Planck WG 7

- Galactic and solar system science
  - preparatory work for studies of own Galaxy
  - template maps of diffuse sources
  - studies of dense cores
  - analysis tools and radiative transfer methods
  - predictions of solar system bodies and zodiacal light

WG 7.1 Physics of dust

- dust properties ay Planck wavelengths
- a lot is known in far-infrared, less in sub-mm – mm range
- laboratory studies
  - dust emissivities at long wavelengths (up to mm-range) and at low temperatures (~10K)
  - laboratories in Italy (OAC) and France (CESR, IAS)
- theoretical work (IAS, CESR)
  - e.g. related to anomalous microwave emission, emissivity index changes, mm-excess, ...

WG 7.2 - ancillary data

- existing surveys are gathered and converted to common format (Healpix)
- infrared data
  - IRAS, COBE, MSX, 2Mass, ISO, Spitzer, ELISA, Astro-F
- line observations
  - HI, Hα (Leiden, WHAM, Shassa, VTSS)
  - CO and ^{13}CO surveys
    - Nagoya group: the whole Galactic plane with a resolution of 3'
  - radio maps, radio polarization

Survey type	Survey	Resolution [arcmin]	Coverage	Status
CO	Composite CFA ^{12}CO[a]	8'	-10° <b<+10°	Completed
	FCRAO(CGPS) ^{12}CO[b]	0.8'	+74° <l<+147°	In progress
			-3.6° <b<5.6°	
	Nagoya U. $^{12/13}CO$[c]	2.7'	-10° <b<+10°	In progress
HI	Dwingeloo/NFRA[d]	30'	Full Sky	Completed
	CGPS/DRAO[e]	1'	+74° <l<+147°	In progress
			-3.6° <b<5.6°	
	HIPASS/HIJASS	15'	Full Sky	In progress
IR	2MASS 1.25/2.2 μm	0.06'	Full Sky	Completed
	IRAS 12/100 μm[f]	4'	Full Sky	Completed
	DIRBE 1.25/240 μm	30'	Full Sky	Completed
	MSX 4/26 μm[g]	0.3	-5° <b<+5°	Completed
	ISO Serendipitous 170μm [h]	2'	15% sky	Completed
	IRIS/ASTRO-F 50/200μm [i]	0.8'	Full Sky	Future
	SPITZER 24/160 μm[j]	0.27'	Maps	In progress
	ELISA-balloon 200/600μm [k]	3'	-20° <b<+20°	Future
	Herschel 100/600μm	0.5'	1000 Sq. Deg.	Future
H-alpha	WHAM-Fabry-Perot[l]	60'	Northern sky	Completed
	SHASSA-filter[m]	5'	Southern sky	Completed
	Manchester WFC-filter[n]	5'		Future
Radio	Stockert/Bonn 1.4 GHz[o]	34'	Northern sky	Completed
	Halslam 408 MHz[p]	50'	Full Sky	Completed
	FIRAS 100/1000 μm	420'	Full Sky	Completed
	DMR 90/30 GHz	420'	Full Sky	Completed
	WMAP 22/90 GHz	20'	Full Sky	In progress
	Bonn MLS 1.4/2.7 GHz[q]	10'	-10° <b<+10°	In progress
	HatRAO 2.3 GHz[r]	20'	Southern sky	In progress
	CGPS/DRAO 408/1420 MHz[s]	1'	+74° <l<+147°	In progress
			-3.6° <b<+5.6°	
	Green Bank 8.35/14.35 GHz[t]	5'	-5° <b<+5°	In progress
X-ray	ROSAT 0.1-4 keV[u]	12'/2°	Full Sky	Completed
γ-ray	CGRO >100 MeV[v]	120'	Full Sky	Completed
	INTEGRAL <10 MeV	60'	-15° <l<+15°	Future

WG 2.8 in WG 7.3

- template maps for diffuse interstellar medium
  - vibrational and rotational (?) dust emission including polarized dust emission
  - synchrotron emission (including polarization)
  - free-free emission
  - zodiacal light and solar system bodies

