First RR Lyrae light curves from CoRoT
Multiperiodicity and Blazhko phenomenon

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RR Lyrae stars play a major role in astrophysics as standard candles for distance determination and as witnesses of the evolution of the universe at young age. These variable stars occupy a very specific status in the pulsating variable stars family. With their large amplitudes they have been known for more than a century. Although these stars are well studied, major questions concerning RR Lyrae stars remain to be solved, like the origin of the so-called Blazhko effect (Blazhko 1907, Astr. Nachr. 175, 325), a periodic modulation in both the amplitude and the phase of the main pulsation on timescales of typically tens to hundreds of days. A century after its discovery, the phenomenon remains a mystery and we stIll lack a plain explanation of the physical mechanisms driving the Blazhko effect. Ground-based data are often affected by single-site aliasing. To cope with this challenge we took advantage of the quasi-uninterrupted coverage over several Blazhko cycles and the unprecedented photometric accuracy of CoRot observations in the first Long Run Center of the Milky Way. Here, we discuss the first frequency analysis results of the RR Lyrae stars in CoRoT field LRC1 and we give new insight for future Blazhko theoretical investigations.

RR Lyrae CoRoT stars in LRC1

New RR Lyrae stars were discovered
in Long RunCenter of Milky Way1
Almost of them Blazhko stars

CoRoT ID: 0100689962
0101128793
0101370131
0100881648
0101503544

Variable stars type RR Lyrae

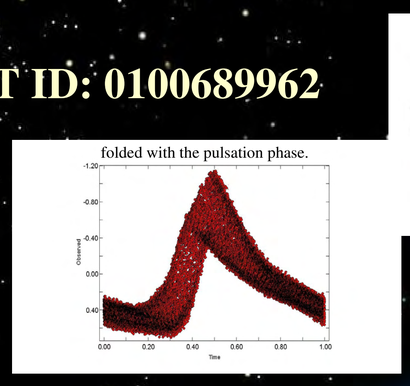
RRab Pulsation period: 11 – 15 hours
Light amplitude: 1.3
Fundamental

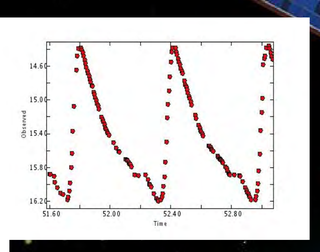
RRc Pulsation period: 8 – 10 hours
Light amplitude: 0.5
First Overtone

RRd Pulsation period: 8 – 10 hours
Light amplitude: 0.4
Fundamental & First Overtone

