

λ_0 and Ω_0 from Lensing Statistics and Other Methods: Is There a Conflict?

Phillip Helbig, Juan Francisco Macias-Perez, Althea Wilkinson, Rod Davies

*University of Manchester, Nuffield Radio Astronomy Laboratories,
Jodrell Bank, Macclesfield, Cheshire SK11 9DL, UK*

Ralf Quast

Hamburg Observatory, Gojenbergsweg 112, 21029 Hamburg, Germany

Abstract. We discuss the consistency of constraints in the λ_0 - Ω_0 plane from gravitational lensing statistics, the m - z relation for type Ia supernovae and CMB anisotropies, based on our own (published or unpublished) work and results from the literature.

Recently, several authors, (e.g. Perlmutter et al. 1999, Riess et al 1998, Lineweaver 1998) have made the claim that current observational data provide evidence for a positive cosmological constant λ_0 . This is based mainly on the m - z relation for type Ia supernovae or on CMB anisotropies; although joint constraints from more than one cosmological test also point in this direction (e.g. Ostriker & Steinhardt 1995, Turner 1996, Bagla et al. 1996, Krauss 1998), taken at face value, either the supernovae or CMB data *alone* suggest the presence of a positive cosmological constant.

On the other hand, gravitational lensing statistics (e.g. Kochanek 1996, Falco et al. 1998) has often been seen as setting tight upper limits on the cosmological constant, perhaps even to the point of being in conflict with the ‘cosmic concordance’ of, for example, a flat universe with $\lambda_0 \approx 0.7$ and $\Omega_0 \approx 0.3$. Based on the present observational data, is there a conflict?

We have compared contours in the two-dimensional space of the λ_0 - Ω_0 plane, with no priors on λ_0 or Ω_0 , from results based on our own work involving gravitational lensing statistics and the CMB (Quast & Helbig 1999, Helbig et al. 1999, Helbig 1999, Macias-Perez et al. 1999, hereafter Papers I–IV, respectively) and from results from the m - z relation for type Ia supernovae, kindly made available by the Supernova Cosmology Project and the High-Z Supernova Search Team (Perlmutter et al. 1999, Riess et al. 1998).

Are the results from lensing statistics and the m - z relation for type Ia supernovae consistent? As the 90% confidence contours from all supernovae data sets overlap with that of the lensing statistics, and even the 68% confidence contours from two of three supernovae data sets (one from Perlmutter et al. (1999) and one, with two different methods of analysis, from Riess et al. (1999)) overlap with that of the lensing statistics, the results from the two cosmological tests are consistent and one is justified in calculating joint constraints by multiplying the probability distributions of the individual tests. Interestingly, they are most

consistent at small, but not too small, values of Ω_0 , which is favoured on completely different grounds. Joint constraints from lensing statistics and the m - z relation for type Ia supernovae are discussed in detail in Paper III.

We have used the most recent CMB data available to do an analysis similar to that of Lineweaver (1998) and compare the constraints from the CMB to those of lensing statistics. For more details, see Paper IV. The constraints from the CMB are much tighter than those from lensing statistics or supernovae and a given confidence contour from the CMB is always (almost) contained within the corresponding contours from the other tests. Thus, there is no inconsistency.

The full poster can be obtained from <http://multivac.jb.man.ac.uk:8000/ceres/papers/papers.html> where one can also find related publications. In the poster and related papers, we show plots of constraints from various cosmological tests, both from our own results as well as from the literature, in the same area of parameter space and with the same scale, plotting scheme etc., which makes comparison easy.

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