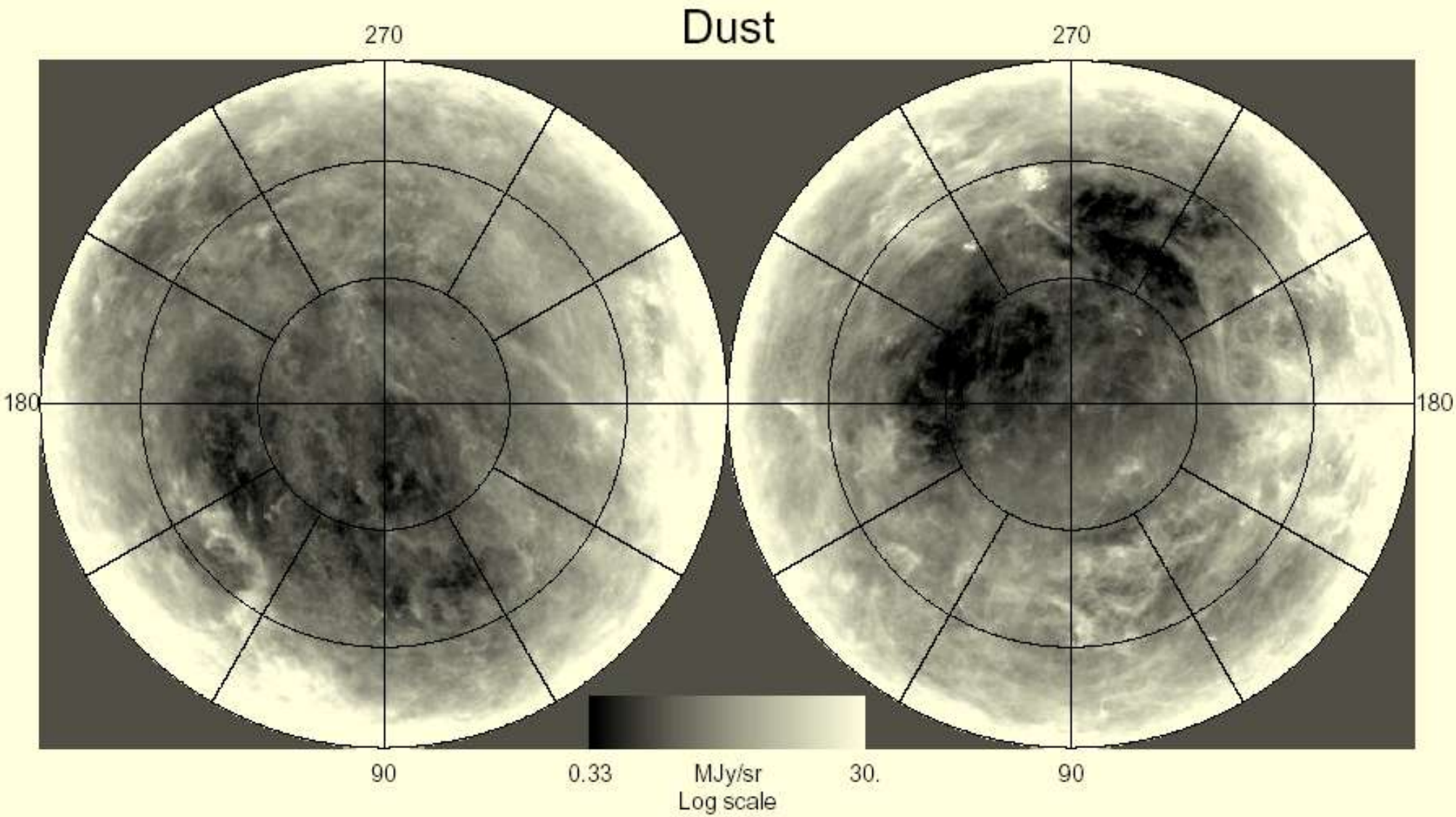
