Can we use gamma ray bursts to measure the cosmos?

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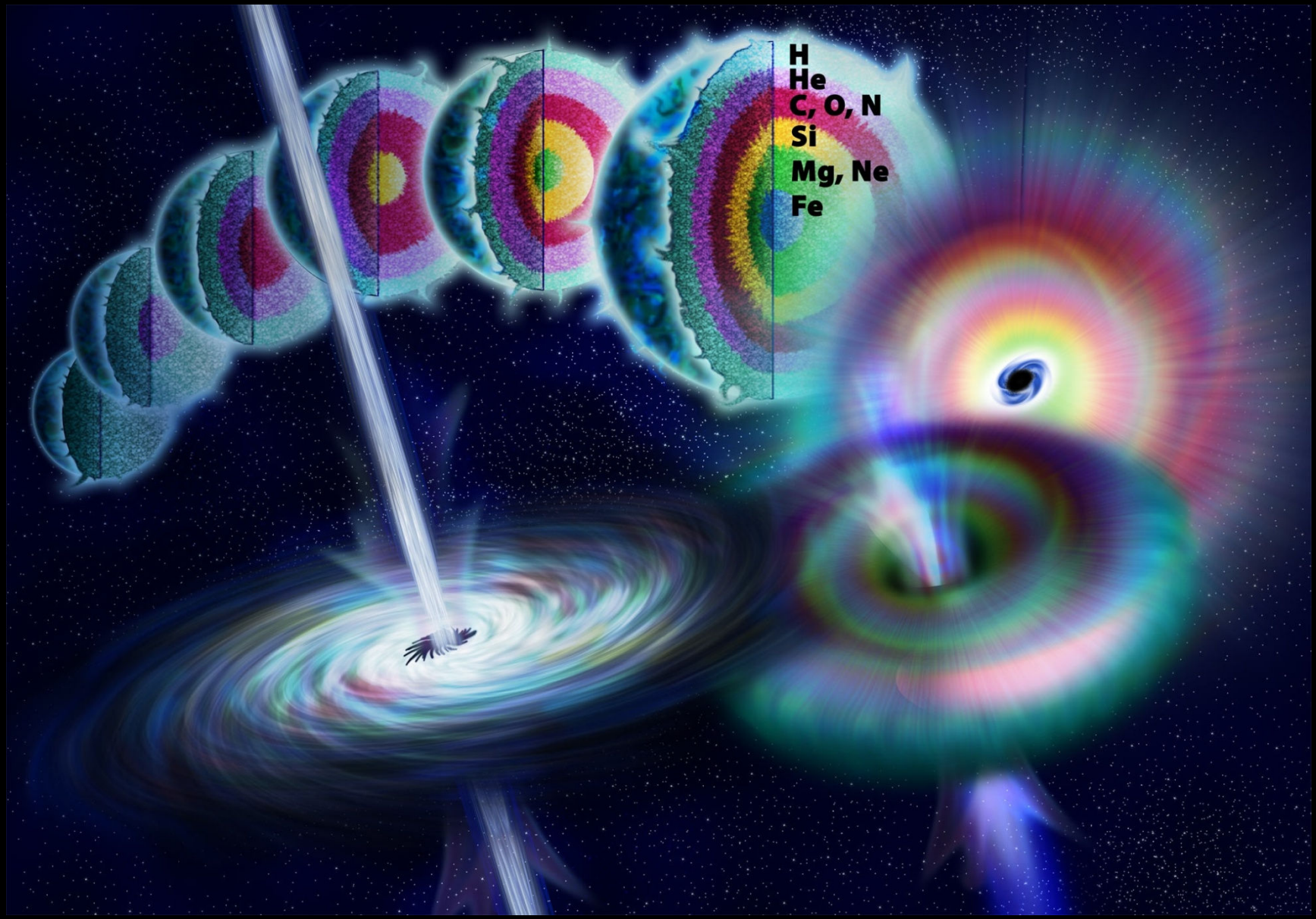
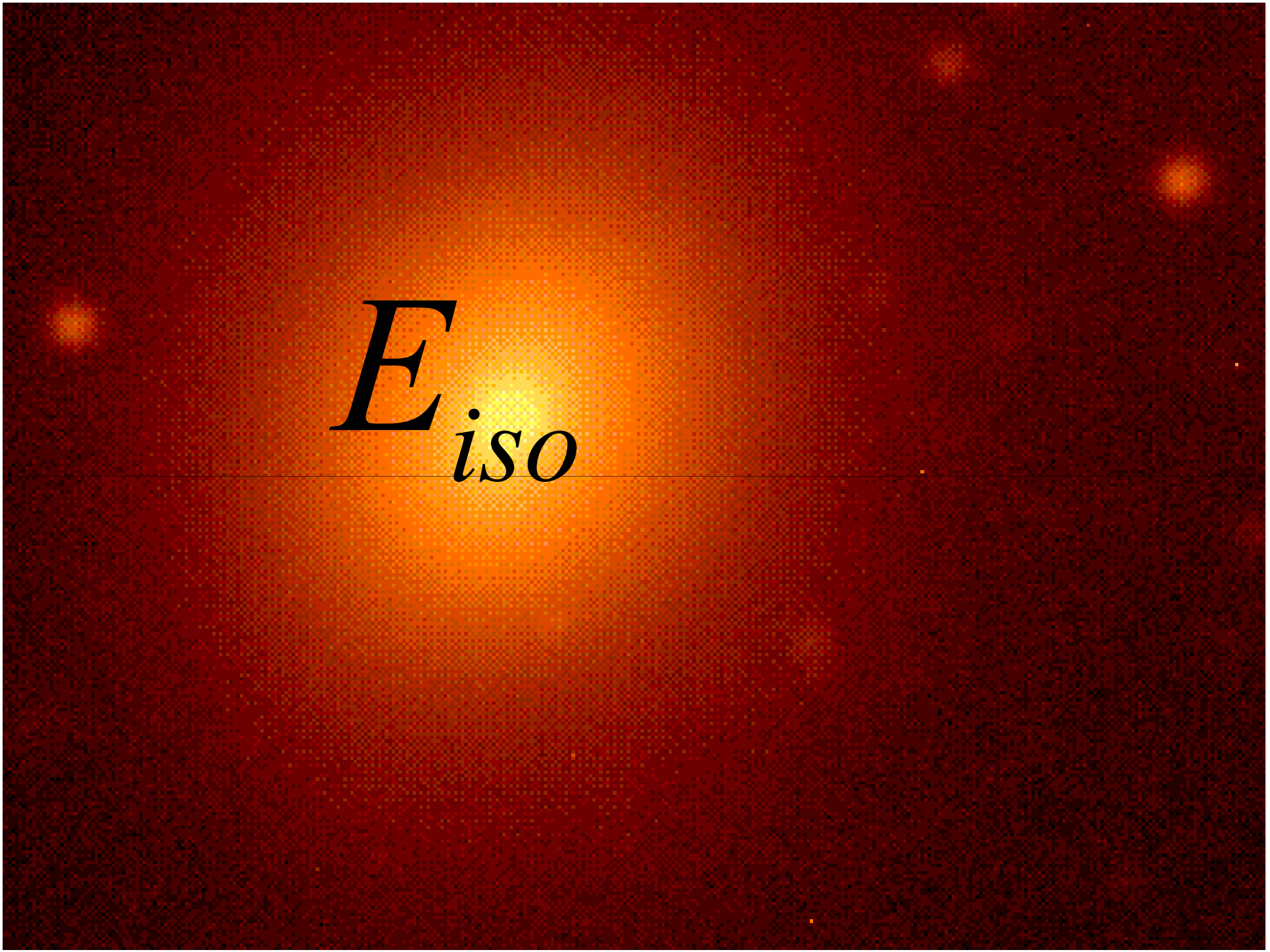
Preliminaries

