Seismology of the stellar cores

Eric Fossat
Département d'Astrophysique,
Université de Nice, FRANCE.

The tremendous development of helioseismology in the last ten years has included extremely important results obtained through full disk measurements, both in Doppler shifts and broad band photometry. It was then looking very attractive to try to detect the same kind of small amplitude p-modes on other stars.

The amplitude of oscillations to be detected are in the range of 1 to 50 cm/s in Doppler, or 10^{-5} to 10^{-6} magnitude in photometry. Periods range from a few minutes to hours. For this purpose, very specialized instruments are under development or in project. I will describe briefly the main directions of this development.

I will also describe the first (still controversial) results obtained on Procyon, Alpha Centauri and Epsilon Eridani.

At first order, the initial results of asteroseismology will provide two important parameters: First the frequency of the fundamental mode of vibration of the star, which is an almost direct measurement of the stellar radius, and second a small frequency splitting between radial and quadrupolar modes, which measures the sound speed gradient inside the stellar core. This gradient is sensitive to stellar age, by the change of chemical composition implied by hydrogen burning along the main sequence life. These two parameters are among the main ingredients of the theory of evolution and their precise measurement on the sun can help a calibration of their role in the evolutive models.

G. Cayrel de Strobel and M. Spite (eds.), The Impact of Very High S/N Spectroscopy on Stellar Physics, 209–210.

It can now be predicted that with together Hipparcos and asteroseismology, the precision of the HR diagram will be improved in the near future at a level which would have looked impossible not so long ago.

DISCUSSION

G. CAYREL Have you already estimates the age of α Cen ? You may know that there is a discrepancy between its age as estimated from isochrones and its age as estimated from its Li abundance.

SODERBLOM The age of α Cen is 6 to 8 Gyr (e.g., Flannery and Ayres 1978) and for α Cen A its lithium is twice the solar abundance (Soderblom and Dravins 1984). Although α Cen A is a spectroscopic twin to the Sun, these values are compatible because we know this star's mass, namely 1.1 $M_{\odot}$. Having a thinner convective zone, a star more massive than the Sun depletes Li at a slower rate.

https://doi.org/10.1017/S0074180900035038 Published online by Cambridge University Press