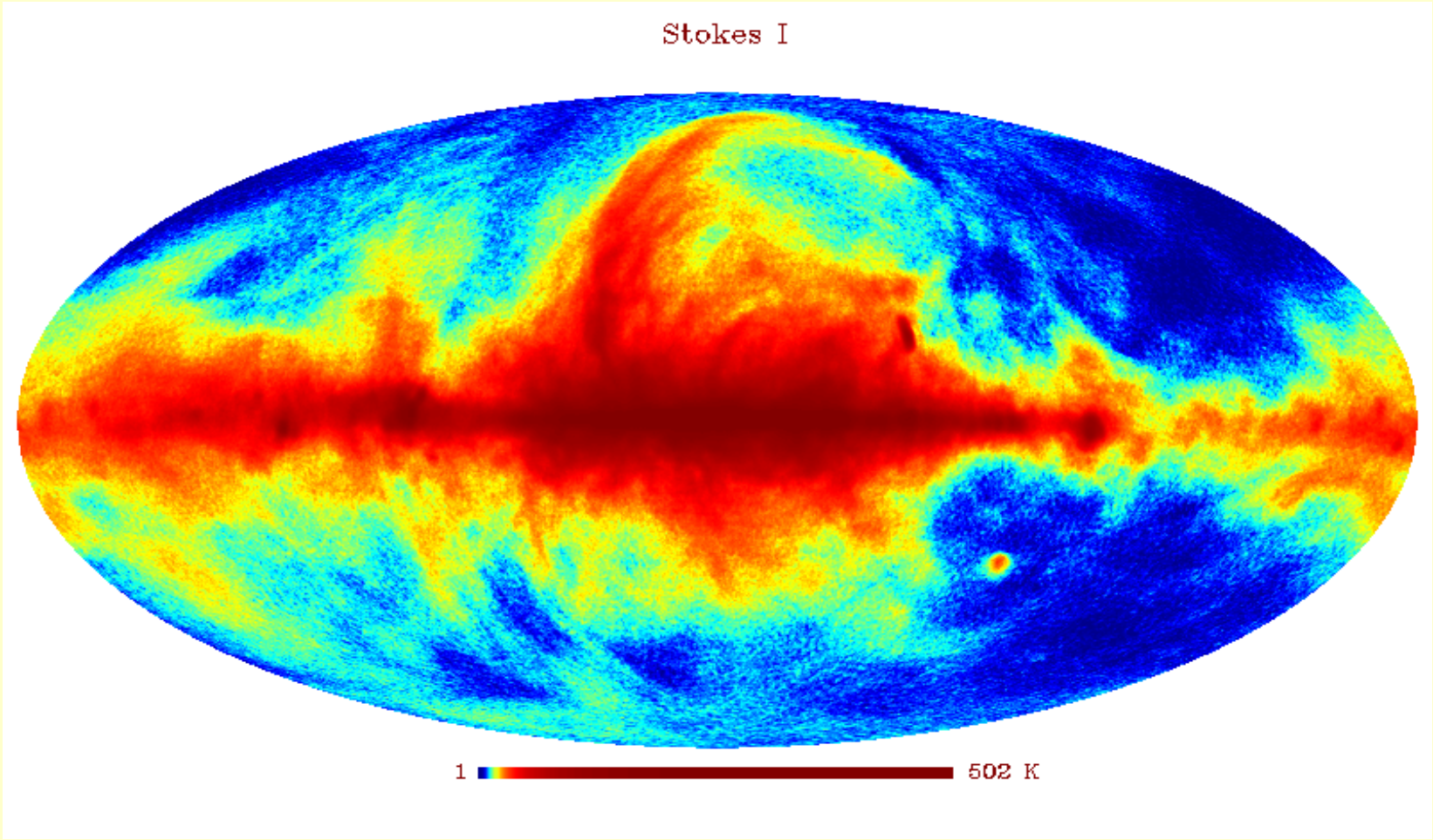
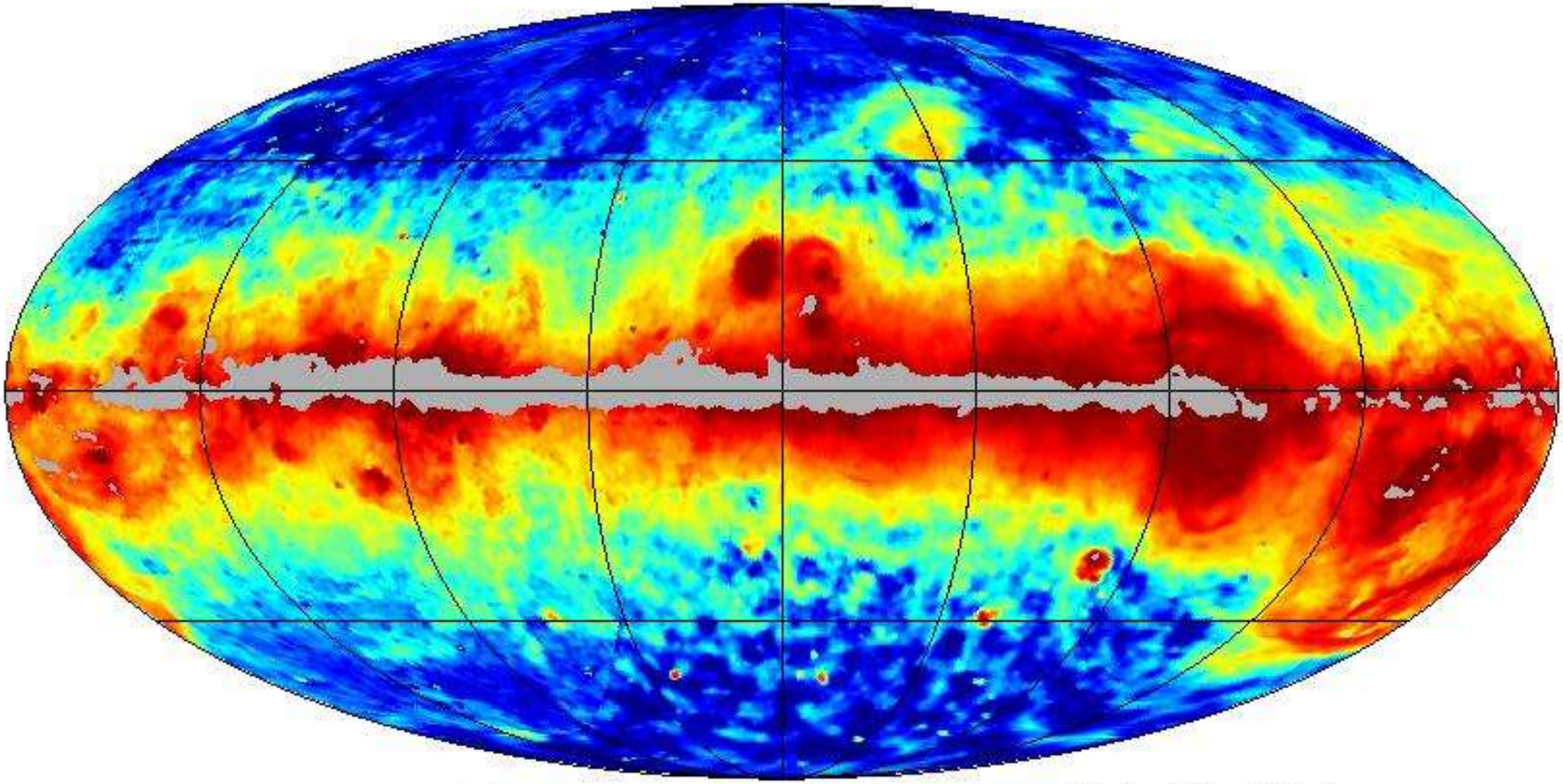
