Baltic Astronomy, vol. 7, 319–328, 1998.

THE EUROWET CO-OPERATION

J.-E. Solheim

Department of Physics, University of Tromsø, N-9037 Tromsø, Norway

Received March 1, 1998.

Abstract. The WET groups in Europe co-operate on many levels. With a grant from the European Union, instrument development, joint observing campaigns and some short-time support for young scientists have been possible. At the moment the grant has expired, but instrument development continues with own funds, concentrating on the development of high-speed CCD photometers.

Key words: observing campaigns – observing networks – instrumentation: CCD photometers

1. INTRODUCTION

The aim of WET is to engage astronomers from all continents in joint observing campaigns and to develop instruments and create tools for analysing the data acquired. In principle, any sub-organizations should not be necessary. Our slogan is that the Whole Earth is our telescope, and we should work ideally as one unit. However, in order to apply for funding related to the geographically limited area, we found it necessary to organise the European partners in WET. The result of this will be explained in the following.

WET has not always been a world-wide co-operation. We must remember that the original idea behind WET was that it should be an instrument for Texas astronomers to observe their targets. Colleagues around the world should apply for observing time, and observers from Texas should bring their instruments, do the observations and bring the data home for analysis. This did not work. It soon became obvious that it would be too expensive to travel all over the world from Texas for each campaign. The Texas group neither could support enough instruments nor raise enough money for all the travels.

The solution for WET has become that people locally apply for observing time, do the observations and take responsibilities for providing instruments. This means that funds for the operations in most cases have to be raised locally. As a bonus, the observers outside Texas could be Principal Investigators, if they are trained or certified as WET observers. The core of the WET observers has always been constituted by previous students from Texas, as well as other scientists who have spent time in Texas to learn this particular observing technique. But now most of the people from Texas are spread in many states and continents, and many of us train our own students and colleagues for WET work. Therefore, some WET groups were formed in Europe, which will be presented below. In the reference list we will present a bibliography, listing some of the WET related publications from the EUROWET groups.

2. THE HCM PROGRAMME

2.1 The application

Apart from local funding, there is always a need for money from other sources. So when we became aware in 1992 of the Human Capital and Mobility Programme (HCM in short) of the European Union, we quickly organized WET groups in Europe and submitted an application. Because of the rules for this programme, we had to have at least 5 members in different countries who participated in the EU science programme. We made our first application based on the Toulouse, Leicester and Tromsø groups and included the Vienna group, which under direction of M. Breger, did excellent work on δ Scuti stars, using the 3-star technique, which was fit for lower frequencies than we could handle with the normal WET procedure. We agreed to plan joint campaigns of WET and DSN (the Delta Scuti star Network). We also included our colleagues from Krakow and Vilnius. They could only be affiliated without getting money from this EU programme. Anyway, we thought that their affiliation in the programme might help them to apply for other EU programmes or for national support. This proved to be true.

With M. Breger, we had four counting members on our application. Still missing one, we invited a group from the Technical University in Berlin as a subcontractor, to make use of their student satellite TUBSAT A (Bruvold 1993) in order to communicate

with WET teams working at remote places as the Central Asian observatories, the Maidanak Observatory in Uzbekistan and the Assy Turgen Observatory in Kazakhstan.

Early in 1994 we were informed that we had been granted 150 kECU, which we spent during a 2-year programme starting from December 1, 1994. The objective of this programme was twofold:

– to operate and improve the European section of WET

and

– to improve instrumentation and data analysis methods, in particular to integrate the 3-star and WET observing techniques to work for low and high frequency modulations at the same time.

In fact our slogan became:

WET+DSN = (EURO)WET

2.2 The EUROWET EU-programme

In the spirit of the EU-programme, we hoped to organize people interchange between the groups, learning various instruments and observing techniques and hopefully arrive at higher and more uniform quality of our data and scientific results.

One important rule for the use of the HCM grant was that only one fraction of the money (maximum 40 rest should be used on people. That was the reason for the name Human ... Mobility. In addition to pay for travel costs for campaigns in Europe, we had the possibility to use money to engage postdocs and to travel to workshops and meetings, and to visit each other for shorter or longer periods of time. One restriction on the use was that these travels should take place in Western Europe, and a special permission from the European Commission was needed to go to outside this area. Finally we obtained permission to finance, in part, a trip to the Ames WET workshop in 1995 for one of the EUROWET participants. Because of these rules, we did not try to fund observing travels outside Europe.

