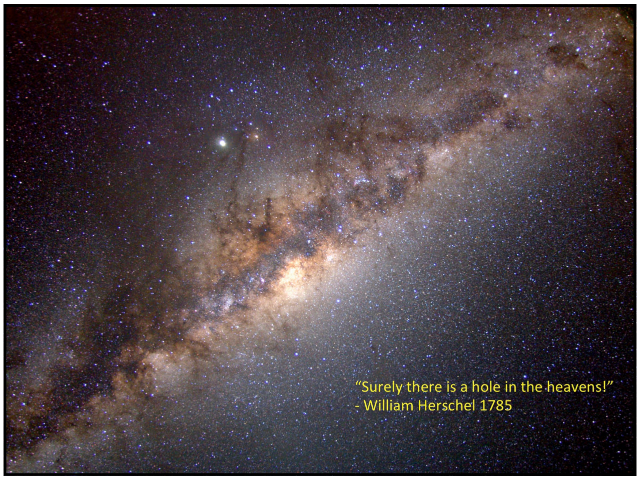

ON A NEBULOUS GROUNDWORK IN THE CONSTELLATION *TAURUS*

BY E. E. BARNARD

VACANCY AND NEBULA IN *TAURUS*

10-inch Lens. 1907, January 9, $12^h 27^m$ to $17^h 55^m$ G. M. T. Enlarged 1.6 times. Scale: 1° = 35 mm.

Barnard 1907

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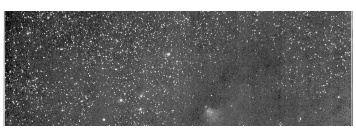
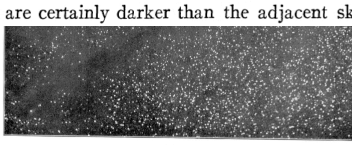


I have been slow in accepting the idea of an obscuring body to account for these vacancies; yet this particular case almost forces the idea upon one as a fact. There are portions of this apparent vacancy that are certainly darker than the adjacent sky.



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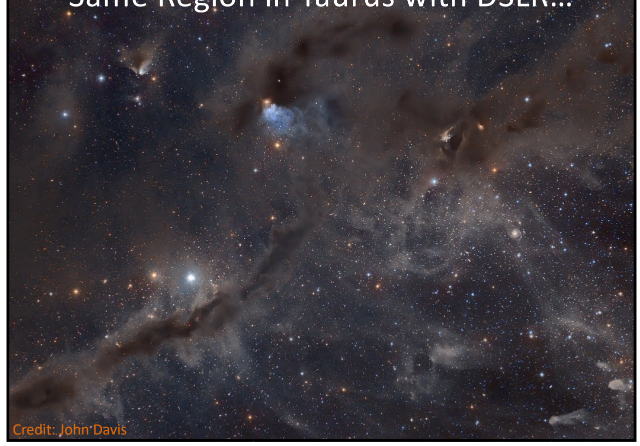
Barnard 1907

