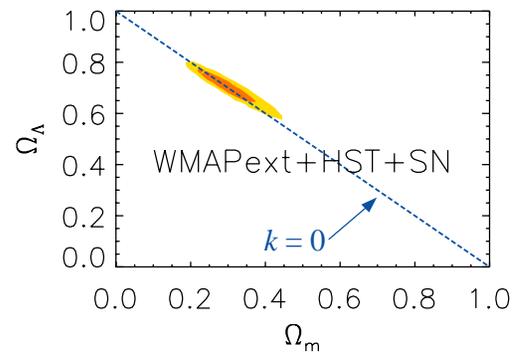
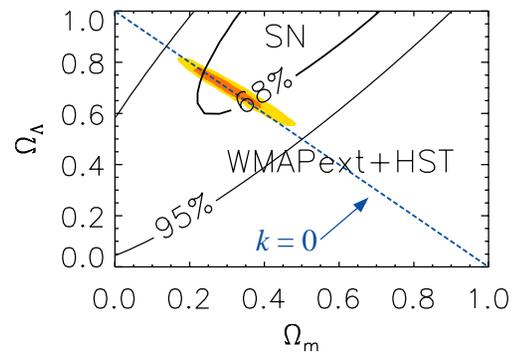
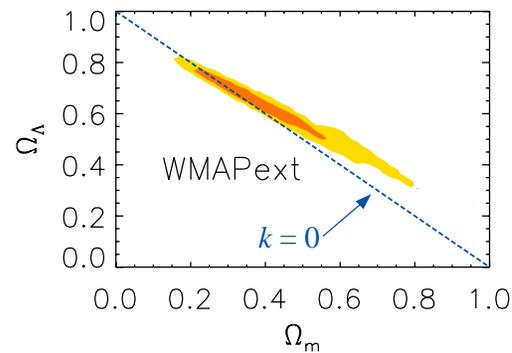
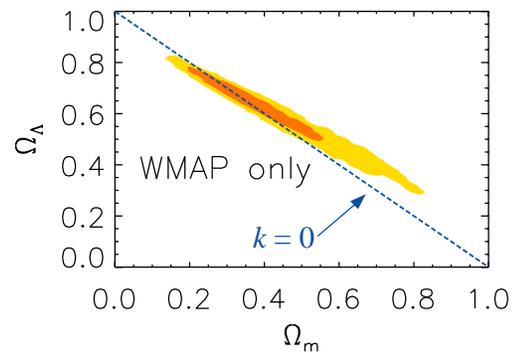


# REVIEWS, TABLES, AND PLOTS

## (Sports Section)

Don Groom Particle Data Group Berkeley Lab

... being an overview of changes and additions, and a discussion of some of the things I've worked on ...



Subject	'02	'04	Author (Caretaker)
<b>Constants, Units, Atomic and Nuclear Properties</b>			
1. Physical constants	Rev	Rev	Mohr & Wohl
2. Astrophysical constants	Rev	Rev	Dobbs (Groom)
3. International System of Units (SI)	<i>u</i>	<i>u</i>	Taylor (Wohl)
4. Periodic table of the elements	<del><i>u</i></del>	<i>r</i>	Wohl
5. Electronic structure of the elements	<i>r</i>	<i>u</i>	Martin (Wohl)
6. Atomic and nuclear properties of materials, <b>AtomicNuclearProperties</b>	<b>R</b>	<i>u</i>	Groom
7. Electromagnetic relations	<i>u</i>	<i>u</i>	Wohl, Maxwell
8. Naming scheme for hadrons	<i>u</i>	<b>R</b>	Wohl
<b>Standard Model and Related Topics</b>			
9. Quantum chromodynamics	<b>R</b>	<b>R</b>	Hinchliffe (Yao)
10. Electroweak model and constraints on new physics	<b>R</b>	<b>R</b>	Erlar & Langacker (Barnett)
11. Cabibbo-Kobayashi-Maskawa quark mixing matrix	<b>R</b>	<i>r</i>	Gilman, Kleinknecht, Renk (Barnett)
12. <i>CP</i> violation in meson decays	<i>r</i>	<b>New</b>	Kirkby, Nir (Yao)

