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Tracing dark energy with quasars.

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The discovery of the accelerated expansion of the Universe lead to the concept of dark energy. This is one of the most interesting topic in modern relativistic astrophysics. Precise measurement of this effect is a key to understand the nature of this medium, and we need good probes to do that. Quasars appears as an ideal candidate for this purpose as these objects are highly luminous and detected in wide range of redshift (0< z <7). They can be used to track the history of the expansion of the Universe (Watson et al. 2011, Czerny et al. 2013, Marziani & Sulentic 2013, 2014; Wang et al. 2013; Hoenig 2014; Yoshii et al.2014). I will describe new encouraging results from the dedicated spectroscopic monitoring being currently performed by our team using Mg II line.

Quasars are not standard candles so their use is based on determination of their two parameters redshifts and, independently, absolute luminosities. Absolute luminosity, combined with the observed luminosity, allows to obtain the luminosity distance to an individual quasar. Thus for each source we have independently the distance and the velocity (from redshift), i.e. the Universe expansion rate. The method is essentially equivalent to the use of the SN Ia but it is important to have several independent tracers as each of them have specific, hard to estimate, systematic errors. Specific advantage of quasars is, they do not show significant evolution of their properties with redshift which is likely a serious problem for SN Ia. The project in which I am involved uses the intermediate redshift quasars observed with 11-m Southern African Large Telescope. Determination of the quasar absolute luminosity comes from the measurement of the time delay between one of the strong emission lines and a continuum. MgII line is suitable for sources with redshift between 0.4 and 1.5, where this strong line moves to optical band of the spectrum. High-quality spectra from SALT allow for a very detailed modeling of the line shape and remove potential sources of the systematic errors. I will summarize all pros and cons of various recently proposed quasar-based methods of the measurement of the dark energy content of the Universe.

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