- GRBs – most violent events in the universe
- Occur in high z – from after glow measurements
- Unlike supernovae, GRBs – not standard candles
- Many attempts to find correlations useful for cosmology


H
He
C, O, N
Si
Mg, Ne
Fe


E_{iso}

Some Attempts

$$E_{iso} \; Vs \; E_{peak} = (1+z) E_{peak}^{obs}$$

$$E_{\gamma} = (1-\cos\theta) E_{iso} \; Vs \; E_{peak}$$

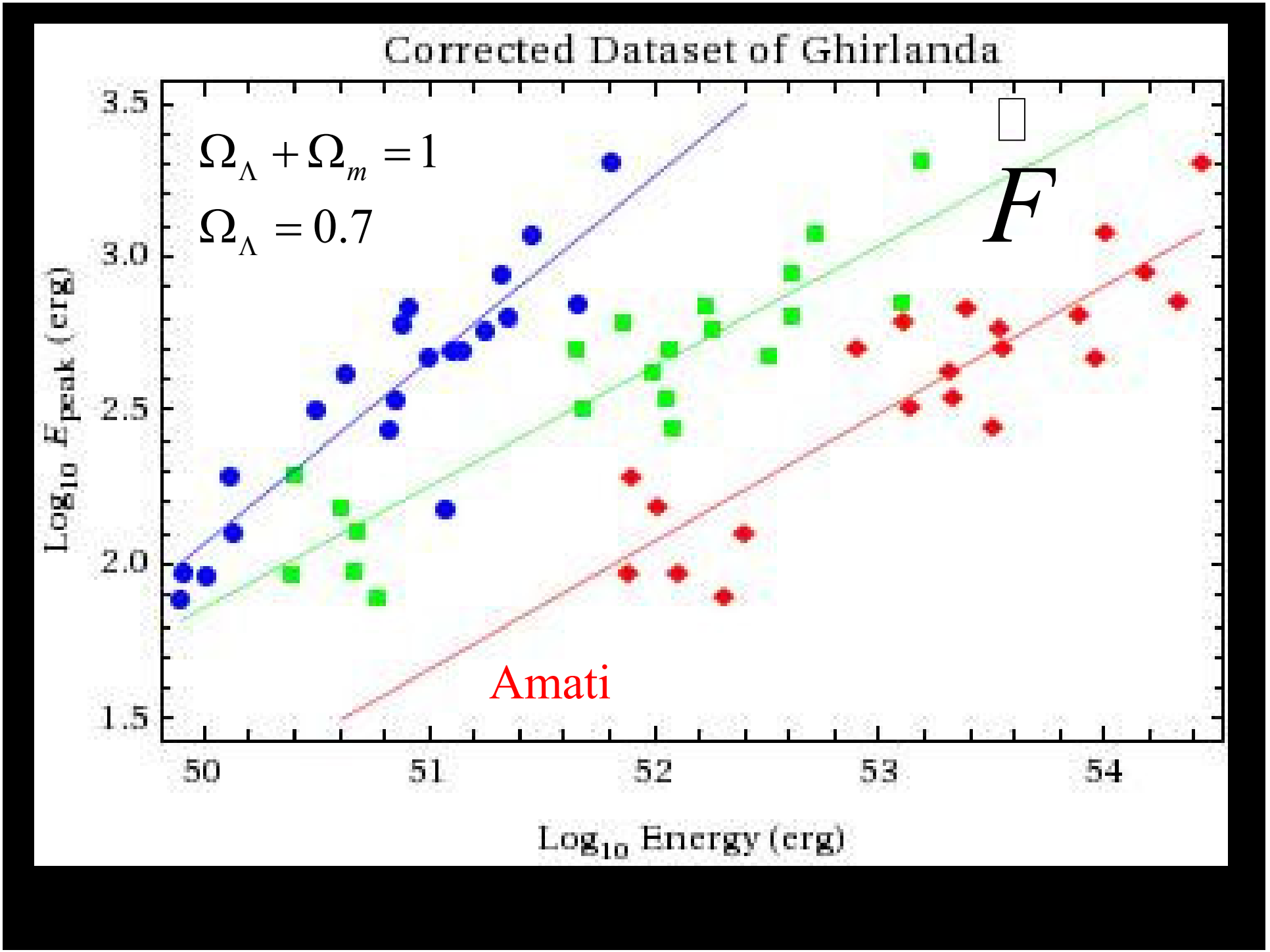
$$E_{peak} = Peak \; of \; \nu F_{\nu} \; spectrum$$