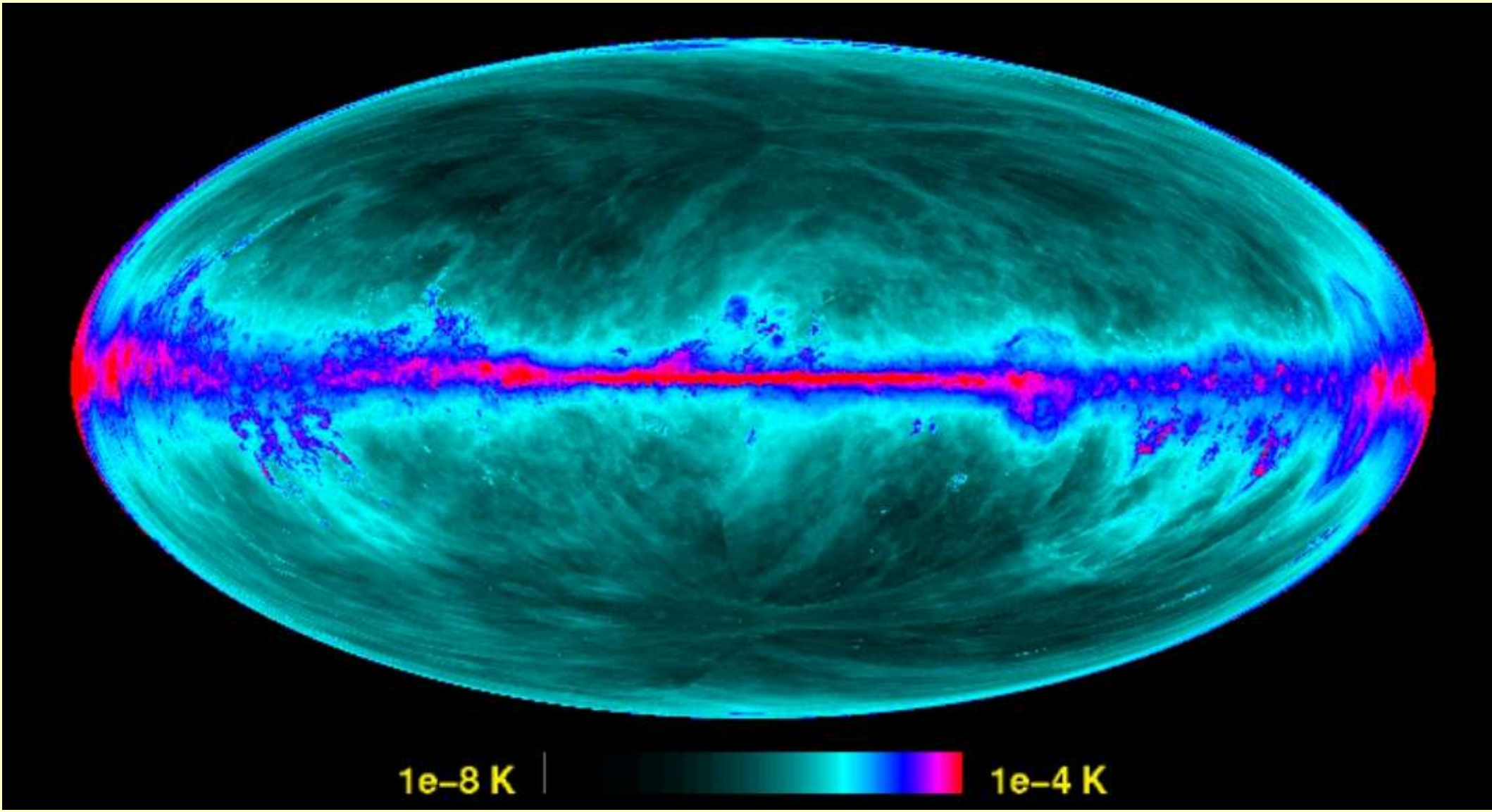


