Abstract

Majority of stars end their evolution as white dwarfs. Because of this white dwarfs are useful in various fields of astrophysics, such as measuring the age or dynamics of galaxies. White dwarfs in binary stars are particularly useful for studying the evolution of stars. The main focus of this thesis was a study of binary stars with white dwarfs that are accreting mass from their companions. This dissertation presents results on both the observational and theoretical problems posed by accreting white dwarfs. The main focus of the paper is on symbiotic stars.

The first part of the thesis describes development of methods for searching and identification of symbiotic stars outside of the Milky Way. This includes developing six new diagnostic diagrams useful for identification of symbiotic stars. Moreover, a new method of searching for symbiotic stars using a He II 4686 narrow-band filter is presented. The application of the proposed methods resulted in a discovery of four new extragalactic symbiotic stars and seven strong candidates. This includes the first known symbiotic stars inside a planetary nebula outside of the Milky Way and the farthest known candidate for symbiotic star, located in M81.

In the second part of the thesis the most interesting phenomena related to accreting white dwarfs were investigated. Among the main results was a discovery that active phases in a symbiotic nova T CrB are quasi-periodic and most probably are caused by disc instability. It was demonstrated that the flickering in T CrB is highly variable in nature. This probably means that it is caused by more than one physical processes, one of which is most likely inverse Compton scattering.

The other investigated object was LMC S154. Analysis of this object showed that this is a symbiotic recurrent nova, the first symbiotic nova in Magellanic Clouds. The object showed long outbursts that lasted over a decade with relatively short recurrence time of few tens of years. This is the first such object known, as novae with such short recurrence time always showed short outbursts with timescales of about a year. Moreover, it was shown that LMC S154 is the first first classical nova with a carbon-rich donor.

The last part of the thesis presents theoretical work using population synthesis. The employed population synthesis codes were expanded by including the state of the art models of mass transfer in binary stars (*wind* and *atmospheric* Roche lobe overflow). The future evolution of two symbiotic stars was simulated, V407 Cyg and SMC 3. The results showed that symbiotic binaries that are containing a Mira donor can be more promising supernova type Ia candidates than previously thought.

The apparent lack of classical novae outbursts in dwarf novae has been puzzling astronomers for decades. The solution to this problem, proposed over 30 years ago, is a hibernation scenario in which all cataclysmic variables undergo cycles of low and high states of mass transfer rate. The recent observations seem to support the hypothesis of hibernation scenario, however this hypothesis was not yet proven. The results of population synthesis show that the hibernation scenario might not be necessary for our understating of cataclysmic variables. In particular, assuming the hibernation scenario the predicted rate of classical nova outbursts in dwarf novae is inconsistent with observations.