Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Designing autonomously motile gels that follow complex paths PRATYUSH DAYAL, OLGA KUKSENOK, ANNA C. BALAZS, University of Pittsburgh — Using theory and simulation, we determine the effect of light on the motion of polymer gels undergoing the Belousov-Zhabotinsky (BZ) reaction. The BZ gels undergo rhythmic mechanical oscillations in response to the periodic reduction and oxidation of ruthenium catalyst that is grafted to the polymer network. The Ru-catalyzed BZ reaction is photosensitive, with light of a certain wavelength suppressing the oscillations within the gel. We exploit this property to control the self-sustained motion of millimeter-sized BZ gel "worms". By tailoring the arrangement of illuminated and non-illuminated regions, we direct the movement of these worms along complex paths, guiding them to bend, reorient and turn. In particular, these gels can make both 90 degree and U-turns. Notably, the path and the direction of the gel's motion can be dynamically and remotely reconfigured. Hence, our findings can be utilized to design intelligent, autonomously moving biomimetic system that can be reprogrammed "on demand" to move to a specific target location and to remain at this location for a chosen period of time. We also determine the controlling parameters that govern their motion. Our findings establish necessary and sufficient conditions required for the movement of these active gels.

Pratyush Dayal
University of Pittsburgh

Date submitted: 20 Nov 2009 Electronic form version 1.4