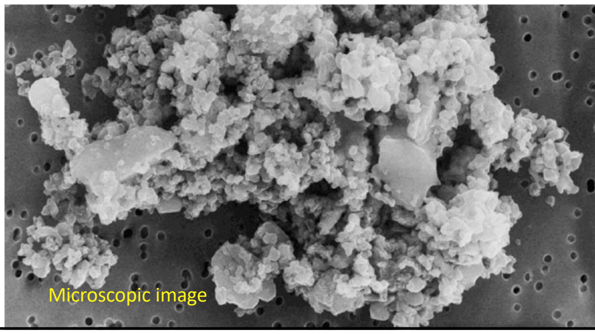
Same Region in Taurus with DSLR…



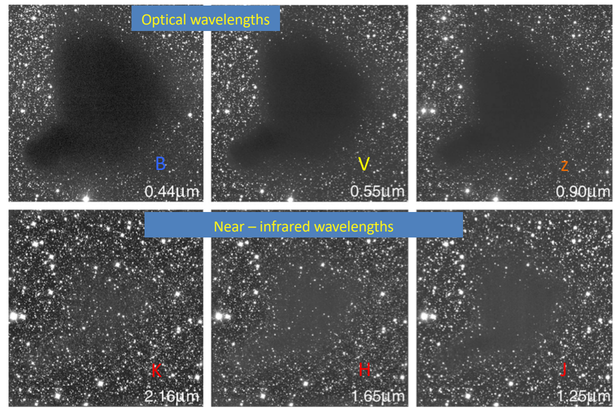
Credit: John Davis

Interstellar Dust Grains

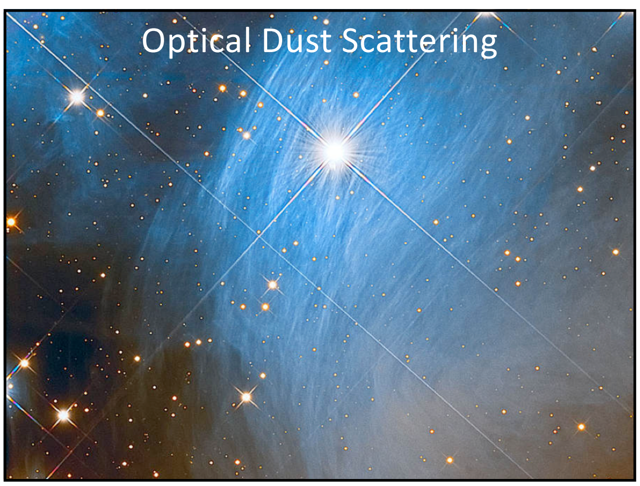
ISM dust sizes from a few atoms up to few μm sizes
can grow much larger in protoplanetary disks



Dust Extinction(Absorption+Scattering)



Optical Dust Scattering



Abundance of Pre-solar Grains

Table 23.2 Types and Properties of Major Presolar Materials[a,b] Identified in Meteorites and IDPs.

Material	Source	Grain Size (μm)	Abundance[c] (ppm)†
Amorphous silicates	Circumstellar	0.2–0.5	20–3600
Forsterite (Mg_2SiO_4) } Enstatite ($MgSiO_3$)	Circumstellar	0.2–0.5	10–1800
Diamond		~0.002	~1400
P3 fraction	Not known		
HL fraction	Circumstellar		
Silicon carbide	Circumstellar	0.1–20	13–14
Graphite	Circumstellar	0.1–10	7–10
Spinel ($MgAl_2O_4$)	Circumstellar	0.1–3	1.2
Corundum (Al_2O_3)	Circumstellar	0.5–3	0.01
Hibonite ($CaAl_{12}O_{19}$)	Circumstellar	1–2	0.02

[a] Other presolar materials include TiC, MoC, ZrC, RuC, FeC, Si_3N_4, TiO_2, and Fe-Ni metal.
[b] See Huss & Draine (2007) for details and references therein.
[c] Abundance in fine-grained fraction (= matrix in primitive chondrites).

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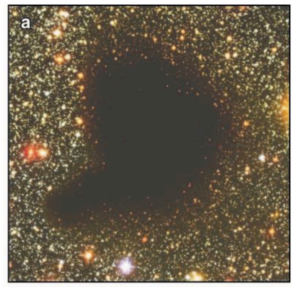
Interstellar Dust Extinction

The amount of dust extinction at a wavelength is give by A_λ [mag]

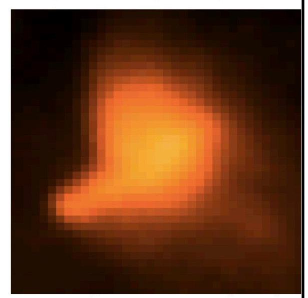
$$m_v^{obs} = m_v^{true} + A_v$$

Dust Extinction vs. Emission

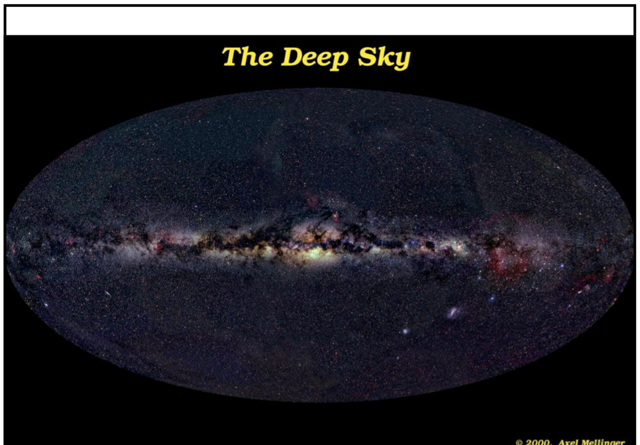
Optical Absorption/Scattering



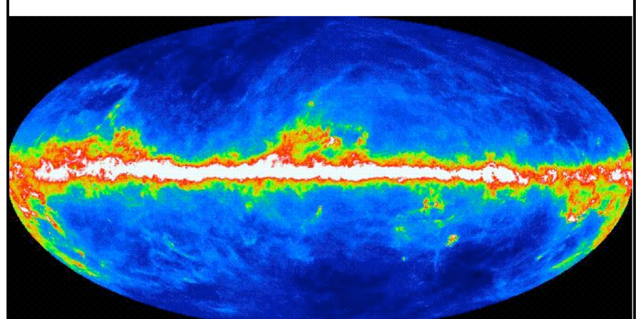
Radio/Submillimeter(0.85 mm) Emission



Bergin & Tafalla 2007 ARA&A



Milky Way at 100 μm



IRAS/NASA