FIG. 8.—Full-sky dust map for the NGP (*top*) and SGP (*bottom*)


Stokes I
1
502 K

Full−sky dust corrected Halpha map




1e–8 K
1e–4 K

WG 7.3

- analysis tools
  - visualization tools (especially for diffuse emission)
  - tools for correlating Planck observations with other data
    - infrared surveys
    - line surveys
  - radiative transfer methods
    - modelling of both diffuse and dense clouds
    - includes cloud models
    - (will be) used also for predictions of e.g. dust emission
  - inversion methods, interstellar radiation field, ...

Modelling of dust emission from interstellar clouds

- *absorption cross section*
- *scattering cross section*
- *scattering law*
- *size distribution*
- *specific heats*

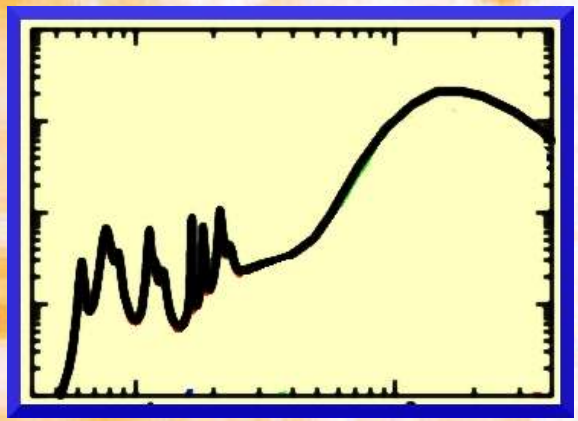
dust model

- *density distribution*

cloud model

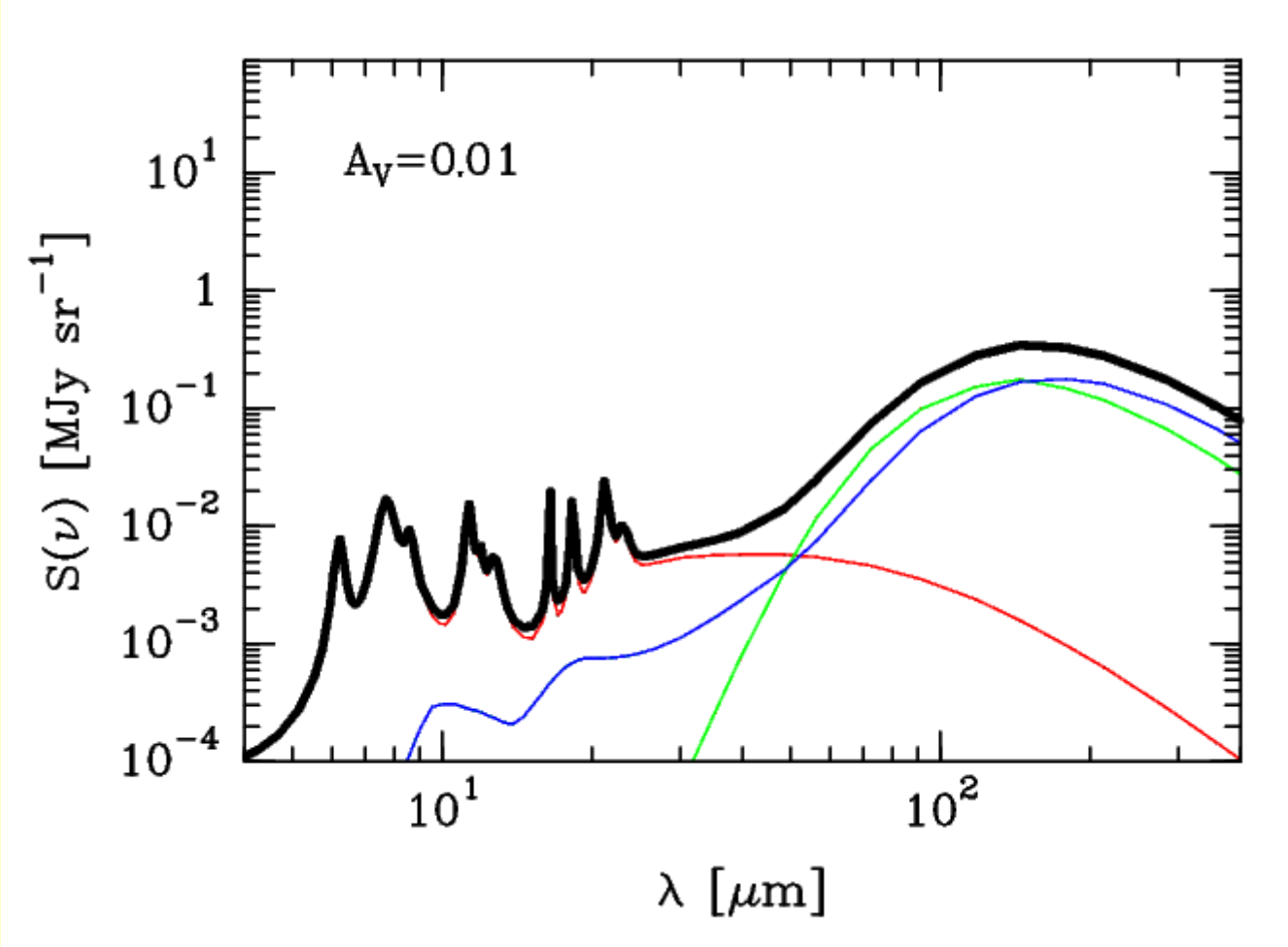
radiation field

radiative transfer



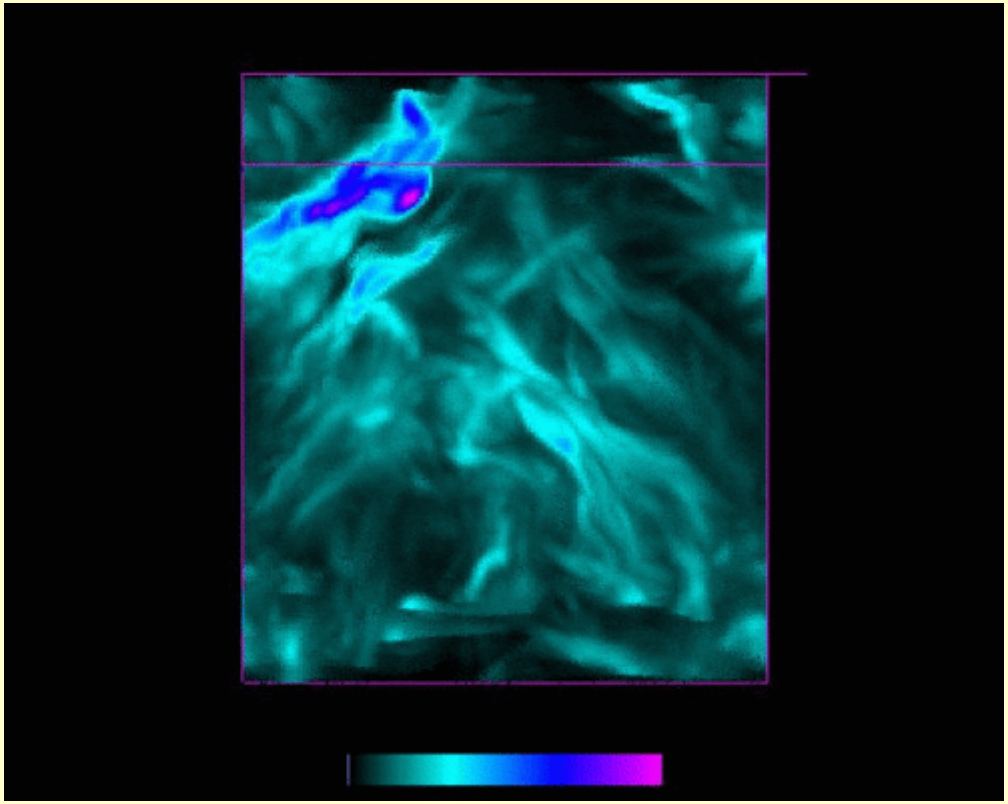
Li & Draine (2001)

- effect of optical depth (spherical cloud)



