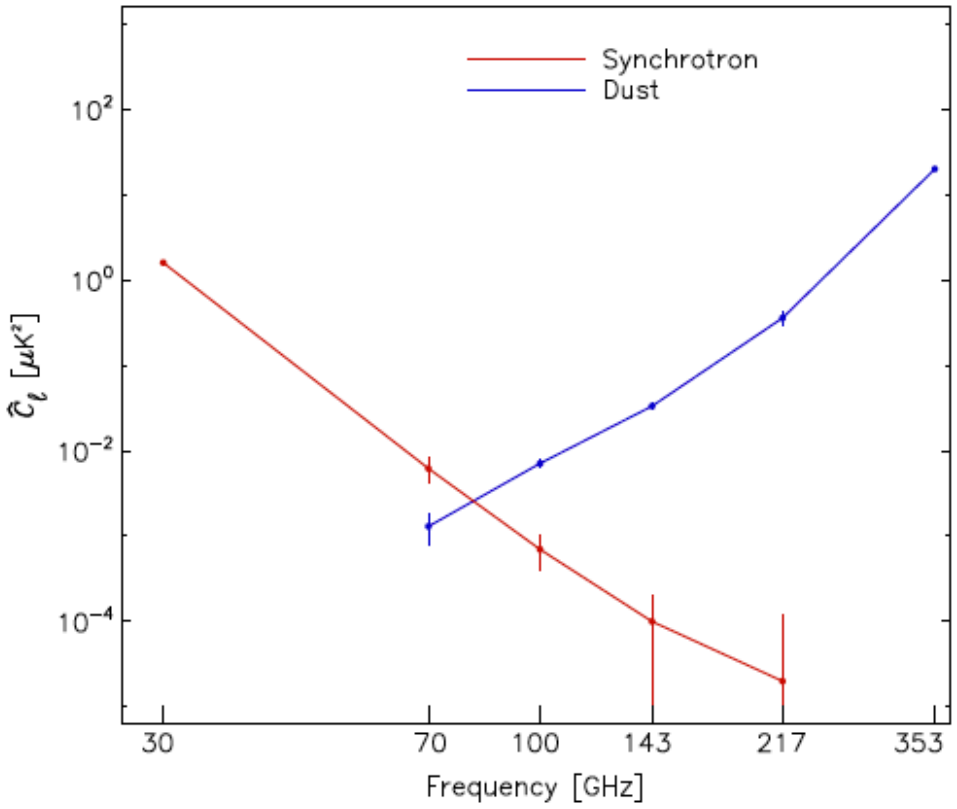
Foregrounds and component separation

J.L. Puget

Institut d'Astrophysique Spatiale

Polar foregrounds

- At frequencies >= 143 GHz, only one dominant foreground: dust
- for high sensitivity polar measurements (r value) we need to control both dust and synchrotron
- estimates of uncertainty on the projection coef (SED) is critical
- several instrument systematics are linked to foregrounds (leakages I to P)
- on the 2017 Planck HFI data processing we show first implementation of integrated map making and component separation

