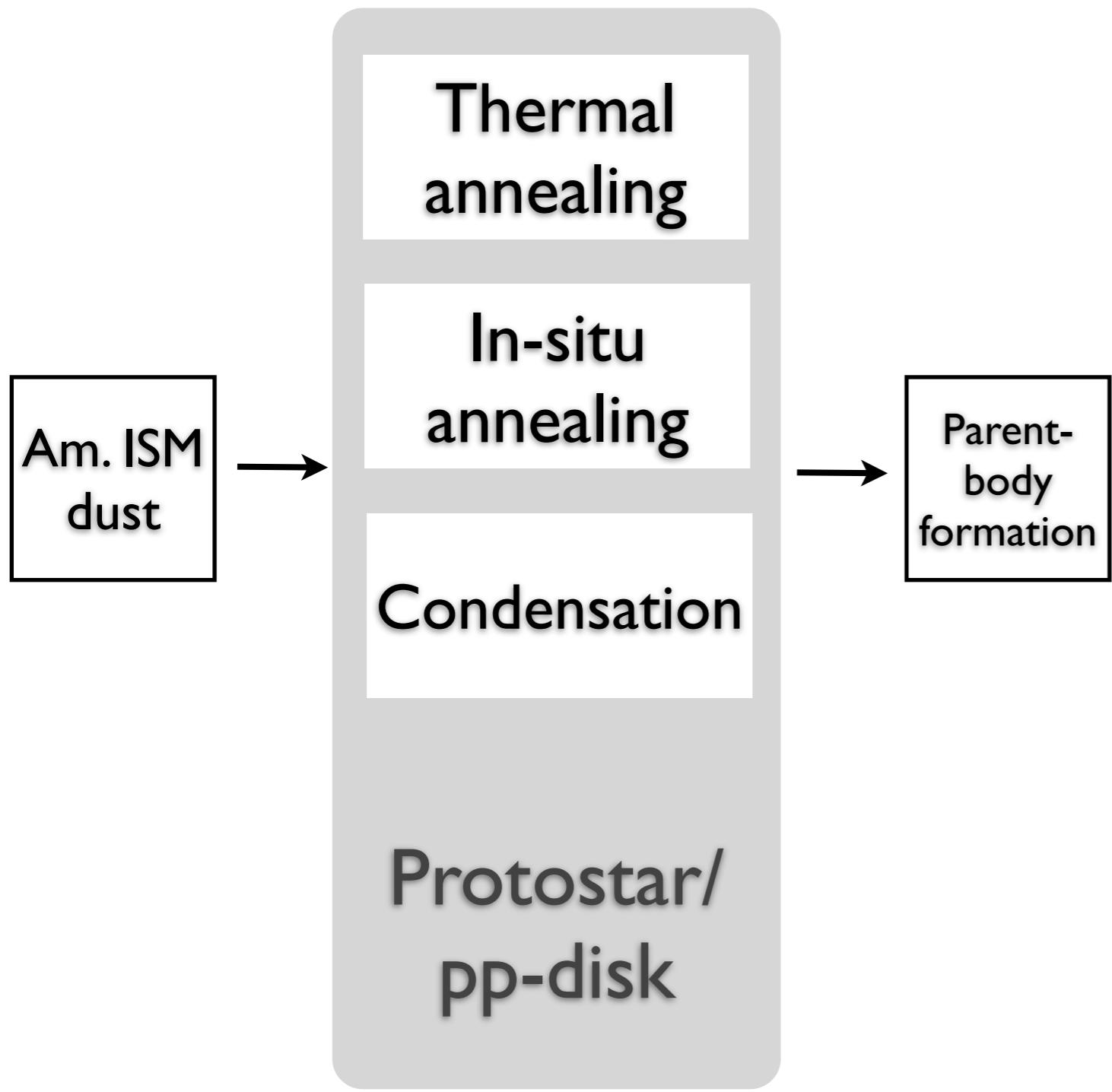
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What happens to