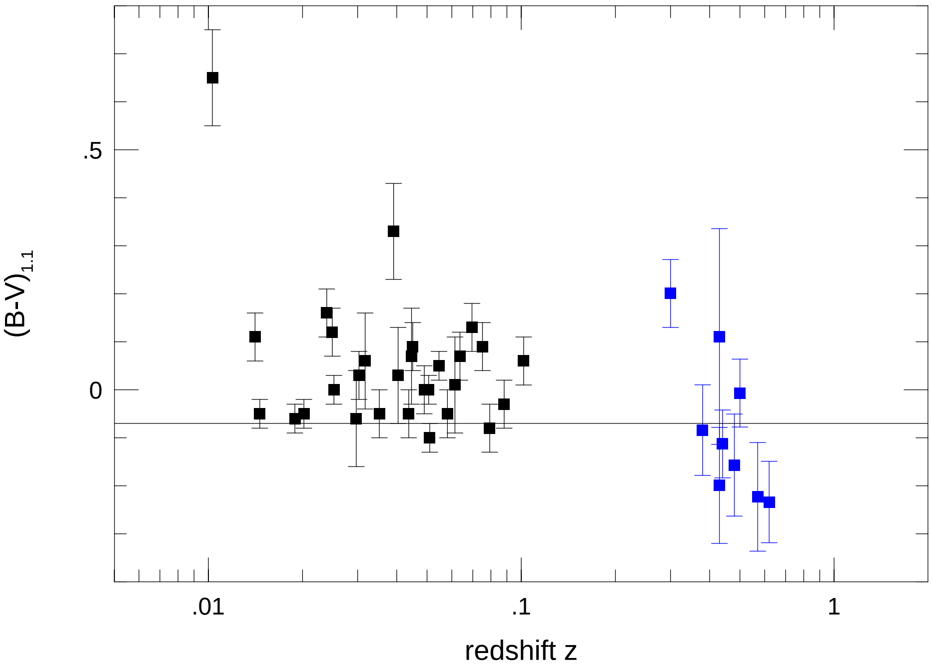


Figure 2: The observed colors of SNe Ia as a function of redshift. The data are from Phillips et al. (1999) for the low-redshift and Riess et al. (1998) for the high-z sample. The line shows the intrinsic color as defined for the nearby SNe Ia in Phillips et al. (1999).

## 3 Results

The proposal to use supernovae to determine the cosmological parameters was made over half a century ago (Wilson 1939). Several cosmological aspects can be tested with SNe Ia at significant redshifts. The time variability and the nearly identical light curves of the events make them ideal tracers for time dilation caused by the expansion of the universe. Their use as distance indicators provides a handle on the global cosmological parameters, in particular the de- or acceleration of the expansion. But SNe Ia are also the most distant individual stars observed. As such they will provide a stellar probe for evolution and the chemical enrichment history of the universe. Although the last few items are still on the horizon, it is not inconceivable that we will soon be able to achieve such measurements.

### 3.1 Time dilation

Type Ia Supernovae are perfect probes to detect time dilation, which is a firm prediction of cosmological expansion models (Wilson 1939, Tammann 1978, Colgate 1979, Leibundgut 1990, Leibundgut et al. 1996, Goldhaber et al. 1997, Riess et al. 1997). The light curve and spectral evolution of a distant supernova act like a clock. Comparing a distant object with nearby ones, we can directly observe the behavior of this clock in different inertial frames. If the universe expands, then the change in the scale parameter translates into the observed redshift and is directly proportional to a change in clock rates. This classical test is taught in textbooks (e.g. Weinberg 1972, Peebles 1993, Peacock 1999). In an expanding