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## Tracing dark energy with quasars.

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The discovery of the accelerated expansion of the Universe led to the concept of dark energy. This is one of the most interesting topics in modern relativistic astrophysics. Precise measurement of this effect is a key to understanding the nature of this medium, and we need good probes to do that. Quasars appear as an ideal candidate for this purpose as these objects are highly luminous and detected in a 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 the 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 us 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 Type Ia supernovae but it is important to have several independent tracers as each of them has specific, hard-to-estimate, systematic errors. A specific advantage of quasars is that they do not show significant evolution of their properties with redshift, which is likely a serious problem for Type Ia supernovae. The project in which I am involved uses intermediate redshift quasars observed with the 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. The Mg II line is suitable for sources with redshift between 0.4 and 1.5, where this strong line moves to the optical band of the spectrum. High-quality spectra from SALT allow for a very detailed modeling of the line shape and removal of potential sources of 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.

### Collaboration

B. Czerny, M. Bilicki, K. Hryniewicz, M. Krupa, A. Kurcz, P. Marziani, A. Pollo, W. Pych, A. Udalski

**Primary author:** ŚREDZIŃSKA, Justyna (Nicolaus Copernicus Astronomical Center PAS)

**Co-author:** Prof. CZERNY, Bożena (Center for Theoretical Physics PAS, Warsaw, Poland)

**Presenter:** ŚREDZIŃSKA, Justyna (Nicolaus Copernicus Astronomical Center PAS)

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