RR Lyrae CoRoT Results

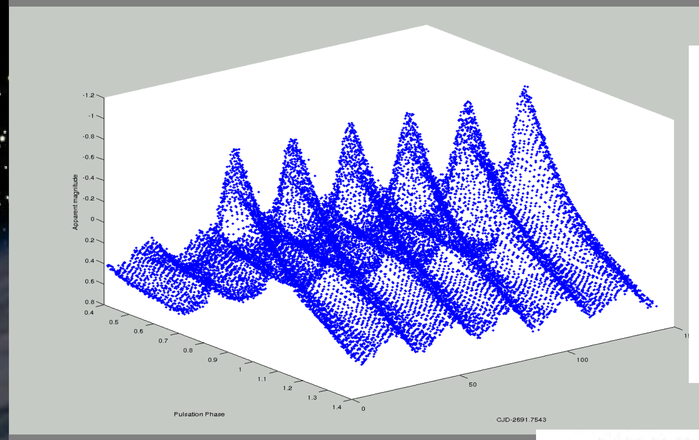
CoRoT ID: 0100689962

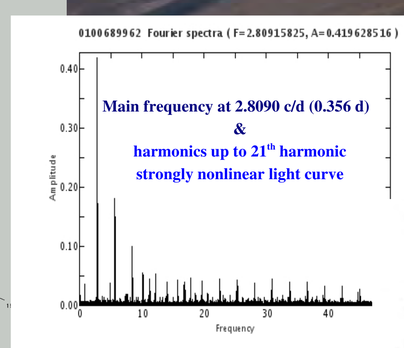


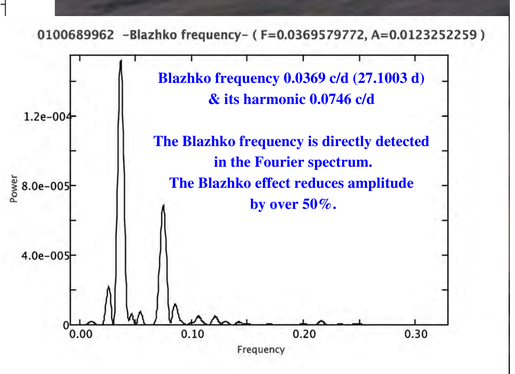


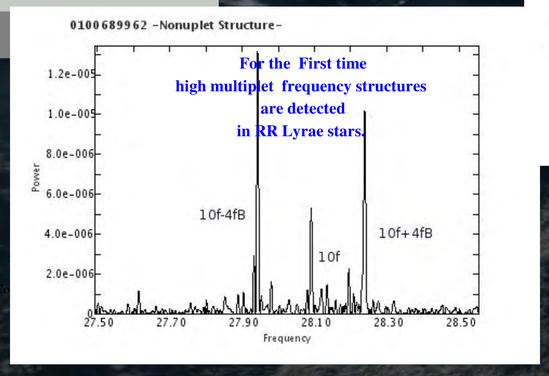
Zoom of the light curve

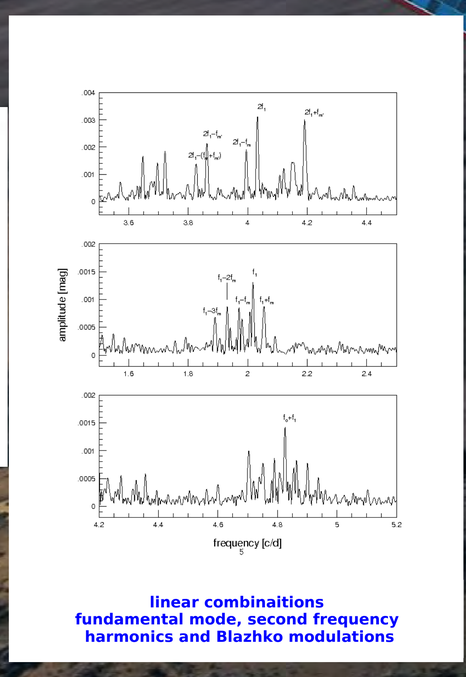
3D CoRoT light curve of the observed star 0100689962 during 150 days











linear combinaitions
fundamental mode, second frequency
harmonics and Blazhko modulations

The frequency analyses has been carried out using the Fourier transform (Period 04). We removed all measurements having non--zero quality flags in the N2 product delivery, retaining only valid flux measurements. Note that a trend and jump filtering code were used to the data.

Our analysis shows that the galactic RR Lyrae stars show, for the first time, multiperiodic behaviours.

Analysis of CoRoT light curve of the CoRoT star ID: 0100689962, during 150 days (6 Blazhko cycles) reveals (1) a dominant mode with a main frequency f1=2.809 c/d (0.36 d) and a modulation Blazhko period B= 0.0382 c/d (26.18 d). This mode present a strong non-linearity with the high multiplet structures, triplet, quintuplet, septuplet, nanuplet, 11plet and 13plet, 15plet, 17plet structures. (2) a second independant frequency f2= 2.0178 (0.496 d) with a modulation Blazhko period b = 0.158 c/d (6.33 d). We detected easily linear combinations with the fundamental mode & its harmonics, the second independant frequency and their modulation Blazhko periods.

RR Lyrae CoRoT results in LRC1 reveal new pulsation properties, provide firm constraints on the physical parameters governing the occurrence of Blazkho RR Lyrae stars and give new insight for future Blazhko theoretical investigations.