crystalline olivine

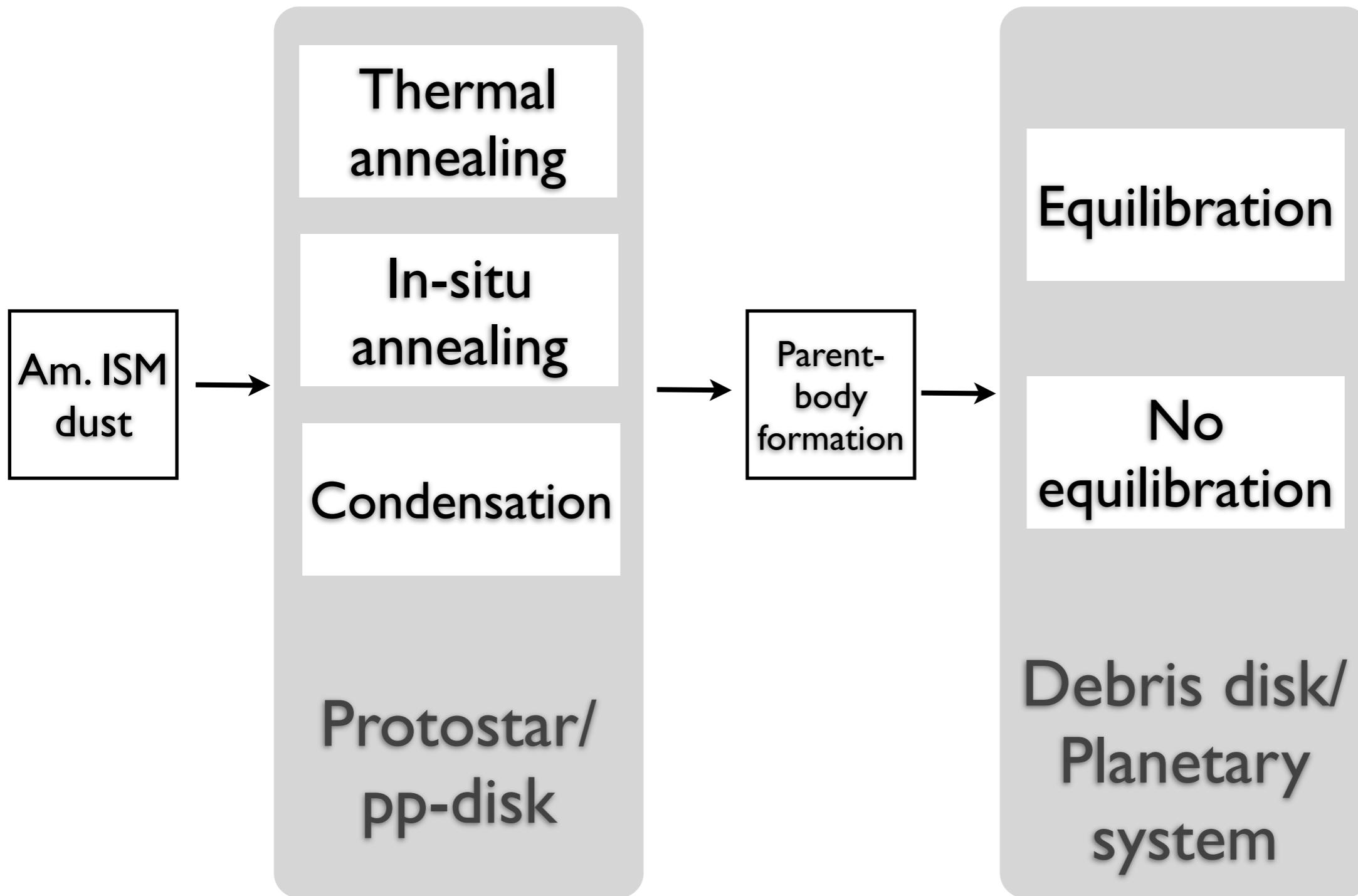


Far from a clear picture ...
But very promising!

