EXTERNAL CONTROL OF EXCITATION WAVES BY ELECTRIC FIELDS

Dähmlow P., Luengviriya Ch.[1], Müller S. C.

Institute of Experimental Physics, University Magdeburg, Universitätsstrasse 2, Magdeburg, D-39106, Germany, +493916718935,stefan.mueller@ovgu.de
[1]Department of Physics, Kasetsart University, 50 Phaholyothin Road, Jatujak, Bangkok, 10900, Thailand, +6625625555, fscicyl@ku.ac.th

Excitation waves are a prototype of self-organized dynamic patterns in nonequilibrium systems. They develop their own intrinsic dynamics resulting in travelling waves of various forms and shapes. Prominent examples are rotating spirals and scroll waves. It is a challenging task to find ways to control their behavior by applying external signals, upon which these propagating waves react. We apply electric fields to excitation waves propagating in the Belousov-Zhabotinsky (BZ) reaction. There are several remarkable effects including the influence on wave speed, reversal of propagation direction [1], annihilation of counter-rotating spiral waves [2] and reorientation of scroll wave filaments [3]. These effects can be explained in numerical simulations where the negatively charged inhibitor variable bromide plays an essential role.

Furthermore we demonstrate the action of electric fields on waves and Turing type patterns [4] forming in the BZ reaction when embedded in a microemulsion. We investigate the role that such fields may play in the establishment of long range interactions within the system.

References

1. *H. Sevciková, M. Marek and S. C. Müller*. The reversal and splitting of waves in an excitable medium caused by an electrical field // Science **257**, 1992. Pp. 951-954.
2. *J. Schütze, O. Steinbock and S. C. Müller*. Forced vortex interaction and annihilation in an active medium // Nature **356**, 1992. Pp. 45-47.
3. *C. Luengviriya, S. C. Müller and M. J. B. Hauser*. Reorientation of scroll rings in an advective field // Phys. Rev. E **77**, 2008. Pp. 015201.
4. *B. Schmidt, P. DeKepper and S. C. Müller*. Destabilization of Turing structures by electric fields // Phys. Rev. Lett. **90** 2003. Pp. 118302-1 118302-4.