---

13. Neutrino mass, mixing, and flavor change	R	<i>Rev, moved</i>	Kayser (Miquel)
14. Quark model	<i>u</i>	Rev	Amsler, Wohl (Barnett)
15. Grand Unified Theories	<i>New</i>	<i>u</i>	Raby (Barnett)
16. Structure functions	New	R	Foster, Martin, Vincter (Miquel)
17. Fragmentation functions	New	r	Biebel, Nason, Weber (Miquel)
<b>Astrophysics and Cosmology</b>			
18. Experimental test of grav. theory	r	r	Damour (Groom)
19. Big-Bang cosmology	New	r	Olive & Peacock (Groom)
20. Big-Bang nucleosynthesis	New	<i>r</i>	Fields & Sarkar (Olive, Groom)
21. The cosmological parameters	<i>u</i>	<i>New</i>	Lahev & Liddle (Olive, Groom)
22. Dark matter	r	<i>New</i>	Drees & Gerbier (Olive, Groom)
23. Cosmic background radiation	r	<i>New</i>	Smoot & Scott (Olive, Groom)
24. Cosmic rays	r	<i>u</i>	Gaisser & Stanev (Groom)

---

## Experimental Methods and Colliders

- |   |          |            |                                 |
|---|----------|------------|---------------------------------|
| 25. Accelerator physics of colliders    | r        | r          | Desler & Edwards (Groom)        |
| 26. High-energy collider parameters     | r        | r          | Many informants ( <b>Dahl</b> ) |
| 27. Passage of particles through matter | Rev      | <i>u</i>   | Bichsel, Groom, Klein           |
| 28. Particle detectors                  | r        | <b>Rev</b> | Many authors (Groom)            |
| 29. Radioactivity, radiation protection | <i>u</i> | <i>u</i>   | Donahue & Fassò (Groom)         |
| 30. Commonly used radioactive sources   | <i>u</i> | <i>u</i>   | Browne (Groom)                  |

## Mathematical Tools and Statistics, Monte Carlo, Group Theory

- |   |          |          |                      |
|---|----------|----------|----------------------|
| 31. Probability   | Rev      | r        | Cowan (Miquel)       |
| 32. Statistics  | Rev      | r        | Cowan (Miquel)       |
| 33. Monte Carlo techniques  | <i>u</i> | r        | Cowan, Miquel        |
| 34. MC particle numbering scheme  | R        | R        | Trippe & consultants |
| 35. Clebsch-Gordan coefficients, spherical harmonics, and $d$ functions | <i>u</i> | <i>u</i> | Wigner (Wohl)        |
| 36. SU(3) isoscalar factors and representation                          | <i>u</i> | <i>u</i> | Kelly (Wohl)         |
| 37. SU( $n$ ) multiplets and Young diagrams                             | <i>u</i> | <i>u</i> | Wohl                 |

---

## Kinematics, Cross-Section Formulae, and Plots

- |   |     |          |                       |
|---|-----|----------|-----------------------|
| 38. Kinematics  | r   | <i>u</i> | Jackson (Yao)         |
| 39. Cross-section formulae for<br>specific processes  | r   | <i>u</i> | Cahn (Yao)            |
| 40. Plots of cross sections and related<br>quantities | Rev | R        | Many authors (Miquel) |
- 
- 

— plus 47 more specialized “minireviews” in the Full Listings

### NOTATION:

*u* = *Unchanged*

r = Small changes and/or error corrections

R = Substantial revision and/or addition

Rev = Basically a rewrite

Primary or most recent author is given

AtomicNuclearProperties:  
Work in progress (someday)



