The CoRoT Legacy Book

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I.1
The general framework

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It has been recognized since the early days of Astronomy, that the brightnesses of some cosmic objects, stars in particular, were not constant. The observation interpretation and application of those changes became a permanent preoccupation of astronomers.

The recognition, in the sixties, of the oscillations of the Sun – a seemingly ordinary star – and their application as a "window" into the otherwise hidden interior of the Sun, transformed the subject of stellar photometry.

Solar seismology from space was proposed as early as 1982 and has become a powerful tool to understand our home star.

The first experiment in space, called IPHIR, flew on the Soviet Mars missions PHOBOS 1 and 2 with successful results almost 30 years ago (Froehlich et al. 1991; Toutain et al. 1993). As a consequence, helioseismology became one of three main objectives of ESA's first Horizon 2000 Cornerstone mission SOHO (Solar and Heliospheric Observatory), which was launched in 1995 and that recently received funding for its continued operation until at least the end of 2016 (originally designed for a 2-year lifetime!).

Then, the need to study accurately stellar activity and variability of stars other than the Sun started to be promoted as the new challenge for stellar physics.

In the early eighties, stellar astronomers began to see the incredible potential of extending the techniques of solar seismology to other stars. They also recognized the incredible challenge of detecting Sun-like oscillations in distant stars.

In observing stellar variability, and in particular solar-like oscillations, there are three major requirements: (1) long duration of the time series of data on the same target; (2) the highest possible duty cycle (i.e. continuous or nearly continuous coverage, with very few gaps; and (3) the highest possible photometric precision.

For decades and even centuries, this field had two natural enemies associated with the Earth: the variable transparency of the atmosphere, and the rotation and orbit of our planet (daily sunrises ending nightly data collection, and seasonal changes in what part of the sky are above the horizon at night).

The combination of the demands of stellar seismology and the natural limitations of ground based observations called for a new class of instrumentation and a new vantage point for those instruments.

That vantage was space!

Space astronomy was already underway, but the focus was on accessing wavelengths unobservable from the Earth, namely infra-red and ultra-violet.

The objective of monitoring bright stars from space at visible wavelength and continuously was poorly understood at the beginning. It took a long time to convince the space astronomy community of the importance of such observations. It took even longer to convince the community that such observations were even possible with existing technology.

So many people, in so many countries, dedicated so many years of their lives to demonstrate that ultra-high-precise photometry of stars from space could go from dream to reality.

At the beginning, the scientific objectives were purely stellar, but double: activity and oscillations. Then, the enormous success of helioseismology lead to focus more on oscillations. Finally a major discovery entered the game: the observation of the first extra solar planet, and the immediate conclusion that Ultra High Precision of stars will also be a way to discover small planets through shallow transit signals in photometry from space.

Exoplanetology became a challenging issue. This new perspective added another compelling reason for long duration, continuous, and ultra precise photometry from space and increased significantly the scientific community interested in.

Then after recognizing that such observations were feasible from space, many ideas of space missions have been proposed and discussed in the astronomical community.

The two most ambitious projects were first conceived in the early 1980s: CoRoT in Europe (lead by France,) and Kepler in the United States. In the late 1990s, Canada entered the field with a smaller but effective microsatellite project called MOST.

All these initiatives lead to successful missions.

References

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