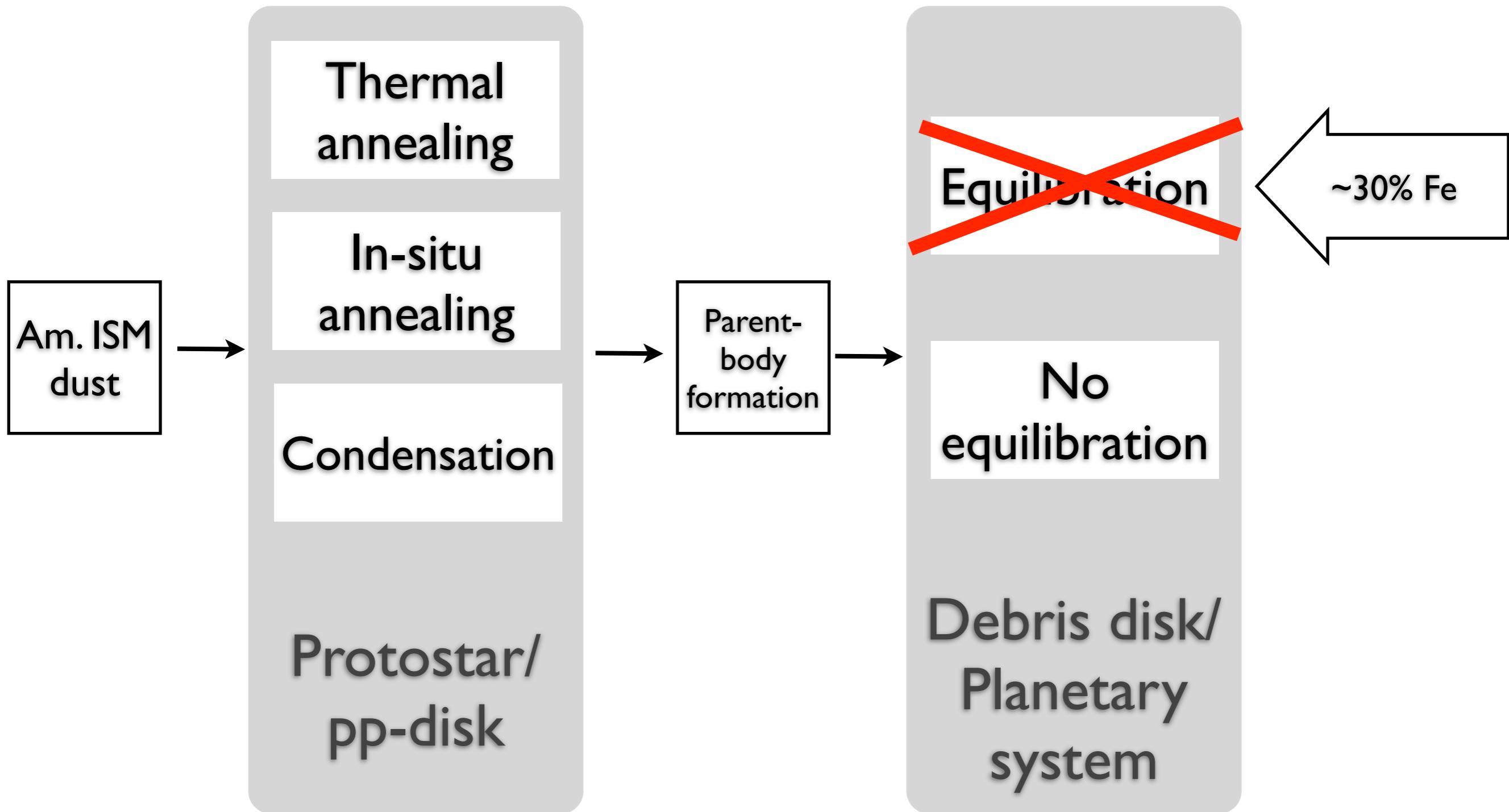
What happens to crystalline olivine



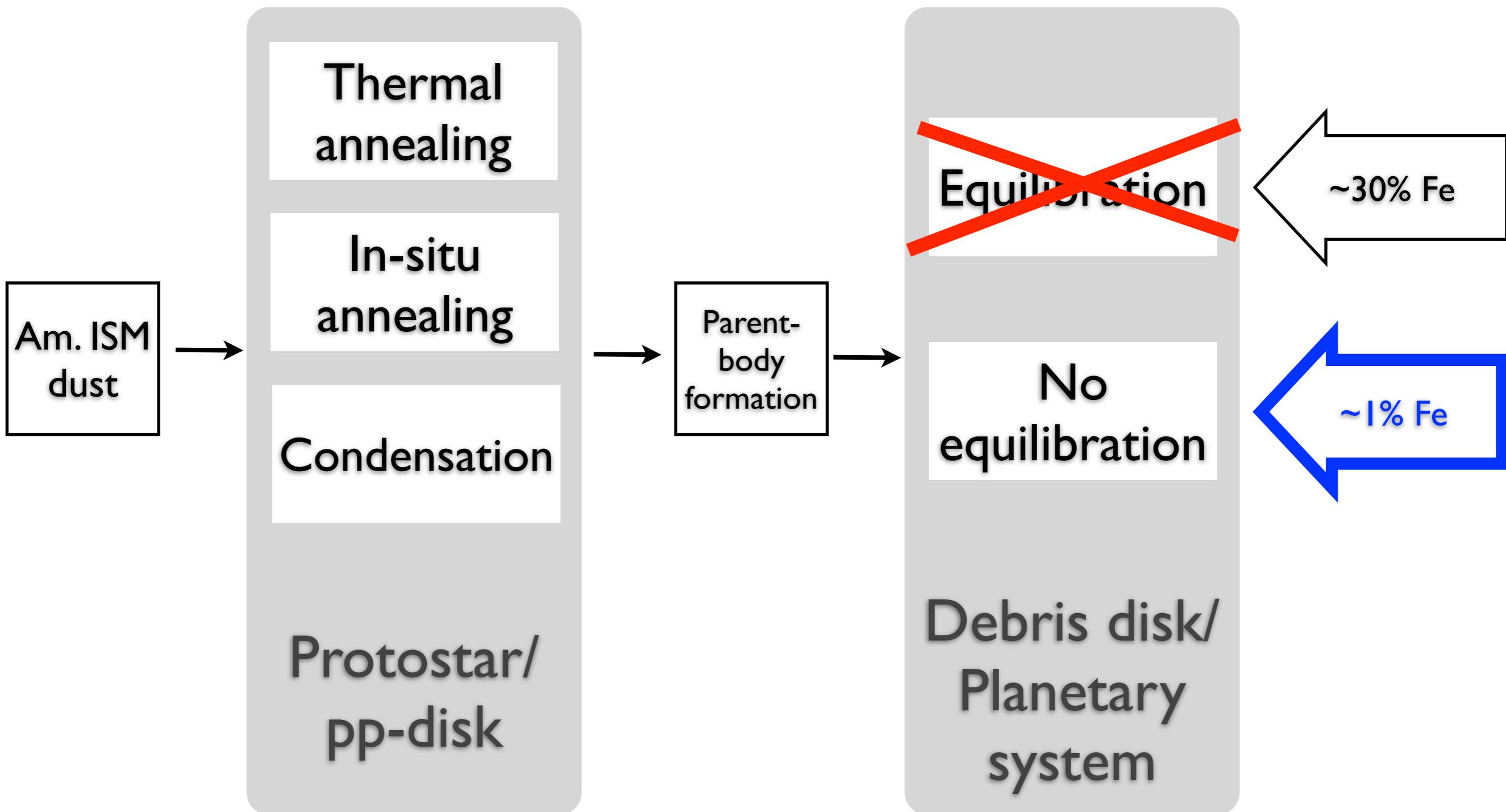
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