Scientific Justification

ZZ Ceti, also called R548, is a DAV. This star has been observed for the last 3 decades. The pulsation spectrum consists mainly of 2 doublets, one at 213 s and the other at 274 s. There are 3 objectives in observing R548 and they are outlined below.

Both periods of the 213 s doublet demonstrate remarkable stability; a rate of change of period with time of only one part in a few billion years. This rate of change in period is consistent with our theoretical cooling models. Such a great stability in the periods makes R548 the second most stable optical clock known, second only to G117-B15A, another DAV. White Dwarfs like R548 and G117-B15A are more stable than atomic clocks and most pulsars. Observing R548 again this season will improve the current estimate of this rate of change in period with time and more importantly, it will reduce the error in the estimate.

However, the critical purpose in observing R548 will be to decipher what is going on with the 274 s doublet. This doublet has a faster rate of change of period. There could be variations in period at shorter timescales (than evolutionary timescales) due to phenomena like Avoided Crossings. In order to unravel the 274 s doublet, we need data sets separated by smaller time gaps. We have data last year from September, October and November 1999. We also observed it again in September 2000. We therefore intend to get WET data in November, 2000. So, by analysing the 1999 and 2000 data sets together, we might be able to determine the timescale of variations affecting the 274 s doublet. If this doublet is going through an avoided crossing, then this detection will be the very first observational proof that such crossings exist.

Last, but not the least, we need to detect more pulsation modes in the star in order to probe its interior using Asteroseismology. Three other pulsation modes have been observed in R548 at about 187 s, 318 s and 333 s. We hope to improve our period determinations of these modes. We also hope to search for other new pulsation modes.