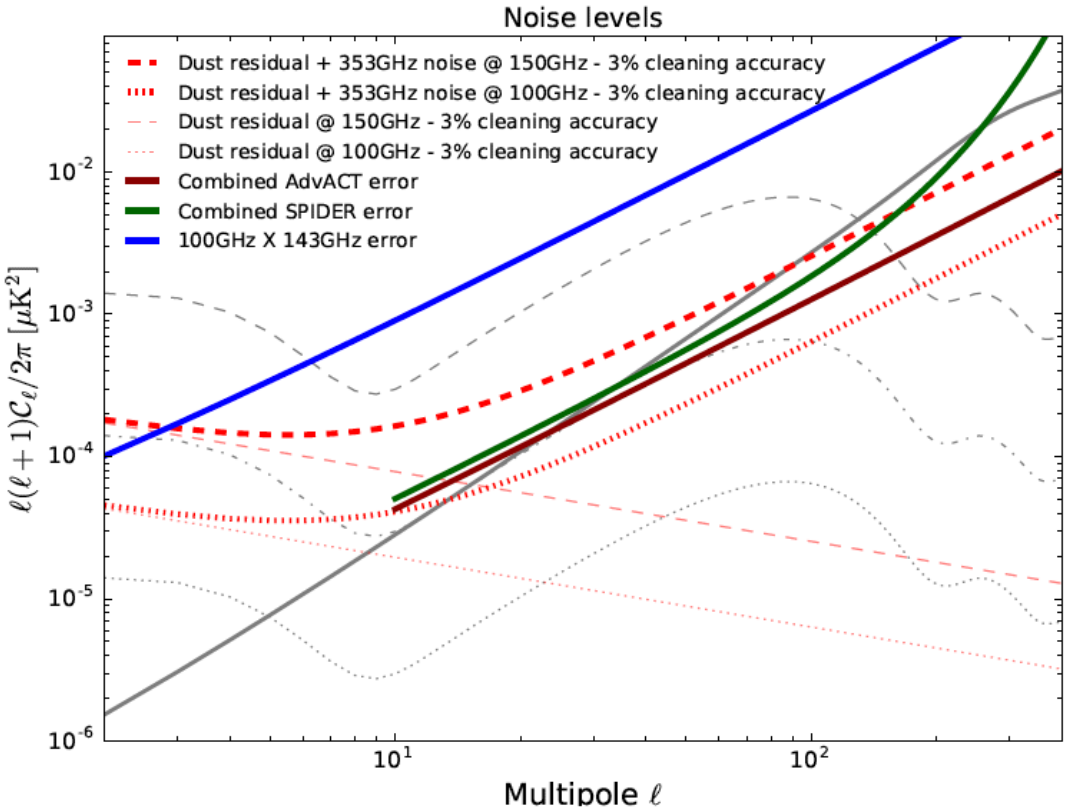


Component separation

- for B modes search foregrounds removal will become a major problem
- removal accuracy needs to be

  < 1% for r order 10^{-2}

  < 0.1% for r order 10^{-3}
- the SED are not stable over the sky (see talk by Josquin)
- decorrelation between frequencies measuring foreground and CMB is a key question
- need an absolute instrument or a way to very accurate differential measurement : solar dipole is one

