RevMexAA (Serie de Conferencias), **20**, 267–267 (2004)

A VLA SURVEY OF MAGNETIC CATACLYSMIC VARIABLE STARS

Candace Gray[1] and Paul A. Mason[1]

I. Introduction

Cataclysmic Variables (CVs) are close binaries containing a white dwarf primary and a Roche-lobe filling red dwarf secondary. In magnetic CVs (MCVs) the white dwarfs have magnetic fields that are sufficiently strong ($10^6 - 10^8$ Gauss) to direct the accretion flow onto the surface of the primary. MCVs are divided into the lower field intermediate polars (IPs) and the higher field polars. Typically, IPs have accretion disks that are disrupted in the center and magnetically channelled flow onto the poles. Polars are diskless, an accretion stream flowing from the inner Lagrangian point impacts directly onto one or both magnetic poles. In addition, polars tend to have white dwarfs which rotate in synchronism with the binary orbit, while IPs have white dwarfs which rotate faster than the binary period. There are a few rare exceptions to this characterization, such as the slightly asynchronous polars and the stream-fed IPs.

II. Previous Work

Surveys of CVs suggest that non-magnetic CVs (outside of outburst) are not radio emitters (Cordova, Mason, and Hjellming 1983 and Fuerst, et al., 1986). However, some MCVs have been reported to be radio sources. Including three polars, three IPs, as well as the probable IP: FIRST J1023+0038.

The polars are AM Her, V834 Cen and ST LMi. AM Her exhibits quiescent non-thermal emission (0.67 mJy) and a 100% circularly polarized flare (9.7 mJy), both at 4.9 GHz (Chanmugam and Dulk 1982). V834 Cen has strongly variable emission at 8.4 GHz (2 mJy) with multiple flare events (up to 35 mJy) (Wright et al. 1988). There is marginal evidence that the emission is a function of orbital phase (Wright et al. 1988). And ST LMi was detected (2.0 $\pm$ 0.3 mJy at 5 GHz) on 2 out of 3 occasions. This is a 6σ detection, but Beasley et al. (1994) warn that confusion may have occurred.

The IPs are AE Aqr, DQ Her, BG CMi and the probable IP, J1023+0038. AE Aqr has variable non-thermal emission (1-12 mJy at 15 GHz) with multiple flare events (up to 35 mJy) (e.g. Bastian, Dulk, and Chanmugam 1988). It is a strong variable source across the spectrum, including γ-rays at TeV energies (Meintjes et al. 1992, de Jager et al. 1994). DQ Her was detected (1-4 mJy at 5 GHz) on 3 of 4 occasions, with a flaring event (Pavelin et al. 1994). Strong upper limits on important MCVs have been obtained (Mason, Fisher, and Chanmugam 1996 and Beasley et al. 1994) An exciting result is J1023+0038, a probable MCV with highly variable emission including a 6.6 mJy flare at 1.4 GHz (Bond, White, Becker, and O'Brien, 2002).

III. The Survey

We have begun a VLA survey of magnetic CVs in order to place strong constraints on models of radio emission by (1) completing the sample of all MCVs closer than 100 pc and by (2) observing binaries with system properties similar to the quiescent and flaring radio MCV, AM Herculis. In addition, we shall attempt to confirm the detection of the first radio selected MCV, FIRST J1023+0038. Previous VLA surveys have shown that only a small fraction of MCVs are radio sources. However, these surveys have failed establish linkages between system properties such as magnetic field strength and the presence of radio emission. Such connections are vital in order to place constraints on radio emission mechanism models. Shortly after this meeting, data reduction began and the high field polar AR UMa was found to be a radio source.

REFERENCES

Bastian, T.S., Dulk, G., and Chanmugam, G. 1988, ApJ, 324, 431
Beasley, A.J., Bastian, T.S, Ball, L., and Wu, K., 1994, AJ, 108, 2207
Bond, H.E., White, R.L., Becker, R.H., and O'Brien, M.S. 2002, PASP, 114, 1359
Chanmugam, G., and Dulk, G.A. 1982, ApJ, 255, L107
Cordova, F.A., Mason, K.O., and Hjellming, R.M. 1983, PASP, 95, 96
De Jager, O.C., Meintjes, P.J., O'Donoghue, D., and Robinson, E.L. 1994, MNRAS, 267, 577
Fuerst, E., Benz, A., Hirth, W., Kiplinger, A., and Geffert, M. 1986, A& A, 154, 377
Mason, P. A., Fisher, P. L., and Chanmugam G. 1996, A& A, 310, 132
Meintjes et al. 1992, ApJ, 401, 325
Pavelin, P.E., et al. 1994, MNRAS, 269, 779
Wright, A.E., Cropper, M.S., Stewart, R.T., Nelson, G.J., and Slee, O.B. 1988, MNRAS, 231, 319

[1]The University of Texas at El Paso, Department of Physics, El Paso, TX, 79968, USA (clgray@utep.edu).