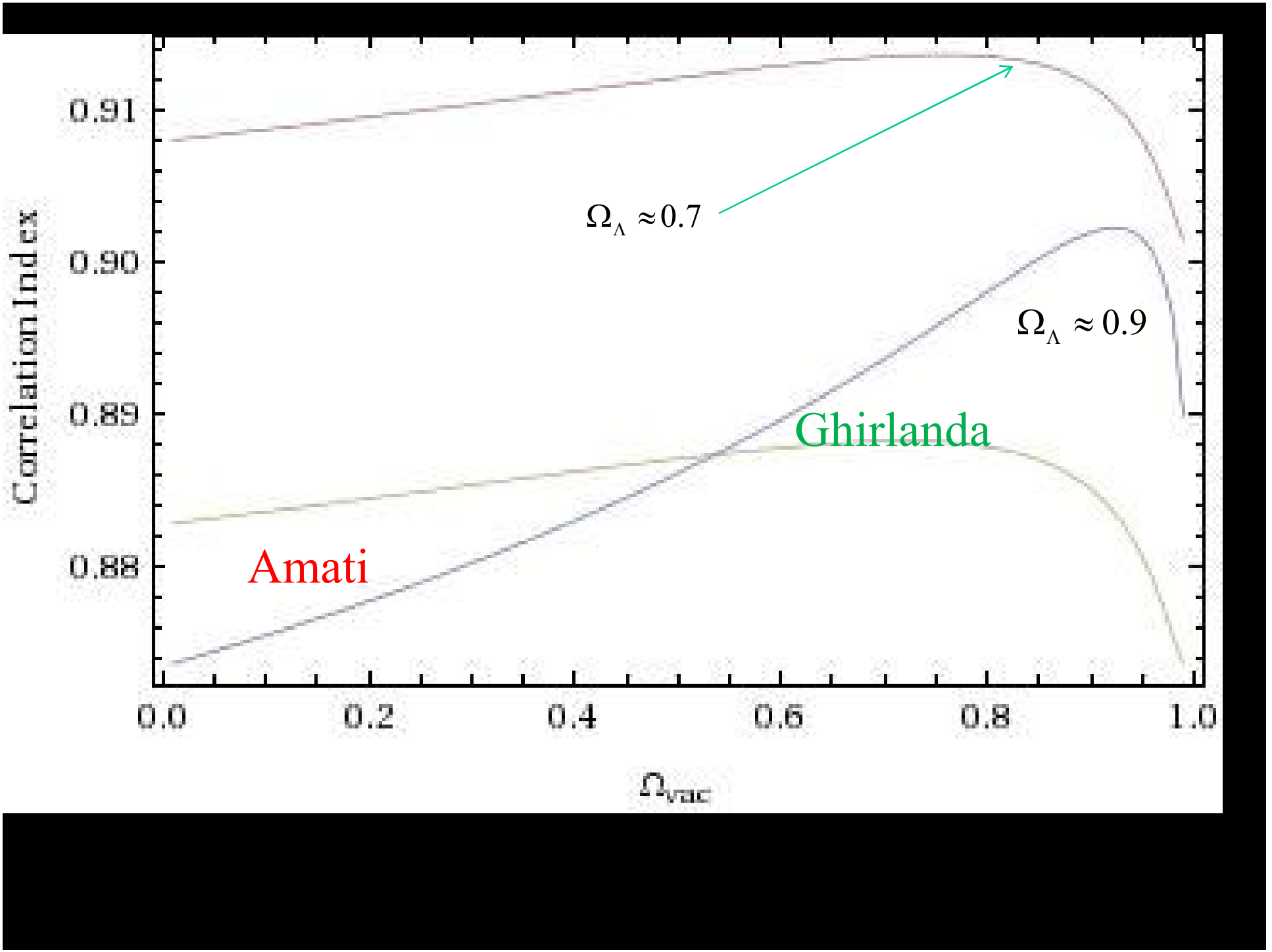
Ghirlanda, ApJ, 2004, 616
Amati, A&A, 2002, 390 & 2008 MNRAS, 391

Quick Calculation

$$dL = L\,J(E,t)\,dE$$

$$F_{obs} = \int\int dE\,dt_0\,\frac{L\,J(E_0.1+z)}{4\pi\,d_L^2} = \frac{\bar{F}\,(1+z)}{d_L^2}$$


Corrected Dataset of Ghirlanda
$\Omega_\Lambda + \Omega_m = 1$
$\Omega_\Lambda = 0.7$
F
Amati
$\mathrm{Log_{10}}\ E_{peak}$ (erg)
$\mathrm{Log_{10}}$ Energy (erg)
3.5
3.0
2.5
2.0
1.5
50
51
52
53
54


