Understanding the chemistry of protoplanetary disks

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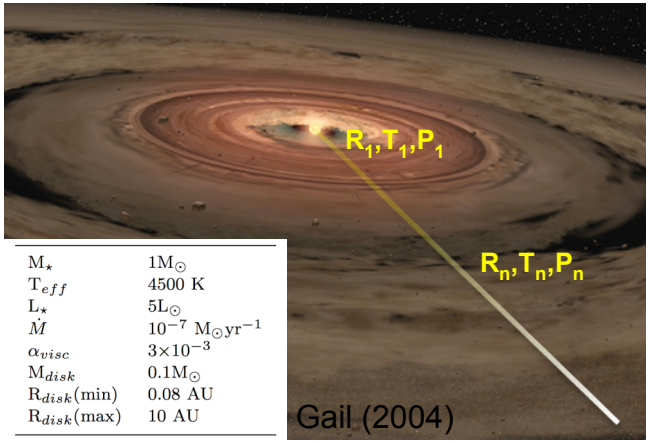
Gas

Element	Abundance (kmol)
H	91
He	8.89
O	4.46×10^{-2}
C	2.23×10^{-2}
Ne	1.09×10^{-2}
N	7.57×10^{-3}
Mg	3.46×10^{-3}
Si	3.30×10^{-3}
Fe	2.88×10^{-3}
S	1.44×10^{-3}
Al	2.81×10^{-4}
Ar	2.29×10^{-4}
Ca	2.04×10^{-4}
Na	1.90×10^{-4}
Ni	1.62×10^{-4}

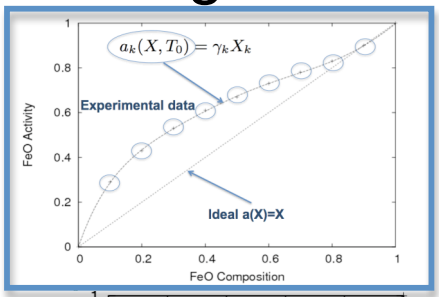
Pasek et al. (2005)

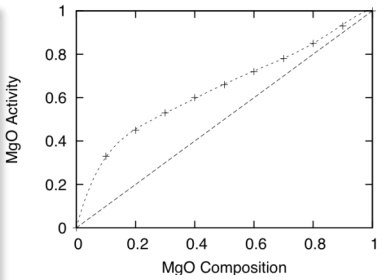
Disk model

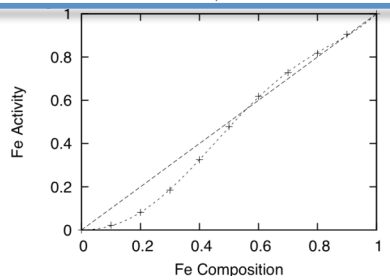


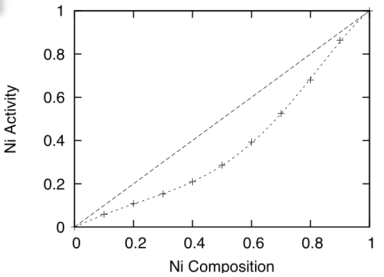
$M_\star$	$1M_\odot$
T_{eff}	4500 K
$L_\star$	$5L_\odot$
$\dot{M}$	10^{-7} $M_\odot yr^{-1}$
α_{visc}	3×10^{-3}
M_{disk}	$0.1M_\odot$
R_{disk}(min)	0.08 AU
R_{disk}(max)	10 AU

Regular Solution model



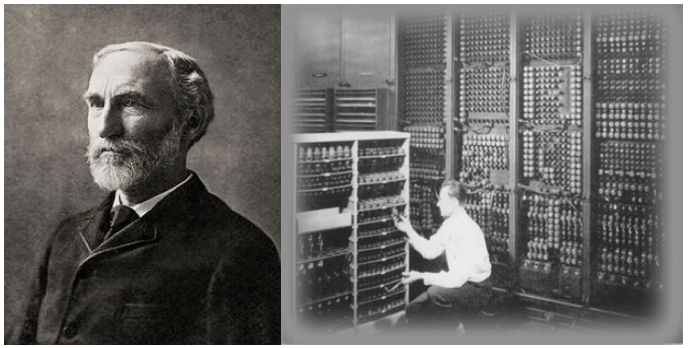






$$\gamma_k(X_k, T) = \frac{a_k(X, T_0)}{X_k} = \gamma_k(X_k, T_0)^{(T_0/T)}$$

Gibbs free energy



Condensation sequence