Material: Polyimide film [C<sub>22</sub>H<sub>10</sub>N<sub>2</sub>O<sub>5</sub>]<sub>n</sub>

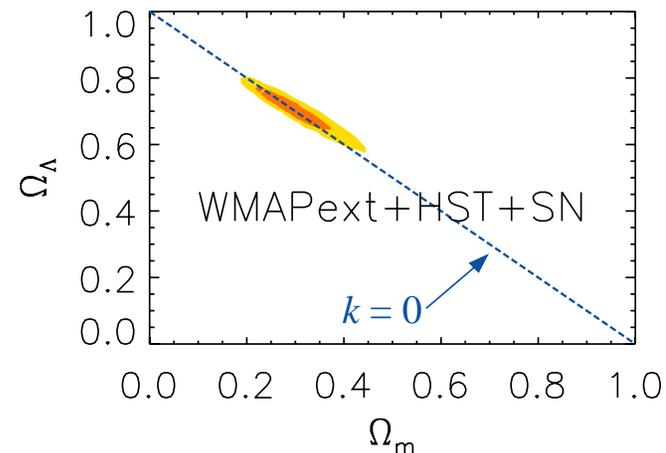
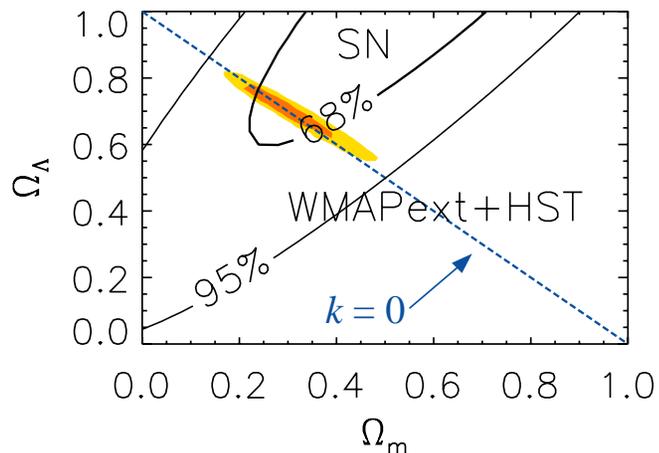
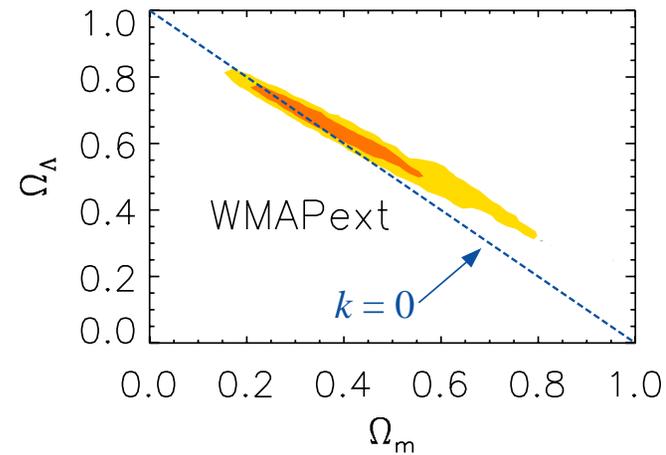
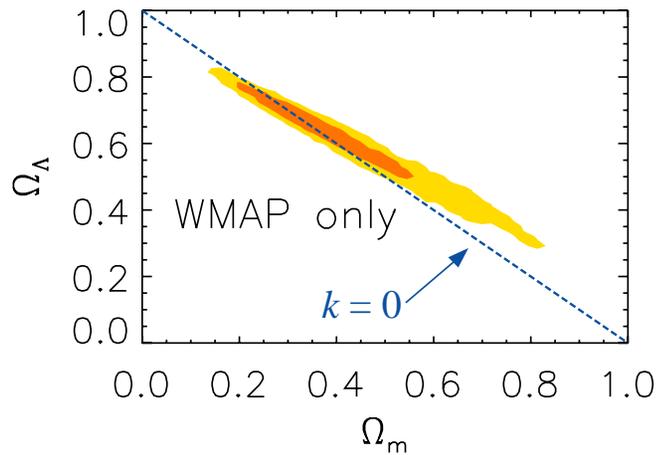
Quantity	Value	Units
<Z/A>	0.51264	
Density:	1.420	g cm <sup>-3</sup>
Minimum ionization:	1.820	MeV g <sup>-1</sup> cm <sup>2</sup>
Radiation length:	40.58	g cm <sup>-2</sup>
Radiation length:	28.57	cm
Critical energy (e):	(Under construction)	MeV
Molière radius:	(Under construction)	g cm <sup>-2</sup>
Molière radius:	(Under construction)	cm
Muon critical energy:	1050.	GeV