With these limitations in mind, we managed to engage two postdocs: Benoite Pfeiffer from Toulouse for 9 months in Leicester and Christophe Massacand from Paris for 3 months in Tromsø. In addition, we arranged shorter working visits between the groups. To hire these young people was good for the project, but in the long run it was a failure, since we could not raise funds to keep them in the field. Now they both have gone to other fields.

We arranged two EUROWET workshops. The first was in Leicester in May 1995 and the second in Skibotn, near Tromsø in June 1996. To both these workshops our Polish and Lithuanian collaborators were invited.

In addition, we supported the DSN14 observing campaign directed from Vienna in December 1994 (FG Vir) and the XCOV13 campaign directed from Vienna in February 1996 (4 CVn and RE 0751+14), and gave travel support for some participants of the XCOV 12, 13 and 14 campaigns.

On the instrumental side, we financed upgrading the 2-channel Texas photometer in Tromsø to a 3-channel photometer, following the Scot Kleinman design (Kleinman et al. 1993). This was done in the Auroral Observatory workshop. This photometer is now situated at the La Palma Observatories and can be used by all members of WET. Furthermore, we have rebuilt a damaged 3-channel Chevreton photometer for China and started to develop CCD photometers both in Paris and in Tromsø: 1/3 of the cost of the Paris CCD photometer was paid by the EUROWET grant. We also purchased photometer electronics developed in Vilnius, thereby somewhat supporting the Lithuanian group.

On the data reduction side, the programmes developed in Toulouse and used in Leicester, have been demonstrated in Tromsø by B. Pfeiffer during her fellowship period. One student from Tromsø, T. Thomassen, spent several weeks in Vienna to reduce data from 3-star DSN-campaigns (Breger et al. 1997).

On the theoretical side, the goal was to become independent of scientists in the US in development of pulsation models. We wanted also to develop and make available for all the teams the non-linear pulsation codes. The work on this was started in Toulouse and Vienna, in co-operation with Polish theorists.

In Leicester, we wanted to continue the existing work on hot white dwarf atmospheres as a complement the pulsation theory work. Direct study of atmospheric composition in white dwarfs can provide an important test of the viability of pulsation mechanisms. Furthermore, the pulsation studies can give information on the atmospheric structure to aid interpretation of spectroscopic data (Barstow et al. 1997).

The Vienna people should organize campaigns for stars with longer pulsation periods and analyse data acquired with the 3-star technique. In particular, they should make experiments in comparing the continuous observing method and the 3-star technique.

They previously had worked out a hybrid observing technique for pulsators of intermediate periods which remains to be tested in full scale (Breger & Handler 1993).

Another task for the Toulouse group was to update existing codes to compute non-radial pulsations of stellar models and to initiate theoretical work on non-linear pulsations. The group should also pursue the application of modern methods in the analysis of time series, developed in other fields of physics and mathematics, to the data obtained during WET campaigns (Roque et al. 1997).

The EU grant contract expired in November 1996, and the last joint observing campaign was the one organized by D. O'Donoghue on PB 8783 in October 1996, where EUROWET financed the JKT run (O'Donoghue et al. 1998).

3. THE FUTURE OF EUROWET

Even if the EU-money is spent, EUROWET is not dead. Based on the experience from the single grant we won, we applied for EU money twice within the TMR programme (Training through Mobility and Research). Here we bid for 20 man-years of postdoc time for training scientists in advanced instrumentation and observation techniques, combined with modern analysis methods for extracting physical information from observations. We also submitted an INTAS application for collaboration with a group of Moscow and Kazakhstan astronomers, in order to train them and supply them with proper instrumentation for future WET participation. None of these applications gave any money.

We have decided that the EUROWET co-operation will continue on a lower level based on our own resources. One common project is to develop a CCD-based photometer that can make the smaller telescopes more efficient. This work is being done in Paris and in Tromsø, and we hope that prototypes of the photometer can be demonstrated at the next WET workshop. We also plan to cooperate in making useful atmosphere models for white dwarfs and also foresee joint DSN/WET campaigns in the future.

ACKNOWLEDGMENTS. We thank the European Union for award of the grant by EU contract CHRX-CT94-0434-HMC-Network, which has made the EUROWET co-operation possible.