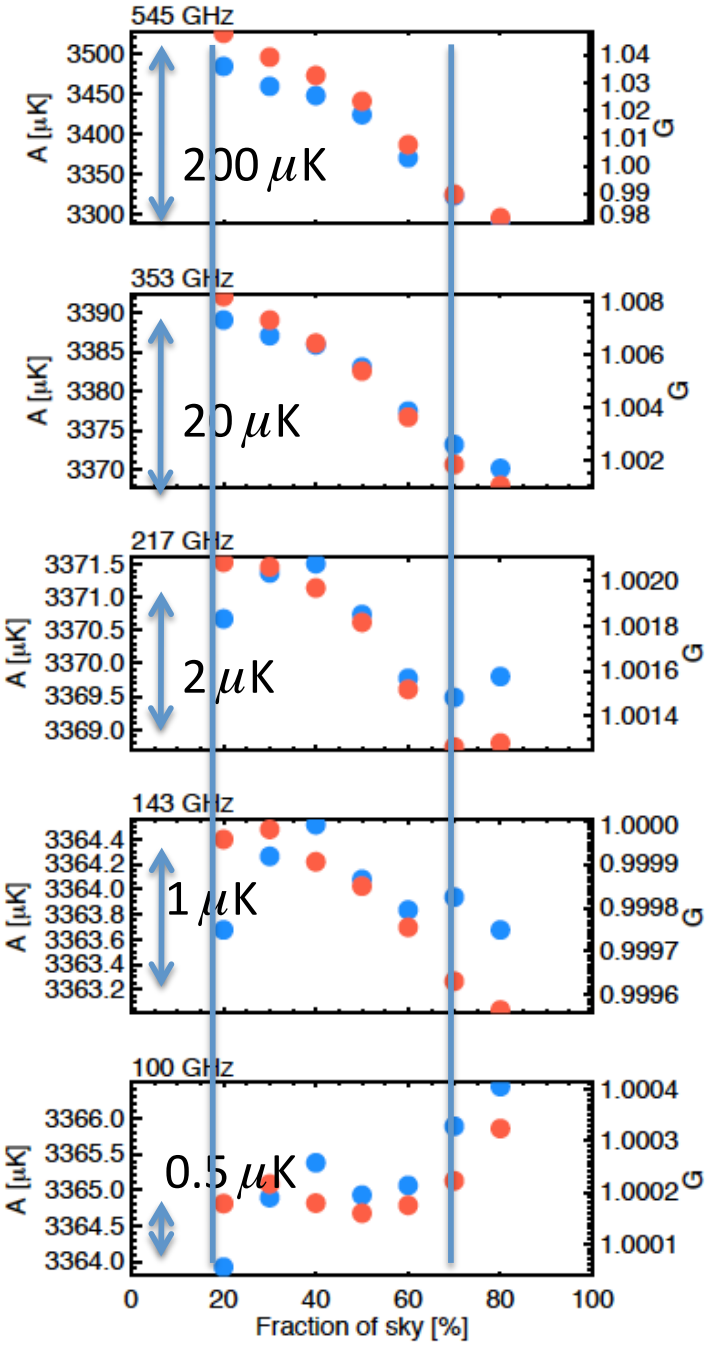


for white noise the best sensitivity is on the reionization peak when dust foreground residuale are brought below the noise

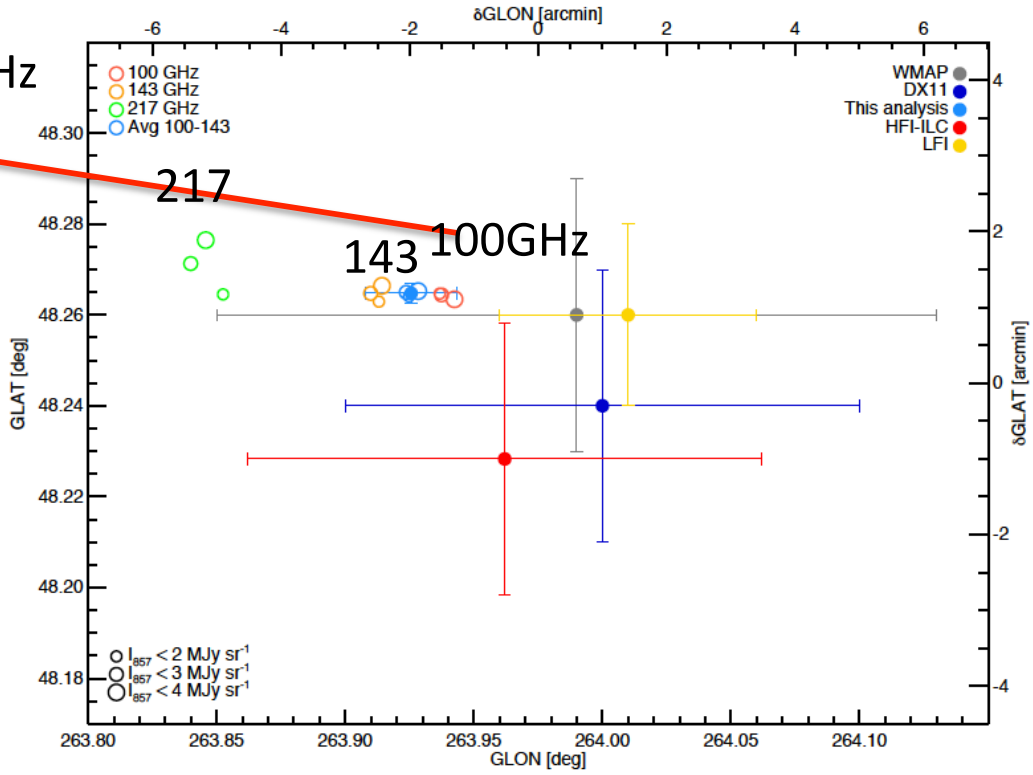
Optimisation of complementary observing tools