0.91
0.90
0.89
0.88
Correlation Index
$\Omega_\Lambda \approx 0.7$
$\Omega_\Lambda \approx 0.9$
Ghirlanda
Amati
0.0
0.2
0.4
0.6
0.8
1.0
Ω_{vac}

Conclusions

- Easy to get our correlation (Amati type)
- Seems ours has the tightest correlation

If tightness believed

- Ghirlanda peaks at the wrong place
- Inconsistent with other cosmological measures

- Beaming model might not be accurate

If tightness believed

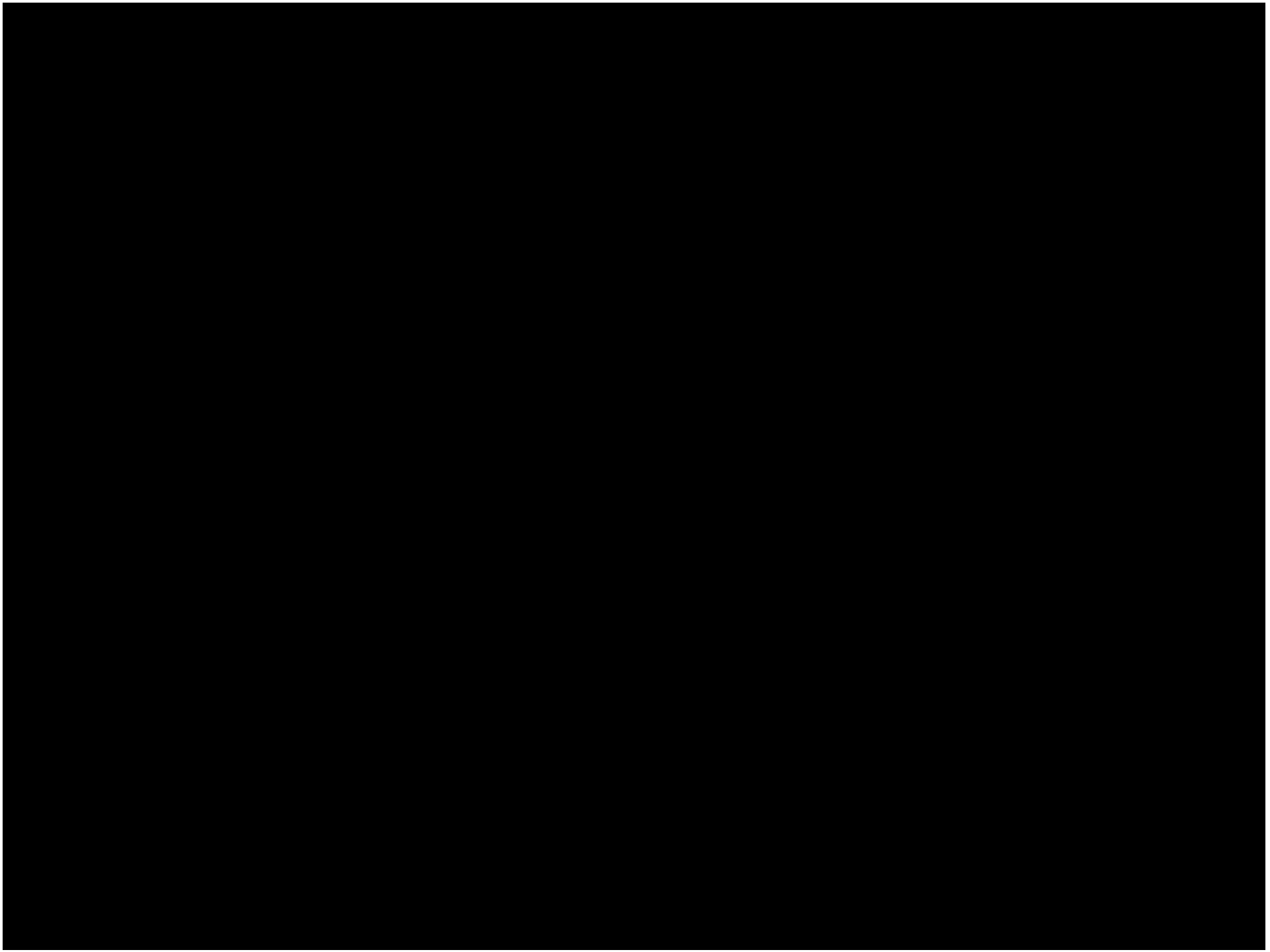
- Ours and Amati's peak at the right place
- Consistent with other cosmological measures