BIBLIOGRAPHY

Bard S. 1996, "Model spectra for the Helium Cataclysmic AM CVn", in CVs and Related Objects, eds. A. Evans & J. H. Wood, Kluwer Academic Publishers, p. 133

Barstow M. A., Hubeny I., Lanz T., Holberg J. B., Sion E. M. 1996, "The structure and composition of white dwarf atmospheres revealed by extreme ultraviolet spectroscopy", in Astrophysics in the Extreme Ultraviolet, eds. S. Bowyer & R. Malina, Kluwer Academic Publishers, p. 203

Barstow M. A., Holberg J. B., Hubeny I. et al. 1996, "Solving the mystery of the heavy element opacity in the DA white dwarf GD 394", MNRAS, 279, 1120

Barstow M. A. 1996, "The strange case of the missing white dwarfs.... and other mysteries", in Proceedings of the Röntgen Centenary Conference: Röntenstrahlung from the Universe, Würzburg, MPE Report 263, eds. H. U. Zimmermann, J. E. Trümper & H. Yorke, p. 77

Barstow M. A. 1996, "Hot white dwarfs: an observational viewpoint", Contemporary Physics, 37, 359

Barstow M. A., Belmonte J. A., Kepler S. O. et al. 1996, "Whole Earth Telescope observations and seismological analysis of the cool ZZ Ceti star GD154", A&A, 314, 182

Barstow M. A. 1997, "Astronomers with X-ray eyes", Astronomy, 11, 41

Barstow M. A., Holberg J. B., Cruise A. M, Penny A. J. 1997, "The mass, temperature and distance of the white dwarf in V471 Tauri", MNRAS, 290, 505

Barstow M. A., Dobbie P. D., Holberg J. B., Hubeny I., Lanz T. 1997, "Interstellar and photospheric opacity from EUV spectroscopy of DA white dwarfs", MNRAS, 286, 58

Barstow M. A., Hubeny I. 1998, "An improved explanation of the EUV spectrum of G 191-B2B invoking a stratified H+He envelope including heavier elements", MNRAS, submitted

Barstow M. A. 1998, "Viewpoint living in the Universe", Astronomy Now, in press.

Breger M., Handler G. 1993, "Extending the Whole Earth Telescope technique to lower frequencies", Baltic Astronomy, 2, 468

Breger M. et al. 1995, "The Delta Scuti star FG Vir. I. Multiple pulsation frequencies determined with a combined DSN/WET campaign", A&A, 297, 473

Breger M., Handler G., Serkowitsch E. 1995, "The 1995 FG Vir campaign: will 550 hours of new data and 19 frequencies be enough to do asteroseismology?" Comm. Asteroseismology, 83

Breger M. 1995, "Main Sequence Variables", Baltic Astronomy, 4, 468

Breger M., Handler G., Serkowitsch E., Reegen P., Provencal J.,... Krzesiński J., Pajdosz G., Moskalik P., Solheim J.-E. 1996, "The δ Scuti star FG Vir II. A search for high pulsation frequencies", A&A, 309, 197

Breger M., Beichbuchner F. 1996, "Gamma Doradus and Delta Scuti stars: cousins or twins?", A&A, 313, 851

Breger M., Audard N. 1997, "Observational asteroseismology of Delta Scuti stars", in Sounding Solar and Stellar Interiors, eds. J. Provost and F.-X. Schneider, Kluwer Academic Publishers, p. 381

Breger M., Zima W., Handler G. 1997, "The variability of a newly discovered Gamma Doradus star HD 108100", A&A, 324, 566

Breger M. 1998, "A half century of astrophysical interpretations of Delta Scuti stars", in A Half Century of Stellar Pulsation Interpretations: a Tribute to Arthur N. Cox, ed. P. A. Bradley & J. A. Guzik, ASP Conference Series, 135, 460

Breger M., Pamyatnykh A. A. 1998, "Period changes of Delta Scuti stars and stellar evolution", A&A, in press

Breger M., Zima W., Handler G., Poretti E., Shobbrook R. R., Nitta A., Prouton O. R., Garrido R., Rodriguez R., Thomassen T. 1998, "The Delta Scuti star FG Vir. III. The 1995 multisite campaign and the detection of 24 pulsation frequencies", A&A, in press

Bruvold A. 1993, "Microsatellites for communication with remote places", Baltic Astronomy, 2, 492

Burleigh M. R., Barstow M. A., Fleming T. A. 1997, "A search for hidden white dwarfs in the ROSAT EUV survey", MNRAS, 287, 381

Burleigh M. R., Barstow M. A., Dobbie P. D. 1997, "The close DAO+dM binary RE J0720-318, a stratified white dwarf with a thin H layer and a possible circumbinary disk", A&A, 317, L27