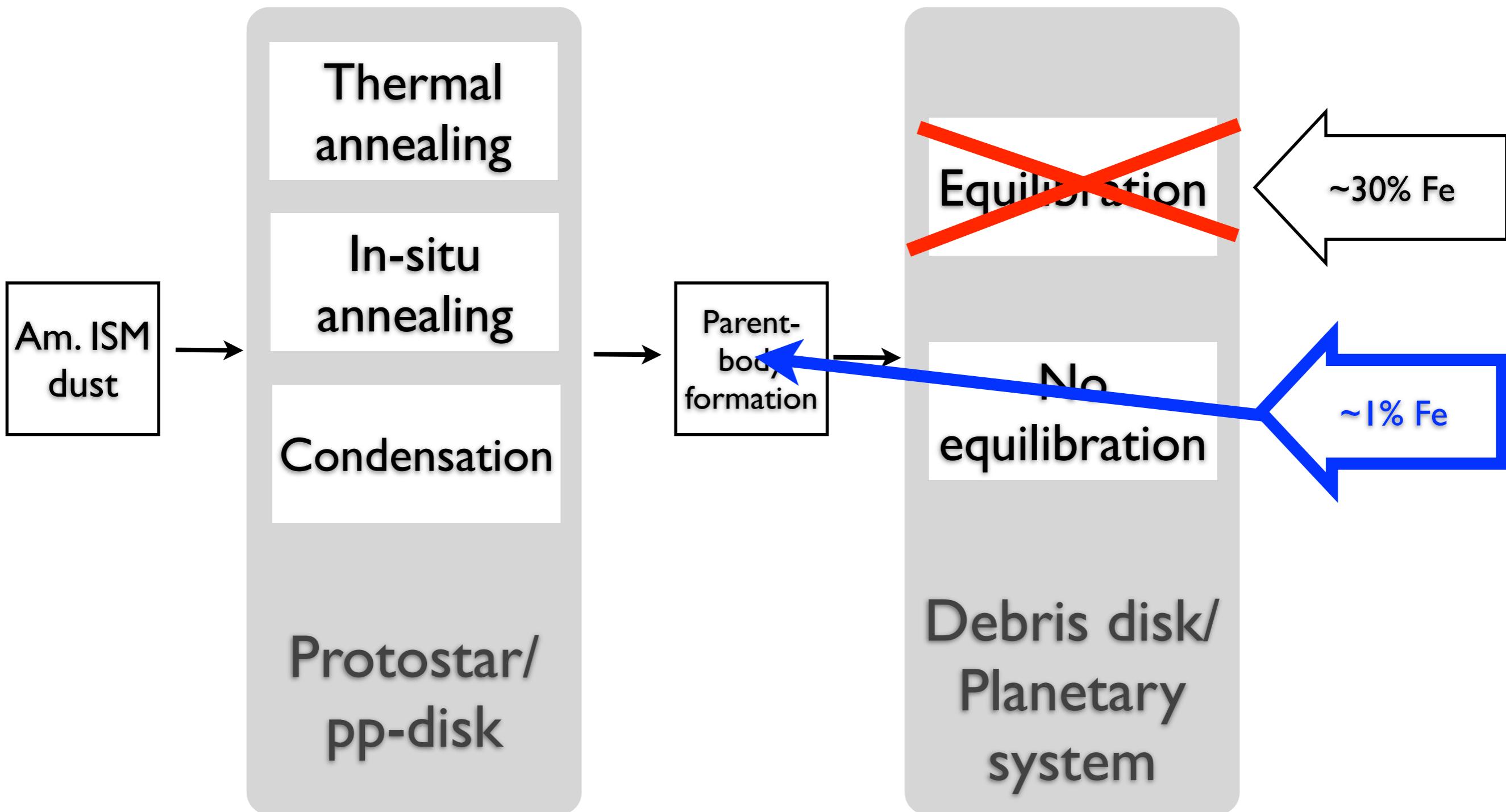
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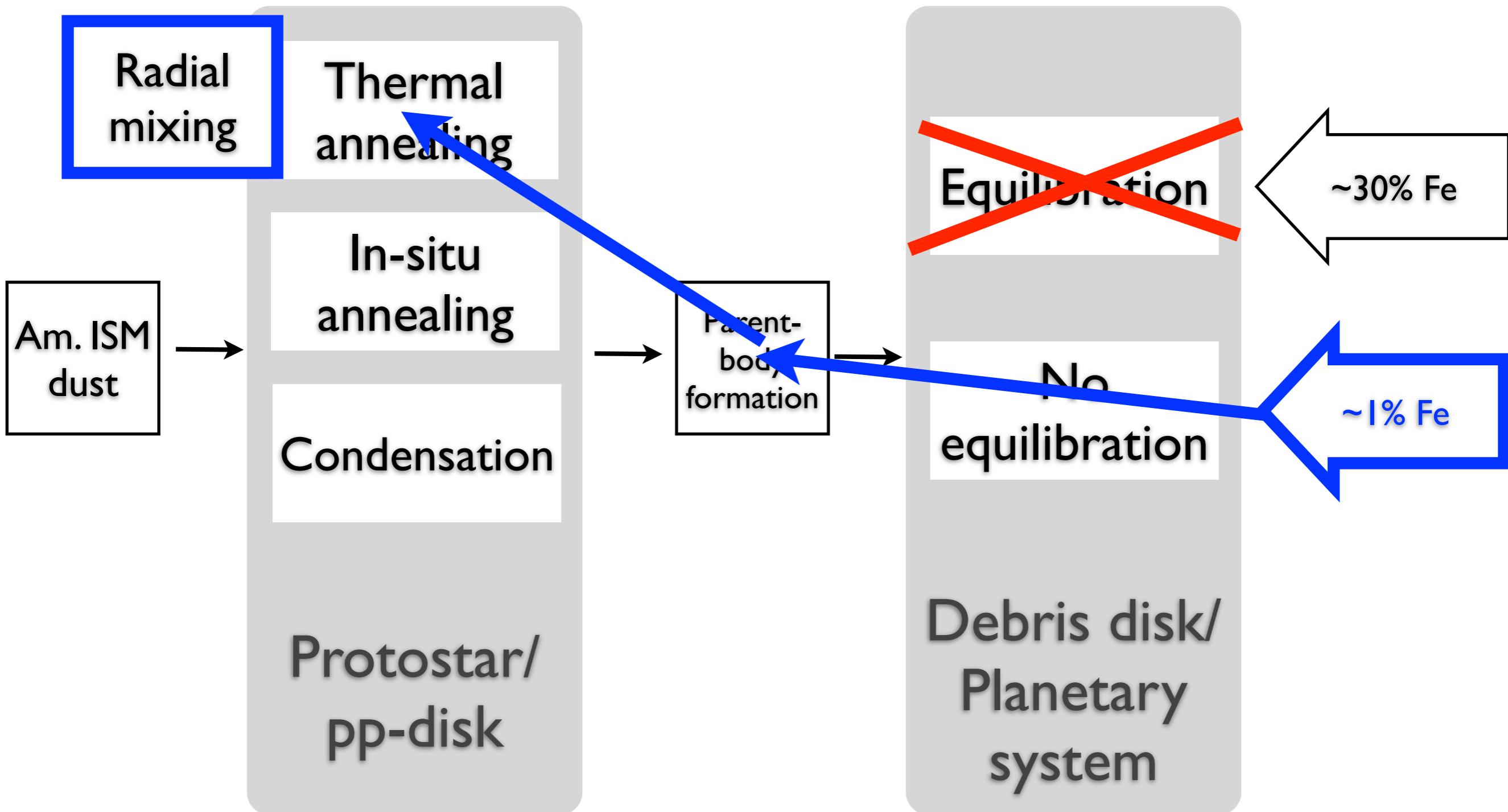
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