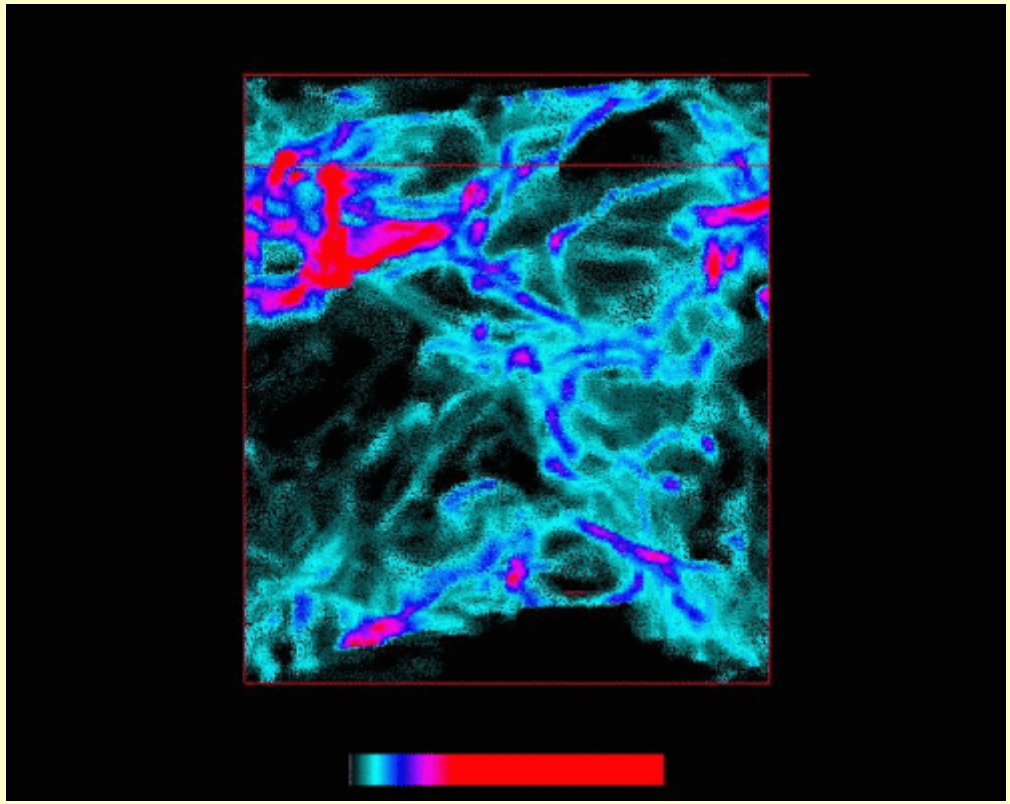
... cloud models

- $M_s = 2.5$



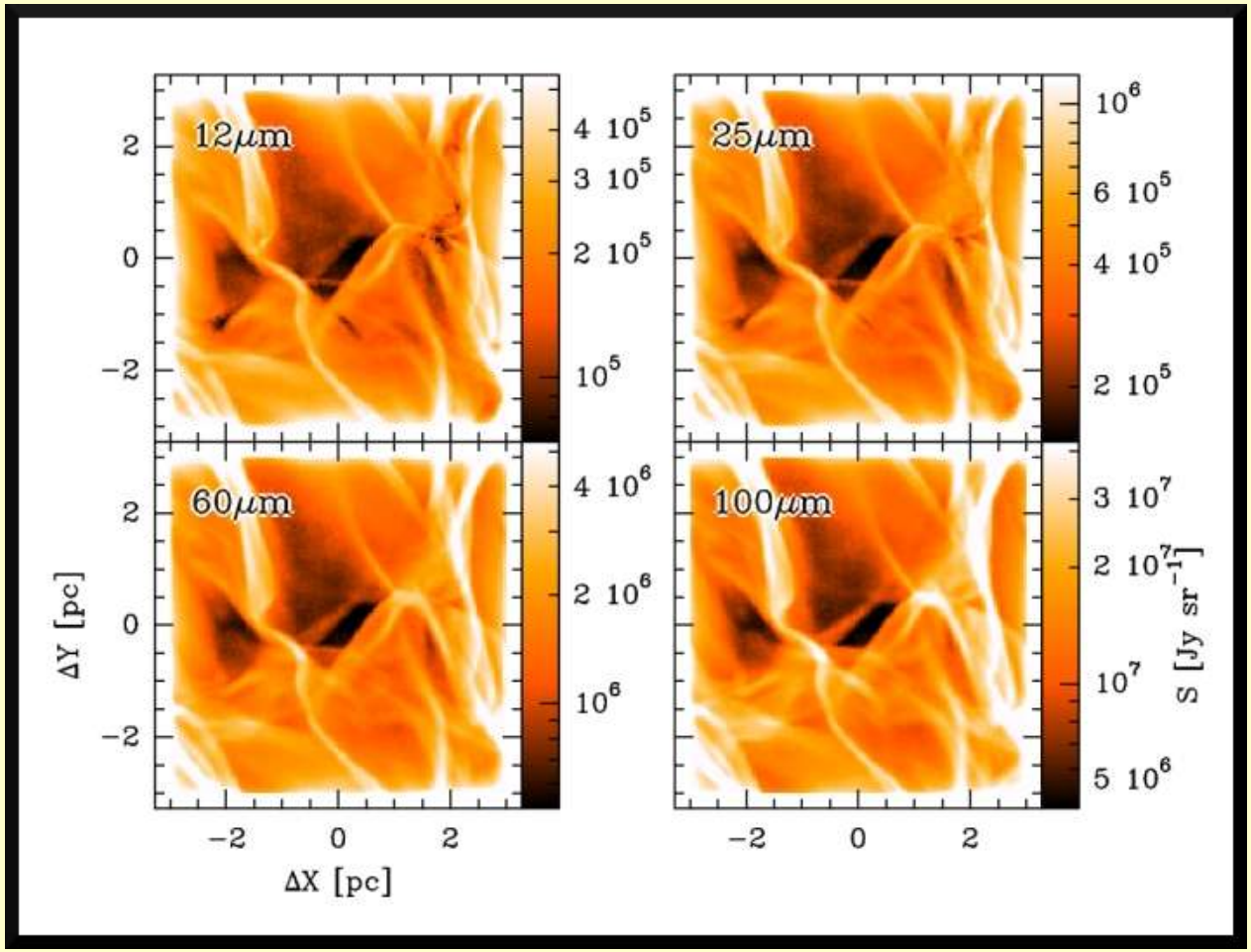
... cloud models

- $M_s = 10.0$