Composition:

Elem	Z	Atomic frac*	Weight frac
H	1	10.000000	0.026362
C	6	22.001366	0.691133
N	7	2.000071	0.073270
O	8	5.000195	0.209235

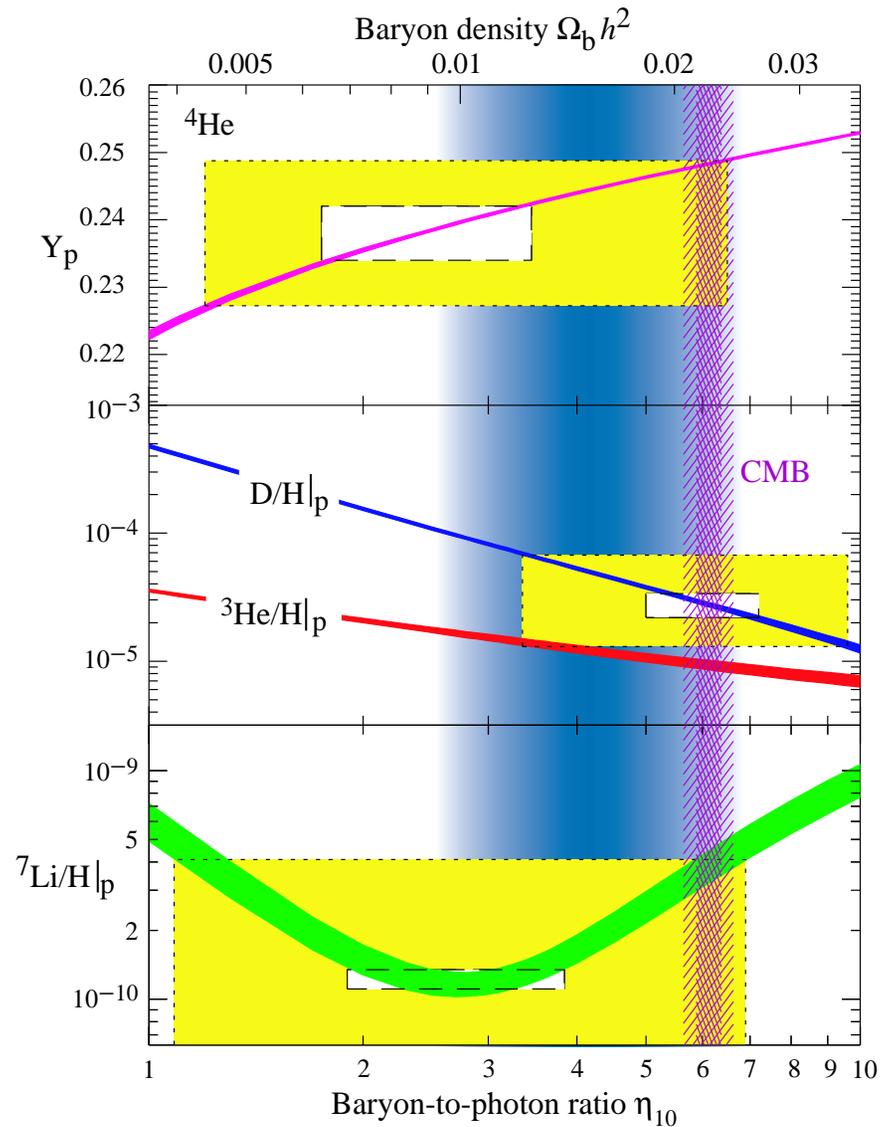
\* calculated from weight fraction data.