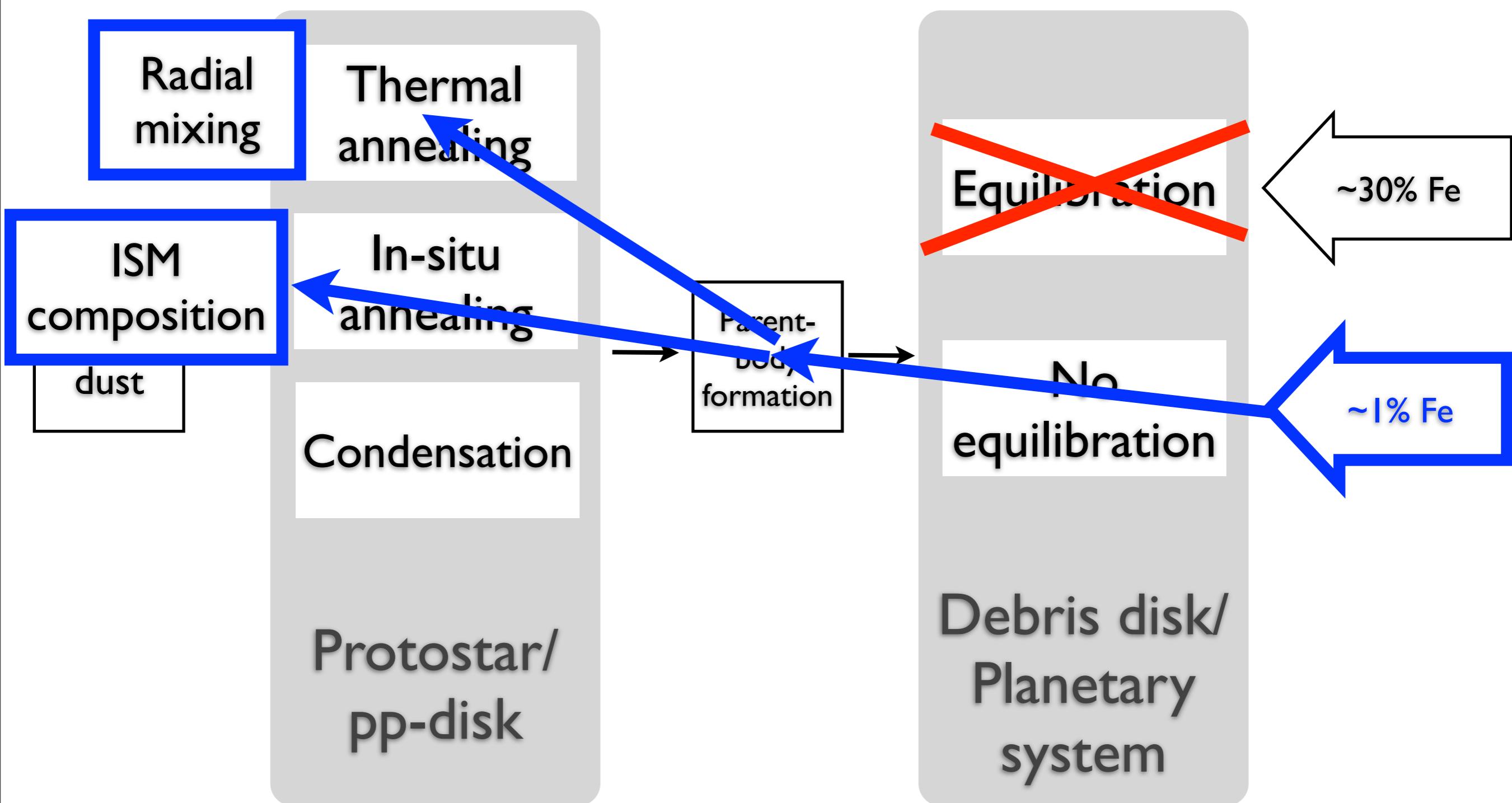
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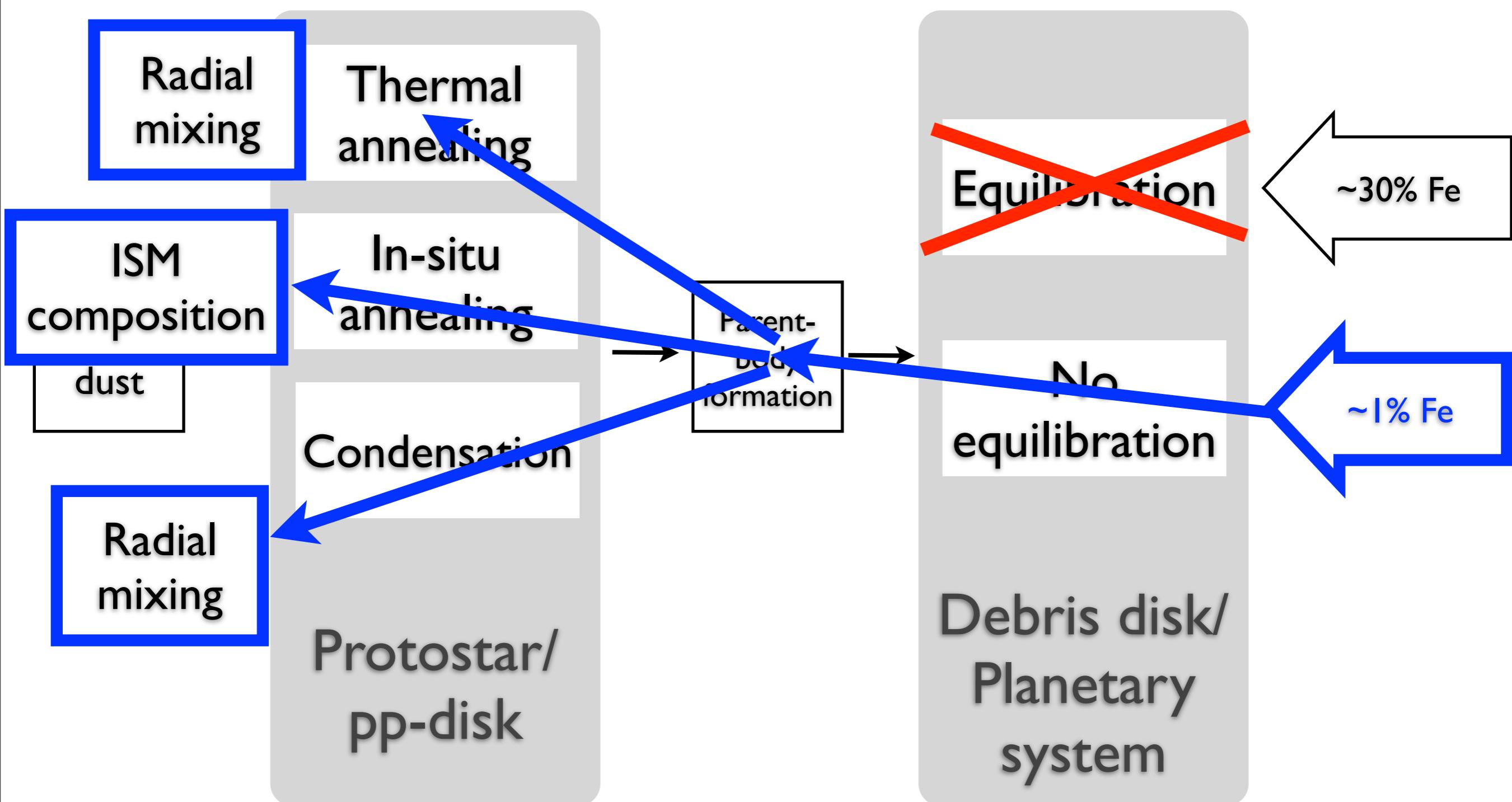