- improvements in CMB measurements from the ground will improve
- the non selection of Pixie leaves the foreground improvement road map to be reworked
- the ground dust measurents at high frequency willprobably be more limited by atmosphere
- balloons can do very good measurements but not all sky
- the 353 GHz noise only limit on r is 1.7 10^{-3} (95%) on the reionization peak (40% of the sky)
- Planck 2017 release demonstrate that very good but limited fsky are very useful
- extracted I to P leakage coefficients for CO the Taurus cloud maps
- reconstruct all sky map from Planck data
- same was demonstrated on dust on iterative process
- on synchrotron it did not wrk yet
- better maps coming (C-BASS, QUIJOTE)

Planck HFI 2016 solar dipole detemination

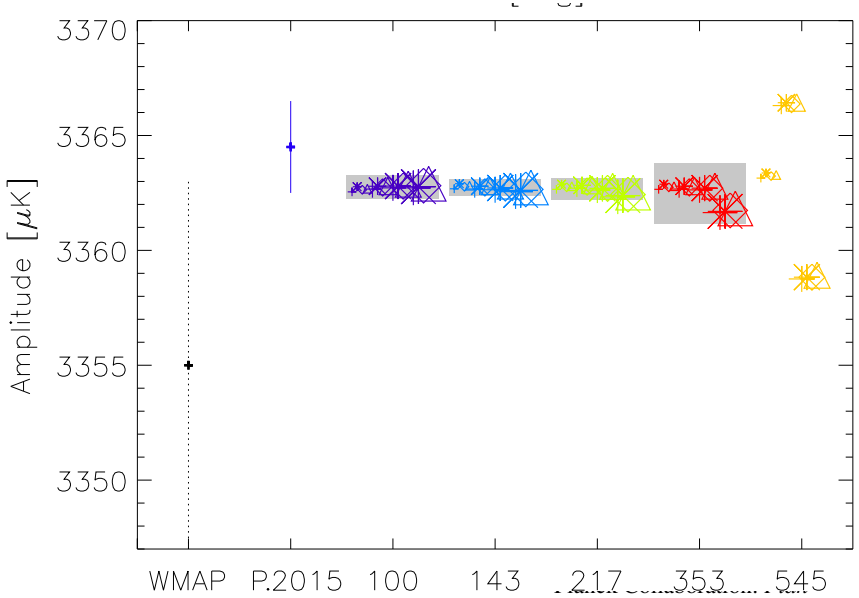


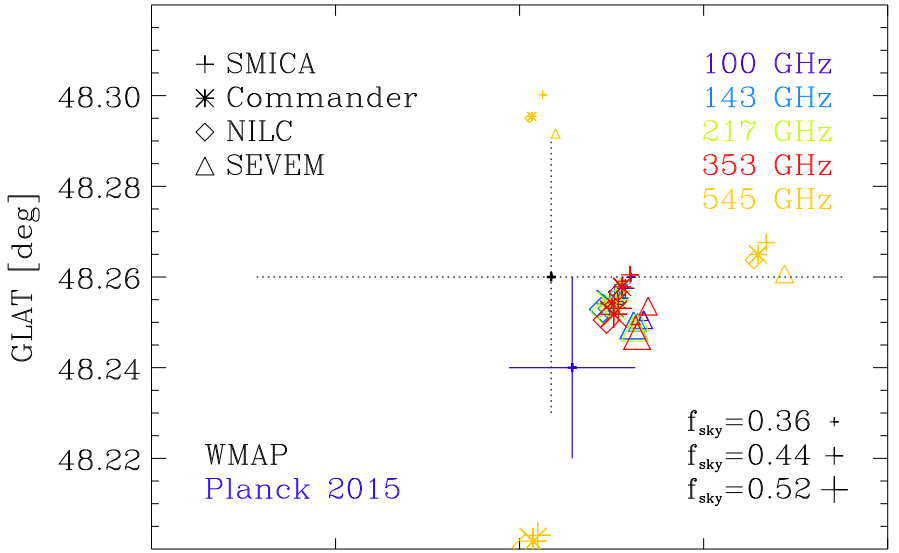
353 GHz

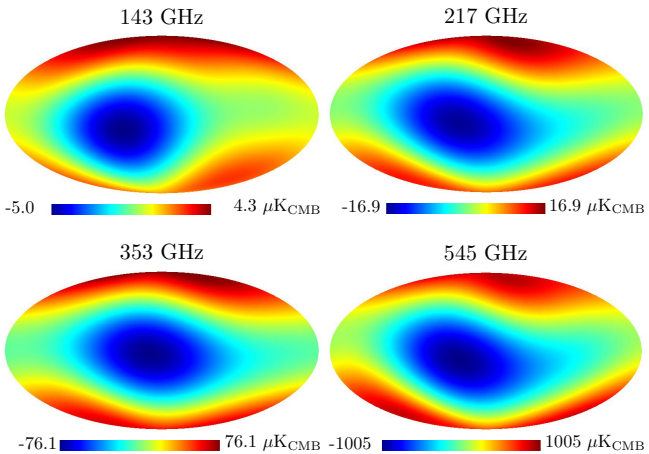


the 2017 solar dipole (preliminary)

amplitude= 3362.71 ± 0.09 μK(stat.) ± 0.35 μK(syst.),
GLON= 264°.021 ± 0°.003,
GLAT= 48°.253 ± 0°.001.







