Photometric variability of QSOs and Active Galactic Nuclei with COROT

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COROT could sample in two colours the photometric light curves of more than 10 known QSOs with a S/N ~ 40-100 per individual exposure during a continuous span of several weeks. Such an observing program will be a free by-product of the search for planetary transits. It will be unique in terms of accuracy, sampling rate and length of the observation period and form an interesting base for similar studies to be carried out with Eddington.

Photometric variability of QSOs with COROT : It is well known that quasars are variable at all wavelengths, in their continuum as well as in their emission lines (Ulrich et al. 1997, Peterson 2001). Many quasars vary at the 0.3-0.5 mag. level over time scales of a few months. Some may vary even more significantly on time scales as short as a few days, or even less, but most QSOs do so with much smaller amplitude variations (i.e. at the level of ~ 0.01 mag.). Intra-day variability (IDV) has also been reported in a number of cases (see Wagner et al. 1995). On the basis of coherence arguments, one can thus conclude that much of the radiation must come from a compact region as small as a few light days in size (typically several times 2.5 10^{15} cm) or even a few AU for IDV. High S/N optical photometric monitoring of QSOs, with a time sampling rate higher than 1 per day during a period of several weeks, ought to set important observational constraints (size, geometry, ...) on the source of the quasar continuum emission. Indeed, the structure of the central inner QSO core is very poorly understood: no evidence has yet been reported for any periodic variability that might be associated with orbital motions; the continuum variations rather look chaotic or stochastic.

Our knowledge of photometric variations over short time scales (i.e. typically less than a few days) is not only hampered by a lack of data but also by the fact that high frequency variations have so small amplitudes that they are often lost in the observational noise. Photometric observations with a S/N ~ 100 and with a good time resolution are badly needed. The COROT observations in the exoplanet search fields ought to provide time series of a few tens of well sampled (Δt ~ 15 min) QSO photometric lightcurves which will lead to the identification of special or fundamental time scales for QSO variability or at least a measure of how much variability power is contained over time scales~ 1 day or less. This pseudo-imaging has the potential to provide information on the QSO inner core structure on scales (typically, less than one light day) much smaller than those currently accessible with modern VLBI techniques (typically, of the order of several tens of parsec). Information on time evolution and stability of the accretion disk should also become accessible.

QSO target candidates in the COROT field of view

A list of 12 QSOs, from the Véron & Véron catalogue, visible in the 14 degree fields centred around RA 6h50 and RA 18h50 is given below.

In total, there are 4 X-ray quasars among the twelve listed objects, all being radio loud. It would be of the utmost scientific interest to simultaneously monitor one or two of these known X-ray/radio quasars with an unprecedented photometric accuracy and time sampling with COROT, with XMM and with a ground-based radio telescope. Note

that due to the low galactic latitude of these fields, no optical QSO survey has yet been carried out. For the case of negligible galactic extinction, one could expect to find out approximately 10 times more radio quiet QSOs than radio loud ones with similar magnitudes. Taking into account the galactic extinction, it is very likely that several tens of radio quiet QSOs ought to be identified.

Id.	**Alpha (2000)**	**Delta (2000)**	**Z**	**Mag.**	**Radio/X**
PKS 0554-026	05 56 52.6	-02 41 05	0.235	17.4	R
OH-010	06 07 59.7	-08 34 49	0.872	17.6	R/X
3C 175.0	07 13 02.3	11 46 15	0.768	16.60	R/X
TEX 0721-071	07 24 17.3	-07 15 19	0.270	18.0	R
TEX 0730-023	07 32 45.1	-02 28 58	2.75	18.3	R
3C 185	07 38 33.9	-02 04 24	1.033	18.4	R
PKS 0736-06	07 38 57.1	-06 26 57	1.901	16.38	R
PKS 0736+01	07 39 18.0	01 37 04	0.191	16.47	R/X
PKS 0743-006	07 45 54.0	-00 44 18	0.994	18.1	R
PKS 1801+01	18 04 15.9	01 01 31	1.522	18.9	R
4C 04.63	18 13 16.1	04 39 32	1.083	19.1	R
PKS 1821+10	18 24 02.8	10 44 24	1.364	17.27	R/X

We strongly encourage the COROT field selection committee to make all possible efforts to select the fields with the lowest galactic extinction and to include one or more of the X-ray/radio quasars in the selected stellar COROT fields. Of course, the brightest (cf. V = 16.4) the selected quasar(s), the best science it will be possible to achieve.

References

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