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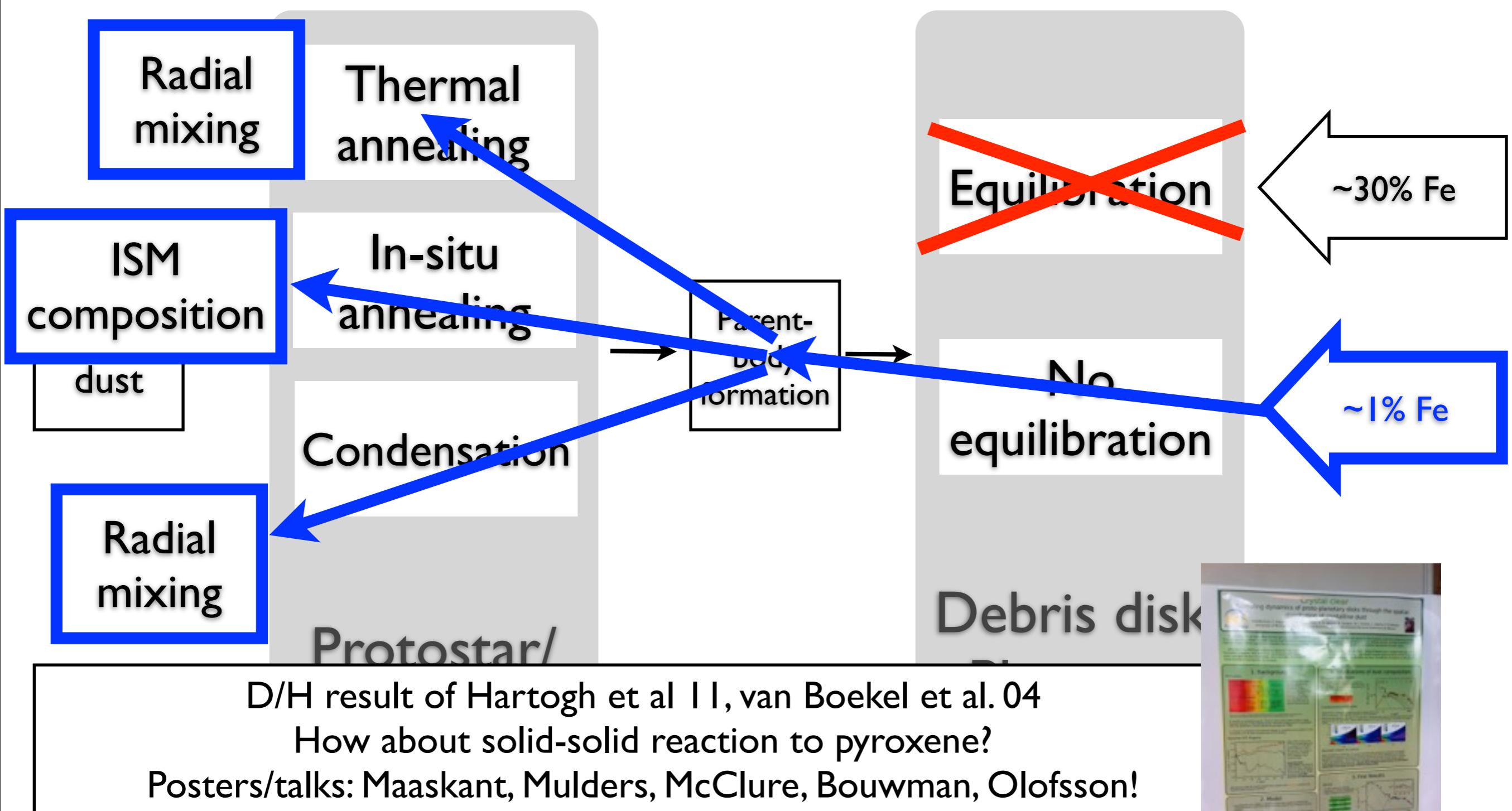
What happens to crystalline olivine



What happens to crystalline olivine



What happens to crystalline olivine



Take home ...

- Minerals contain important information about the evolution and physics of stellar/planetary systems
- Crystalline olivine in β Pictoris contains 1% Fe and is un-equilibrated and cometary



Thank you very much!

deVries et al, 2012 submitted



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