## Astrophysics and Cosmology: WMAP has changed everything!



From Olive & Peacock's revision of "Big-Bang cosmology;" their figure is from Spergel *et al.*, astro-ph/0302209

BBN (Fields and Sarkar) was revised, but it's hard to tell ...



*Cosmological Parameters*, by Over Lahev and Andrew Little, is brand new and was quite a struggle

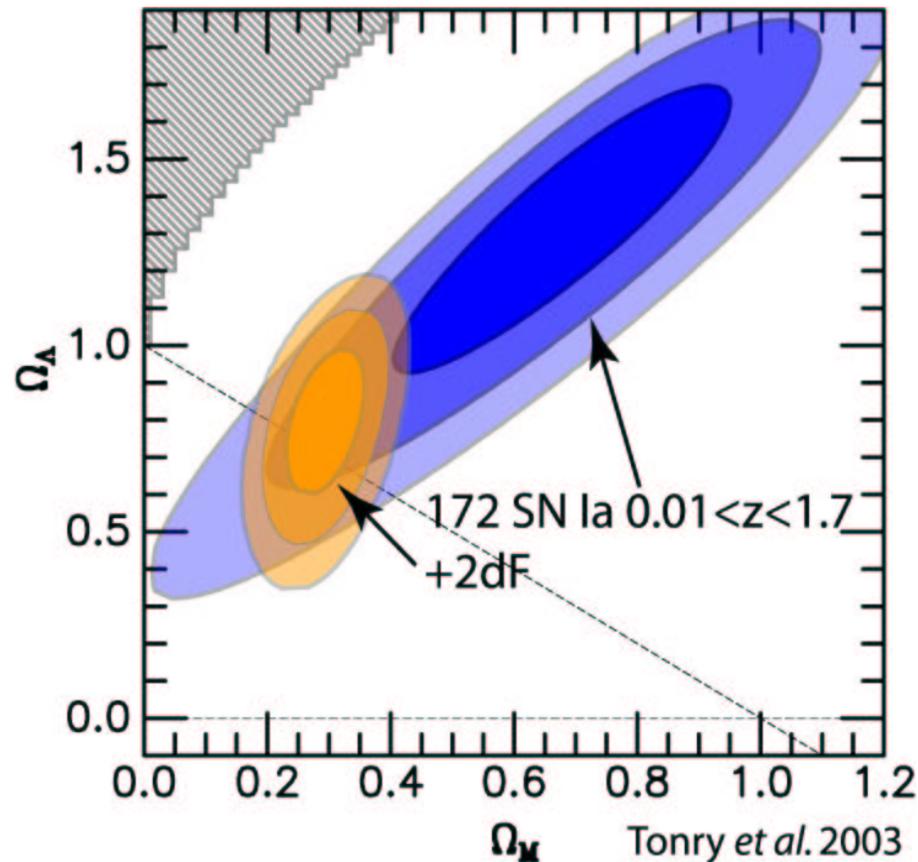
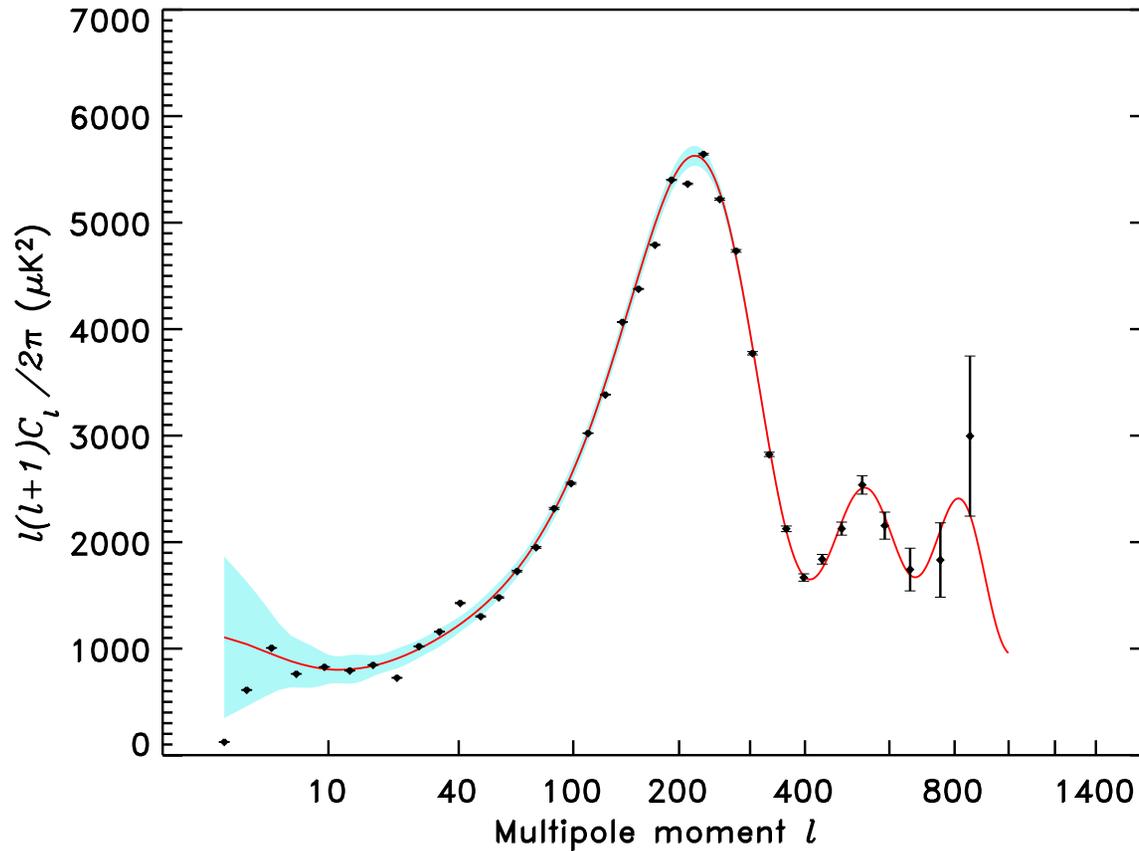