Burleigh M. R., Barstow M. A. 1998, "HR 2875: spectroscopic discovery of the first B star + white dwarf binary", MNRAS, submitted

Dolez N., Roques S, Serre B., Vauclair G. 1998, "Asteroseismology for DAV white dwarfs with time-frequency analysis and band-limited interpolation", in A Half Century of Stellar Pulsation In-

terpretations: a Tribute to Arthur N. Cox, ed. P. A. Bradley & J. A. Guzik, ASP Conference Series, 135, 442

Handler G. 1995, "CD–24 7599: new results", Baltic Astronomy, 4, 434

Handler G., Breger M., Sullivan D. et al. 1996, "Nonradial pulsation of the unevolved Delta Scuti star CD –24 7599 discovered with the Whole Earth Telescope", A&A, 307, 529

Handler G. et al. 1997, "Variable central stars of young planetary nebulae. I. Photometric multisite observations of IC 418", A&A, 320, 125

Handler G., Pikall H., O'Donoghue D.,..., Solheim J-E. et al. 1997, "New Whole Earth Telescope observations of CD–24 7599: steps towards Delta Scuti star seismology", MNRAS, 286, 303

Holberg J. B., Barstow M. A., Bruhweiler F. C., Collins J. 1996, "Photospheric silicon in the DA white dwarf Wolf 1346", AJ, 111, 2361

Holberg J. B., Barstow M. A., Lanz T., Hubeny I. 1997, "Hubble Space Telescope ultraviolet spectroscopy of two hot white dwarfs", ApJ, 484, 871

Holberg J. B., Barstow M. A., Green E. M. 1997, "The discovery of MgII λ4481 in the white dwarf EG 102: evidence for ongoing accretion", ApJ, 474, L127

Holberg J. B., Barstow M. A., Bruhweiler F. C., Cruise A. M., Penny A. J. 1998, "Sirius B: a new more accurate view", ApJ, in press

Kalytis R., Meištas E. G. 1995, "Photometric equipment for WET", Baltic Astronomy, 4, 497

Kalytis R., Meištas E., Sperauskas J. 1998, "On the necessity to standardize the photometric parameters of the WET photometers", 1998, Baltic Astronomy, 7, 341

Kawaler S. D., O'Brien M. S., Clemens J. C., Nather R. E., Winget D. E., ..., Moskalik P., Zola S., Pajdosz G., Krzesiński J., Solheim J.-E., Bruvold A.,..., Vauclair G., Dolez N., Chevreton M., Barstow M. A. et al. 1996, "Whole Earth Telescope observations and seismological analysis of the pre-white dwarf PG 2131+066", ApJ, 450, 350

Kleinman S. J., Nather R. E., Phillips T. 1995, "The WET standard photometer", Baltic Astronomy, 4, 482

Kleinman S. J., Nather R. E., Winget D. E, Clemens J. C., Bradley P. A., ..., Meištas E. G.,..., Moskalik P., Krzesiński J., Solheim J.-E., Bruvold A., O'Donoghue D. W.,..., Vauclair G., Dolez N.,

Chevreton M., Barstow M. A. et al. 1998, "Understanding the cool DA white dwarf pulsator G 29-38", ApJ, in press

Lanz T., Barstow M. A., Hubeny I., Holberg J. B. 1996, "A self-consistent optical, ultraviolet and extreme ultraviolet model for the spectrum of the hot white dwarf G 191–B2B", ApJ, 473, 1089

Marar T. M. K., Seetha S., Ashoka B. N., Kasturianagan K., Mahra H. S., ..., Breger M., Handler G., Sperl M., Serkowitsch E., Reegen P., Moskalik P., Zola S., Pajdosz G., Krzesiński J., Silvotti R., Vauclair G., Dolez N., Solheim J.-E., Pfeiffer B. et al. 1998, "Whole Earth Telescope observations of the intermediate polar RE 0751+14 (PQ Gem)", A&A, submitted

Marsh M. C., Barstow M. A., Buckley D. A., Burleigh M. R., Holberg J. B. et al. 1997, "An EUV-selected sample of DA white dwarfs from the ROSAT all-sky survey. I. Optically derived stellar parameters", MNRAS, 286, 369

Marsh M. C., Barstow M. A., Buckley D. A., Burleigh M. R., Holberg J. B. et al. 1997, "An EUV-selected sample of DA white dwarfs from the ROSAT all-sky survey. II. EUV and soft X-ray properties", MNRAS, 287, 705