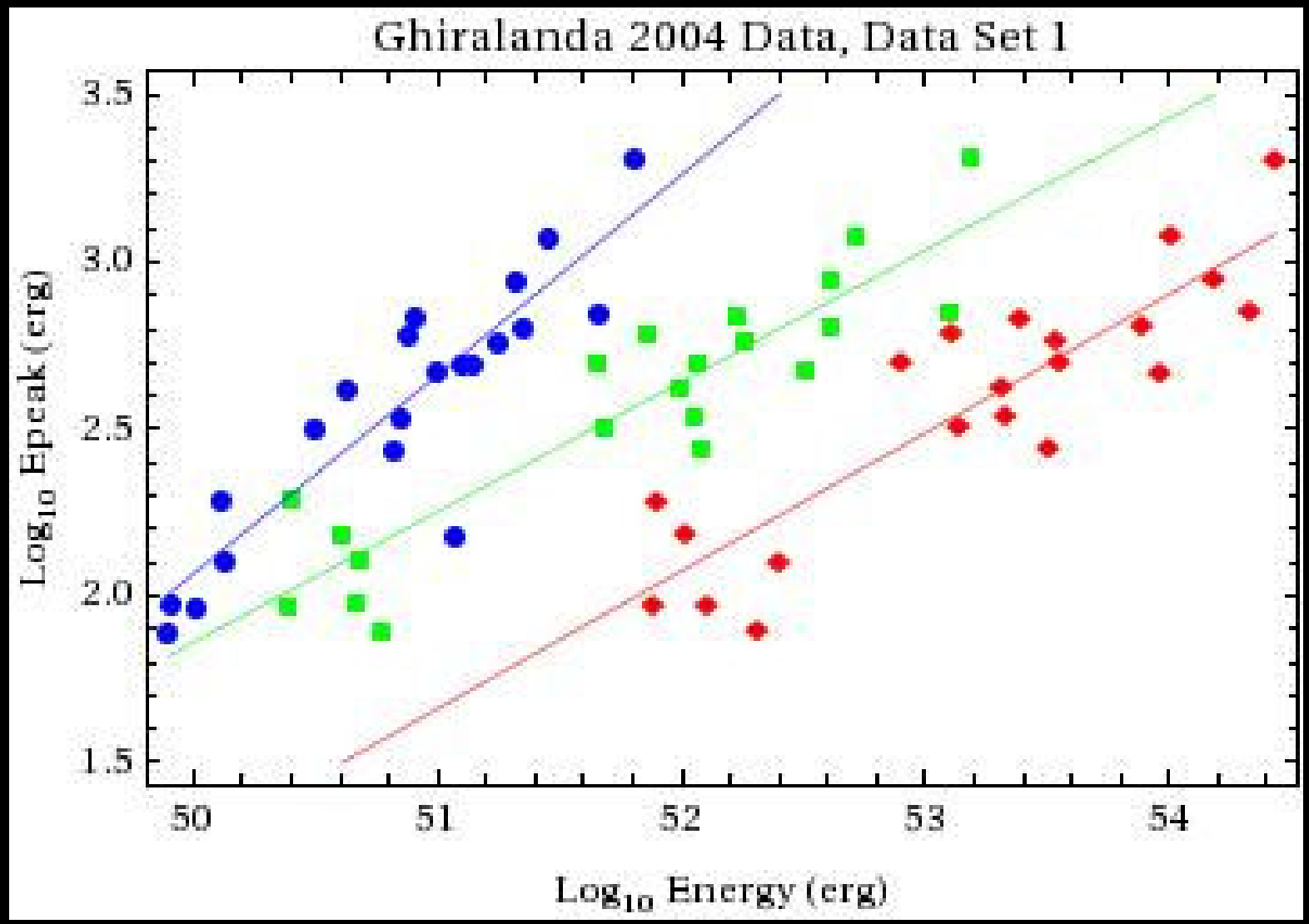
Conclusions with statistical uncertainties