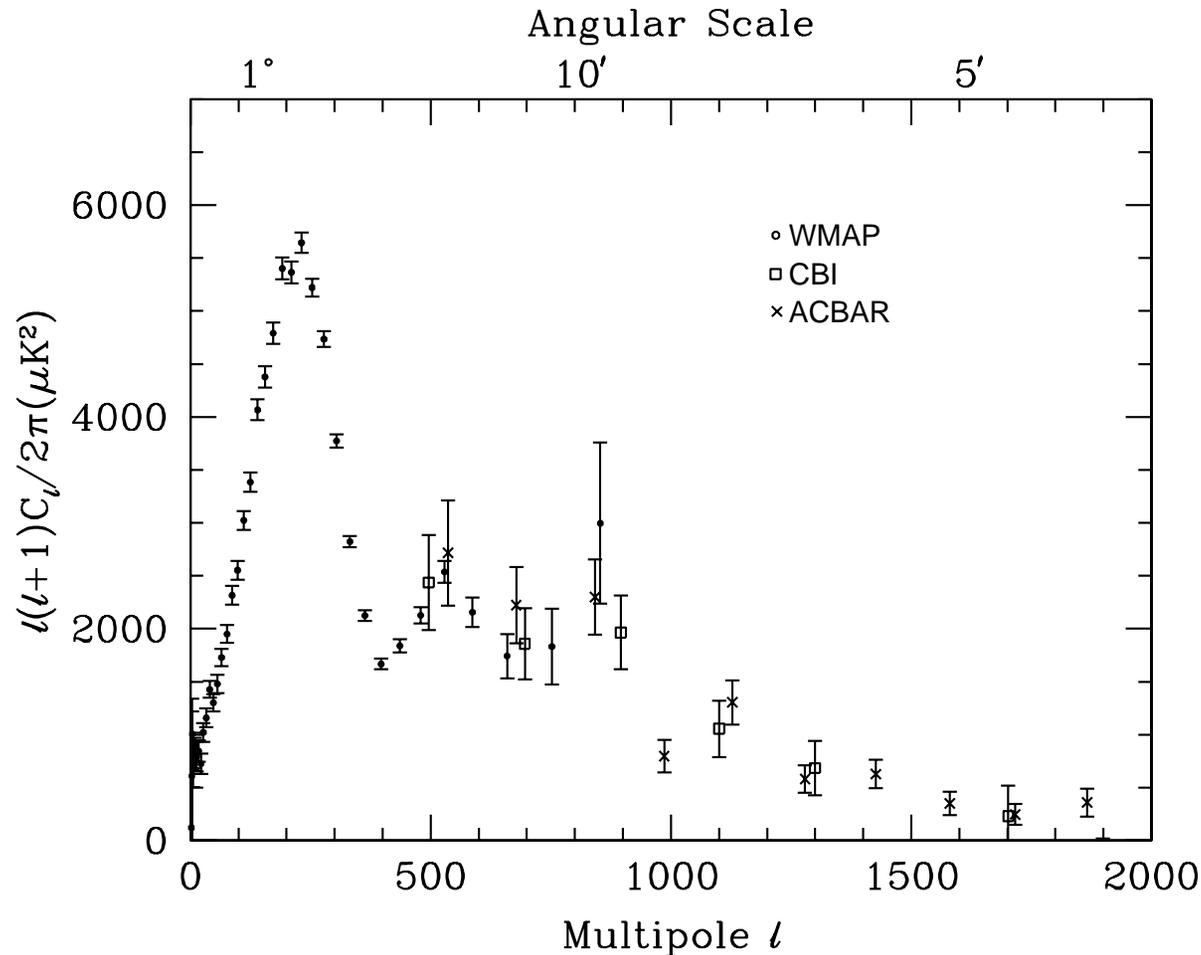
Fig. 21.2 (Note the contour tightening when the 2dF galaxy redshift power spectrum is added as a constraint)