Massacand C. M., Solheim J.-E. 1995, "Observations of modulation amplitude colors in AM CVn", Baltic Astronomy, 4, 378

Nymark T. K., Solheim J.-E. 1995, "The secondary star in AM CVn", Baltic Astronomy, 4, 396

Nymark T. 1997, "Effects of radiation on the secondary star in a tight binary system, exemplified by AM Canum Venaticorum", in White Dwarfs, eds. J. Isern, M. Hernanz & E. Garcia-Berro, Kluwer Academic Publishers, p. 345

O'Brien M. S., Vauclair G., Kawaler S., Watson T. K., Winget D. E.,..., Moskalik P., Zola S., Pajdosz G., Krzesiński J., Dolez N., Chevreton M., Solheim J.-E. et al. 1998, "Asteroseismology of a star cooled by neutrino emission: the pulsating pre-white dwarf PG 0122+200", ApJ, in press

O'Donoghue D., Koen C., Solheim J.-E., Barstow M. A., Dobbie P. D. et al. 1998, "The EC 14026 stars. V. The pulsation periods of PB 8783", MNRAS, submitted

Pfeiffer B., Vauclair G., Dolez N., Chevreton M. et al. 1995, "Whole Earth Telescope observations and seismological analysis of the cool ZZ Ceti star GD 154", Baltic Astronomy, 4, 245

Roques S., Serre B., Dolez N., Bouyoucef K., Marechal P. 1997, "White dwarf time-series under time-frequency analysis", Proc. of the 16th Coll. GRETSI, p. 825

Roques S., Mary D., Dolez N. 1998, "How can wavelets see asteroseismological signals?", in A Half Century of Stellar Pulsation Interpretations: a Tribute to Arthur N. Cox, eds. P. A. Bradley & J. A. Guzik, ASP Conference Series, 135, 447

Roques S., Serre B., Dolez N. 1998, "Band-limited interpolation of multiperiodic white dwarf time series", MNRAS, submitted

Saxton R. D., Barstow M. A., Turner M. L. J., Williams O. R., Stewart G. C., Kii T. 1997, "X-ray emission from the cluster around E 1821+643", MNRAS, 289, 196

Semionovas D. 1997, "Modeling of the accretion disc spectra in AM CVn systems", Baltic Astronomy, 8, 269

Serre B., Marechal P., Roques S., Pfeiffer B., Vauclair G., Lannes A. 1994, "Time-frequency analysis and observation synthesis of non-radial oscillations of white dwarfs", Proc. of the IEEE-SP Int. Symp. on Time-frequency and Time-scale analysis, Philadelphia, p. 349

Sion E. M., Holberg J. B., Barstow M. A., Schieble M. P. 1997, "On-going mass ejection in the peculiar, hot DO degenerate KPD 0005+5106", AJ, 113, 364

Solheim J.-E. 1995, "The AM CVn type stars: an overview", Baltic Astronomy, 4, 363

Solheim J.-E. 1996, "Non-circular disks in AM CVn systems", in CVs and Related Objects, eds. A. Evans & J. H. Wood, Kluwer Academic Publishers, p. 131

Solheim, J.-E. 1996, "AM CVn binaries – will they evolve into DB white dwarfs?", in Hydrogen Deficient Stars, ed. C. S. Jeffery, A.S.P. Conference Series, 96, 309

Solheim J.-E., Provencal J. L., Sion E. M. 1997, HST observations of AM Canum Venaticorum, in White Dwarfs, eds. J. Isern, M. Hernanz & E. Garcia-Berro, Kluwer Academic Publishers, p. 337

Solheim J.-E., Provencal J. L. 1998, "First attempt on discoseismology of AM CVn stars – what can the harmonic structure of the observed amplitude spectra tell us?", Baltic Astronomy 7, 277

Solheim J.-E., Provencal J. L., Bradley P. A., Vauclair G., Barstow M. A.,..., Emanuelsen P.-I., Chevreton M., Dolez N.,..., Sansom A. E., Tweedy R. W., Meištas E. G., Bruvold A., Massacand C. 1998, "Whole Earth Telescope observations of AM CVn – discoseismology at last", A&A, 332, 939

Watson M. G., Marsh T. R., Fender R. P., Barstow M. A. et al. 1996, "The EUV transient RE J1255+266", MNRAS, 281, 1016