IV. First results Juvela & Padoan, 2003, A&A397, 201

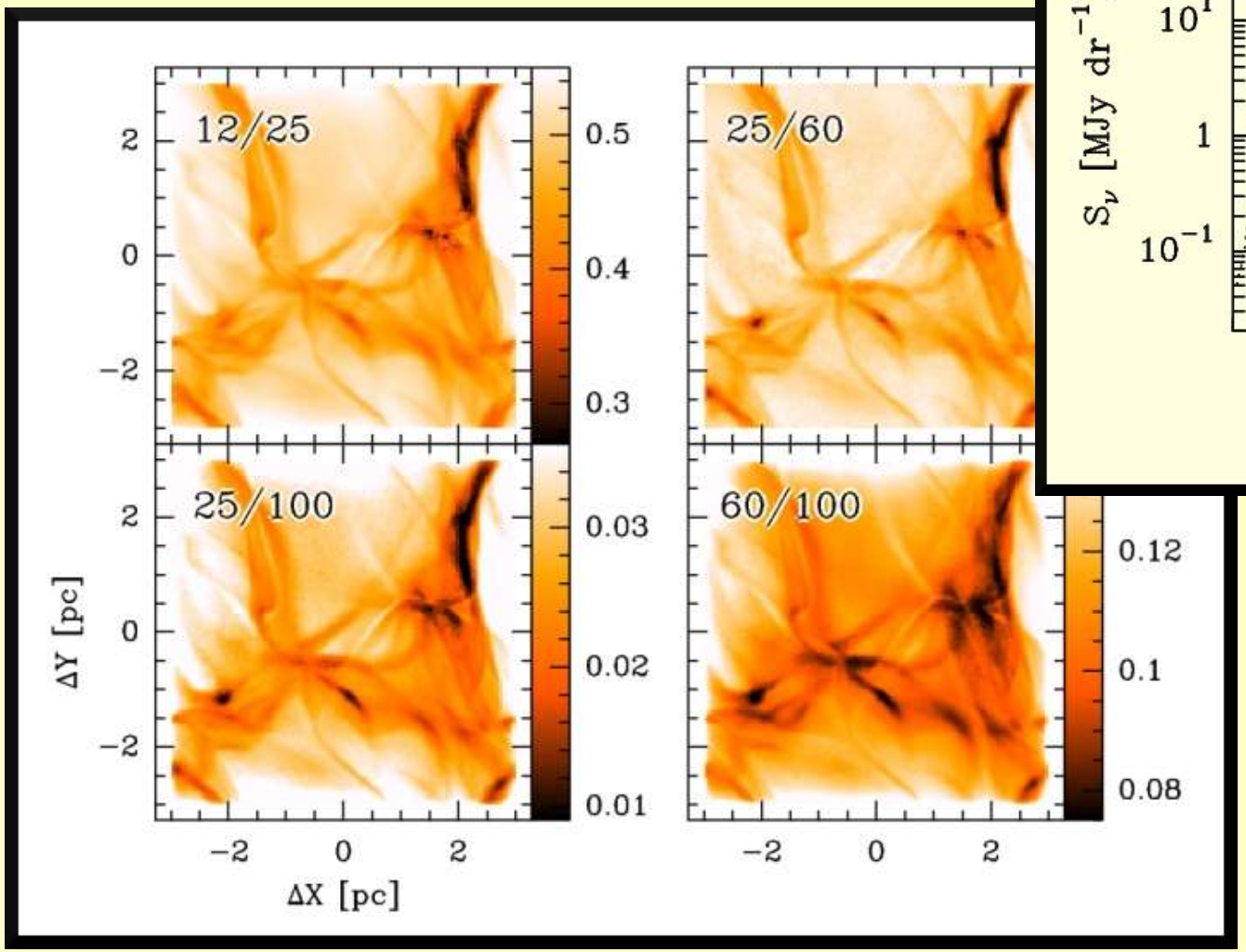
- MHD models and the Li & Draine dust model