*Cosmological Parameters*, Fig. 21.2. WMAP angular power spectrum.  
Compare with RPP02, Fig. 22.6!



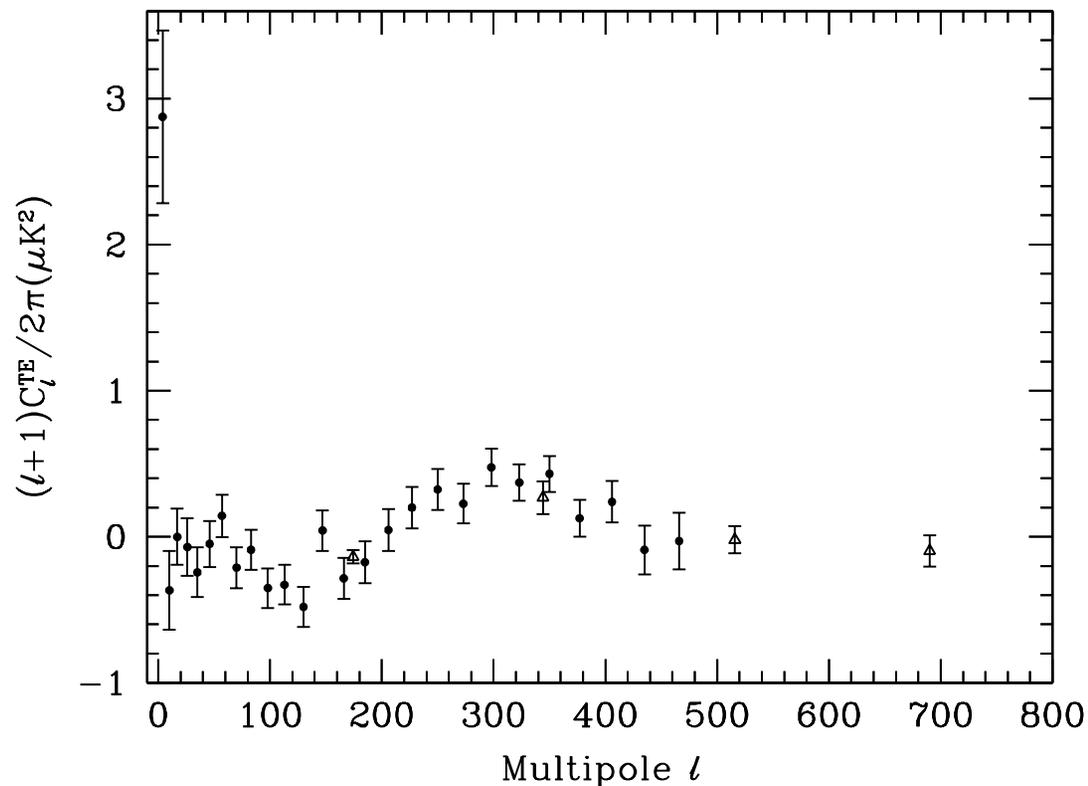
Douglas Scott and George Smoot (note order) wrote a grounds-up new CMB review, under threat of us hiring new authors if they just revised the old one

Figure 23.2 below is the same as the last one except for a linear scale and that binned data from three experiments is shown instead of the WMAP error band



**CMB Fig. 23.3:** Cross-power spectrum of temperature anisotropies in the E-mode polarization signal

**Glimpses of things to come:** Now there is convincing detection of CMB polarization from several detectors, beginning with DASI. Four potentially non-zero cross-power spectra can be extracted, among other things giving evidence of earliest star formation at  $z \approx 20$ . **We look forward to RPP06!**



## *Particle Detectors*

A partly filled shopping list!

First the good news:

- **Inorganic scintillators** has been rewritten and expanded by *Renyuan Zhu* and **Craig Woody**. Craig will retire, and new coauthor Renyuan will take over this section starting with RPP06
- There are *two* new **Cherenkov detector** reviews:
  - Overview and accelerator-based detectors by **Blair Ratcliff**
  - Cherenkov tracking detectors (underground detectors) by **Dave Casper**
- **Electromagnetic calorimeters**  
An entirely new (and excellent!) review by **Renyuan Zhu**

## *Particle Detectors*

### And now the bad:

- **RPC's:** We finally identified the appropriate expert after a few referrals, and he readily agreed to write the review. We never heard from him again
- **Hadron calorimeters:** A rewrite for the next edition is promised. Right now the physics isn't bad, but the examples are old
- **Photon detectors:** This has been a hangnail for a long time. It is easy to find specialized experts, but finding someone to describe **PMT's, SiPM's, hybrid photodiodes, hybrid avalanche photodiodes, electron bombarded CCD's, micro-machined vacuum photodetectors, metal register semiconductors, TMAE, etc., etc.** with some expertise has proven daunting. **Now there are several names, and now is the time to start on it**

That's all, folks!