Detection and Photometric Monitoring of QSOs and AGN with COROT

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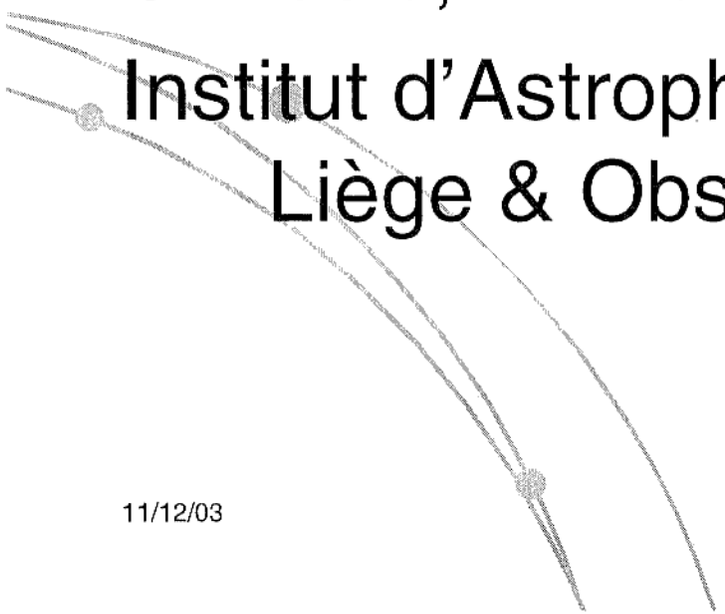
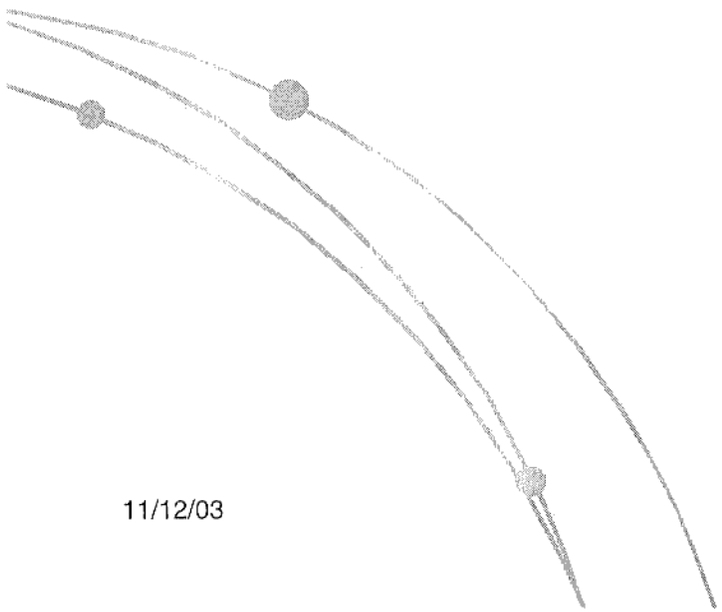


Abstract: COROT *will sample in one or three colours the photometric light curves of more than 10 known QSOs/AGN with a S/N ~ 40-100 per individual exposure during a continuous span of several weeks. Such an observing program will be a free by-product of the search for planetary transits. It will be unique in terms of accuracy, sampling rate and length of the observation period.*



Photometric variability of QSOs/AGN 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 (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 much 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.

QSOs and AGN studies with COROT

- High frequency photometric variations have very small amplitudes; high precision photometry over intraday timescales is thus needed

- A few tens of well sampled ($\Delta t \sim 15$ min) QSO photometric lightcurves (special or fundamental time scales, ? variability power contained over time scales << 1 day; information on the QSO inner core structure on scales << 1 light day)

- Time evolution and stability of the accretion disk

Our knowledge of photometric variations over short time scales (i.e. typically less than a day) is not only hampered by a lack of data but also by the fact that high frequency variations have such 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 ($\Delta t \sim 15$ min) QSO photometric light curves 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.

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**

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 in the table on the previous side.

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.

QSOs and AGN studies with COROT

- Select fields to include one or more of the X-ray/radio quasars in the selected stellar COROT fields (cf. V = 16.4)

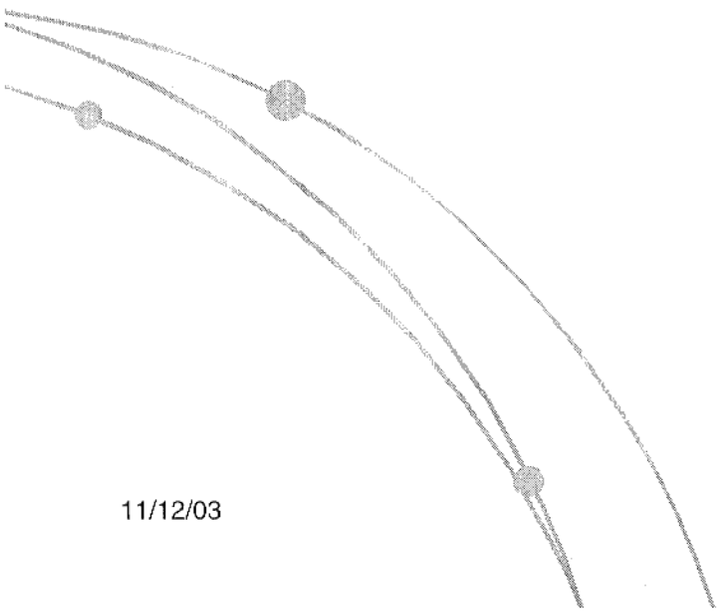
- XMM, Integral, radio, Gallex, UKIDSS, SIRTF, … surveys, second epoch direct imaging at optical wavelengths … to select all possibly bright, variable, X-ray and/or radio emitting quasars and AGN in the COROT fields.

QSOs and AGN studies with COROT

- XMM (30' field) : AO3 → 2005, call for AO4 → winter 2004, AO4 >= summer 2005
- Integral (Ibis 9°x9°) : AO2 → december 2004, call for AO3 → summer 2004, AO3 >= 2005; galactic plane will be covered with GO.
- Radio : 1st (No), VLA
- Gallex : ERO yesterday (only 1% is available right now), plan to cover 35.000 square degrees
- UKIDSS, SIRTF, ESO, … surveys
- Second epoch direct imaging at optical wavelengths …

QSOs and AGN studies with COROT

- Fields need to be selected before proposal submission
- Available data should be made publically available



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

Once the centers of the exoplanet fields will be decided, we propose to carry out various surveys (XMM, Integral, radio, Gallex, UKIDSS, SIRTF, ESO, …) , and take advantage of second epoch direct imaging at optical wavelengths to select all possibly bright, variable, X-ray and/or radio emitting quasars and AGN in the COROT fields.