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DIVISION V VARIABLE STARS

ETOILES VARIABLES

Division V deals with all aspects of stellar variability including intrinsic variability and variability caused by a companion in a binary system. In the case of intrinsic variability the analysis of pulsating stars, surface inhomogeneities, stellar activity, and oscillations are considered. For close binaries, detached eclipsing binaries are studied as well as interacting systems. Contact and semi-detached binaries, or those with compact components like cataclysmic variables and X-ray binaries, are examined within the context of the physics of accretion processes.

DIVISION V COMMISSIONS

Commission 27 **Variable Stars**
Commission 42 **Close Binary Stars**

DIVISION V WORKING GROUPS

INTER-DIVISION WORKING GROUPS

Division IV-V WG **Active B-type Stars**
Division IV-V WG **Ap and Related Stars**

TRIENNIAL REPORT 2009-2012

1. Introduction

Division V on *Variable Stars* consists of Commission 27, also called *Variable Stars*, and Commission 42, *Close Binary Stars*. The former deals with stars whose variations are intrinsic, whereas in the latter the variations are caused by the interactions between the components in the binary or multiple star system. There may be cases where the assignment of an object to one of the two Commissions may be in doubt. For example, the observation of pulsating stars in eclipsing binaries within nearby galaxies, or the relation between some types of oscillation modes and membership to binary systems, continue to be widely discussed.

The report of the Division for the triennium is more extensively documented in the reports of each of the two Commissions.

2. Variable stars

The progress of studies on variable stars has been reviewed in a series of international meetings in almost all the domains of interest for Division V, and listed in the C27 Triennial report. The dominant milestone during this period was the successful launch and deployment of NASA's *Kepler* spacecraft. Though designed to search for Earth-sized planets around Sun-like stars, the photometric and operating characteristics of *Kepler* make it an ideal asteroseismic observatory. A large number of Division members are involved in analysis of *Kepler* data on a variety of pulsating stars – those known about prior to the launch, and many kinds of stellar variability not anticipated prior to being seen in *Kepler* data.

The study of solar-like oscillations in main sequence stars, sub-giants, and giants has blossomed with the availability of *Kepler* data on thousands of targets. On the main sequence, these data have refined the parameters of planetary host stars (in particular the radius, but also the age and mass), paying back handsomely on the investment made by the *Kepler* Mission in asteroseismology. The detailed analysis of solar-like oscillations in red giants has provided a new tool to determine the core structure of these stars, and identify giant stars that have hydrogen shell burning from those stars with helium-burning cores. In the classical variable star area, RR Lyrae stars show evidence of period doubling in Blazhko stars in the exquisite *Kepler* light curves.

Additional results from space-based astronomy, along with many significant advances using ground–based data, are discussed in the report of Commission 27.

3. Close binary stars

As with the intrinsic variable star field, close binary stars have been the subject of, or components of, several international meetings over the past triennium, principally IAU Symposium 282 in 2011, "From Interacting Binaries to Exoplanets: Essential Modeling Tools." Please see the Commission 42 report for further details.

Concerning close binaries, there have also been important new advances. A probable instance of a stellar merger caught "in the act," and a significant nova outburst of V407 Cyg are discussed in the Commission 42 triennial report. As a measure of the overlapping interest of the two Commissions within Division V, significant progress in observing and analyzing pulsating stars within binary systems has been made over the past three years, using ground–based and space–based facilities.

As might be expected, the *Kepler* Mission has been a tremendous asset to the study of eclipsing, reflection–effect, and ellipsoidal variables with periods ranging from hours to months. The central mission of *Kepler*, in fact, is to discover eclipsing binaries, albeit with a substellar companion doing the eclipsing. Discoveries here include fascinating systems such as eccentric binaries experiencing tidally-forced brightenings and oscillations, binary systems with low–mass white dwarfs that produce brightness variations in their (brighter) companions through Doppler beaming, and circumbinary planetary systems.

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