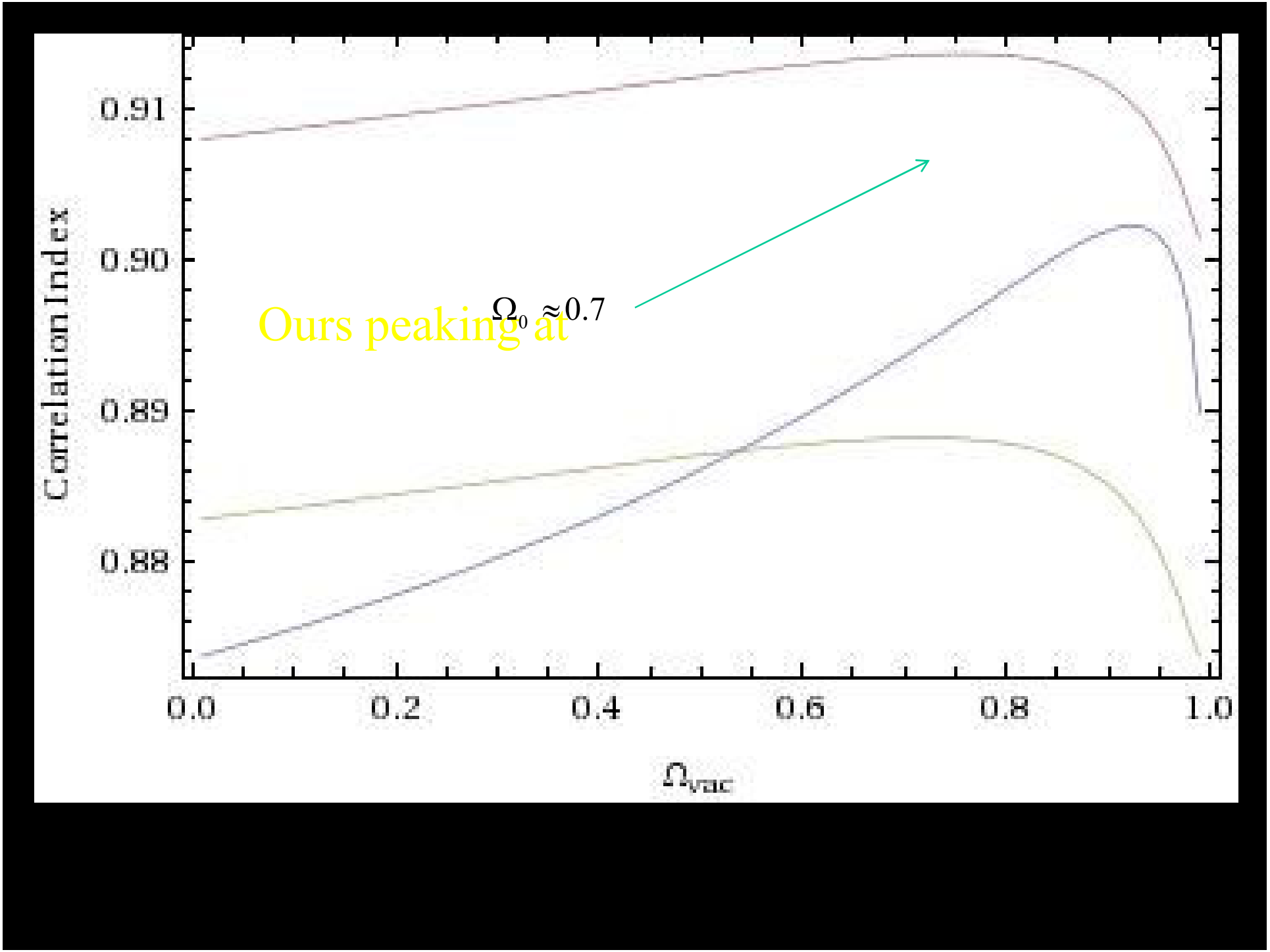
- With errors at least to me all curves are the same
- Forced to conclude that these measures not suitable for cosmology

Measuring w(z)

- Tried to see
- So insensitive at this point
- Not good to say anything about changes in w
- Thanks to Amati, Ghirlanda & Piran




Ghiralanda 2004 Data, Data Set 1
3.5
3.0
2.5
2.0
1.5
50
51
52
53
54
Log10 Epeak (erg)
Log10 Energy (erg)


Correlation Index
0.91
0.90
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0.0
0.2
0.4
0.6
0.8
1.0
Ω_{vac}
Ours peaking at
$\Omega_0 \approx 0.7$