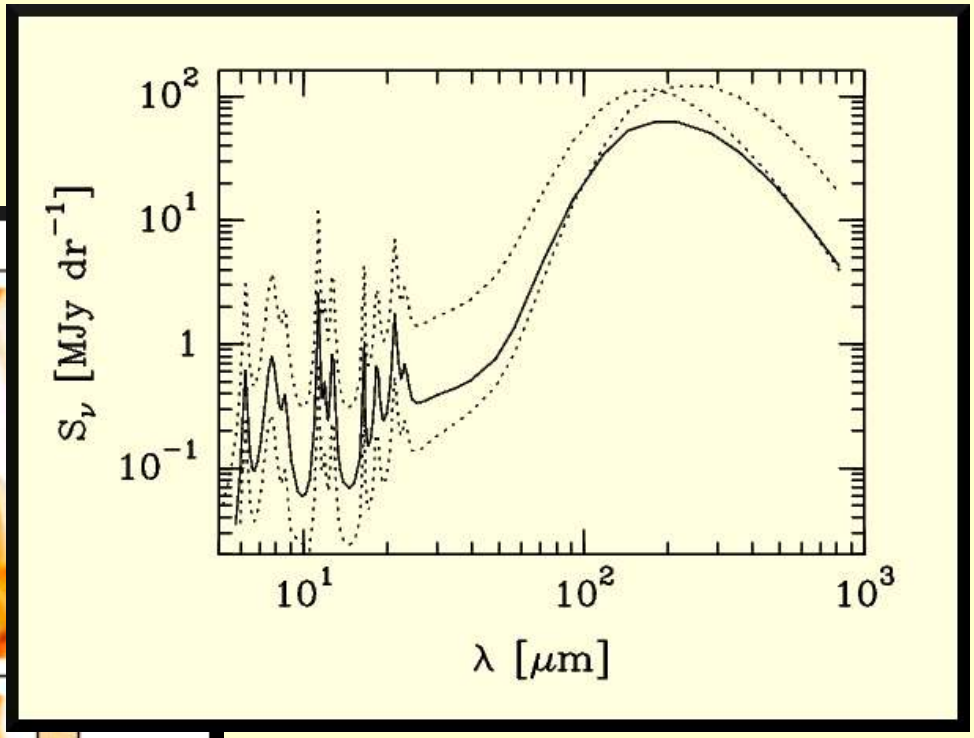


- M ~ 10
- $\langle A_V \rangle$ = 11
- L ~ 6pc
- $\langle n \rangle$ ~ 1280 cm^{-3}

... first results

- IRAS colour ratios





... FIR vs. A_V

- What happens when the size distributions are modified ?
- How to saturate 100μm emission and still keep enough emission at shorter wavelengths ?
- How to reconciliate the models with the observed anticorrelation between dust temperature and emissivity index β ?

WG 7.4 - polarized emission

- develop tools and generate synthetic data for studies of Galactic magnetic field
  - polarized dust emission and synchrotron
- develop algorithms for extracting 3D galactic field from 2D polarization maps

WG 7.5 – Coordination with Herschel

- Herschel satellite is launched together with Planck in 2007
  - 60-670μm
  - resolution ~1'
- it will make high precision pointed observations in infrared and far-infrared
- WG 7.5
  - coordination with Herschel Key Projects
  - exchange of data (interesting regions etc.)

WG 7.6 Galactic point sources

- late stages of stellar evolution
  - sample selection, detection predictions
  - ancillary observations, follow up
  - point source extraction

WG 7.7 Solar system objects

- estimates of observability and fluxes
  - several hundred main belt asteroids
  - a few comets
- predictions of source positions
- algorithms for detection of moving objects
- assists in the reconstruction of beam shapes (and pointing?) using planets