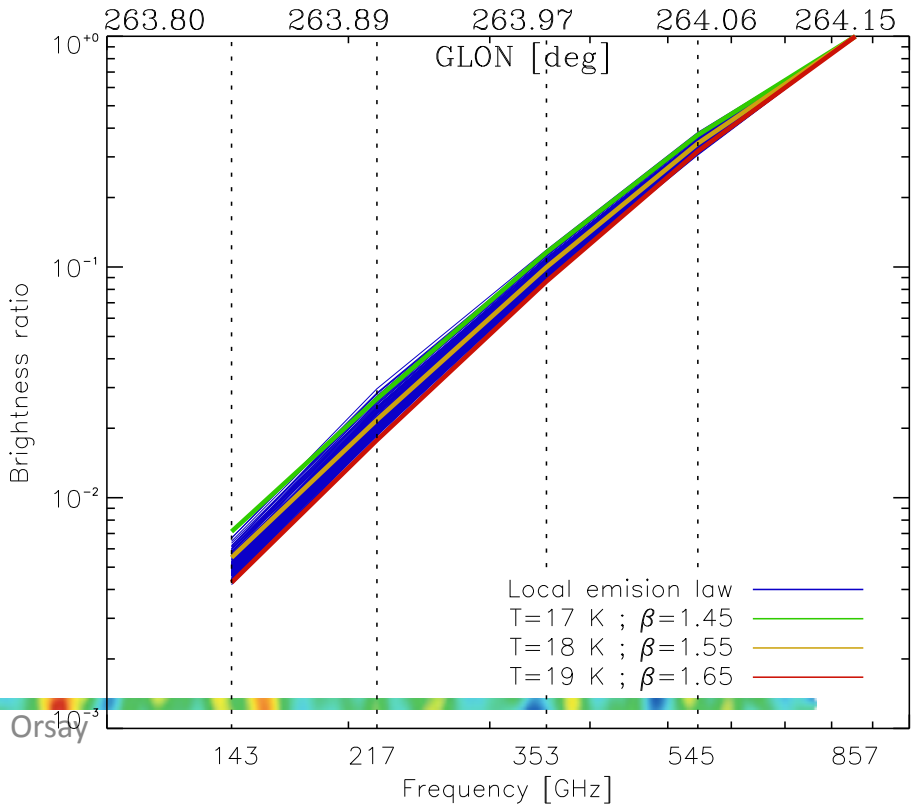
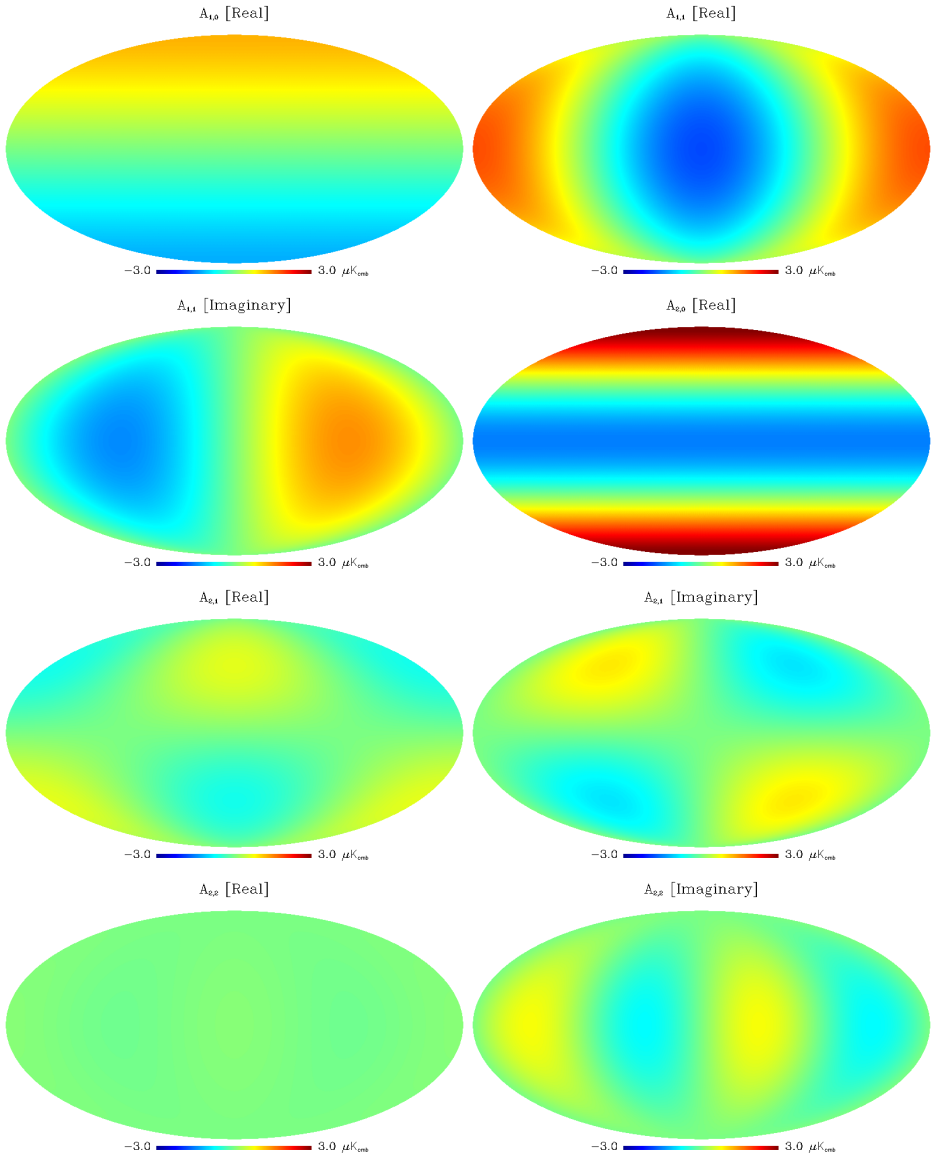


Fig. 17. Maps of the dust removal correction due to the SED variations for the four frequencies to which this correction is applied.

- Dust SED variation on the dipoles and quadrupoles: difference with the average
- dipole: mainly nearly galactic center/anticenter (3 μK), small North South asymetry
- most significant quadrupole terms galactic latitude dominates (5 μK)

@ 143 GHz



summary

- the l=1 and 2 SED variations revealed by the solar dipole analysis will lead to l=3,4,5 effects after sky cut (reionization peak); will affect limit r measurements
- these first demonstrated large scale SED variations could not have been demonstrated without the integrated work map-making/component separation