Dynamics of contracting actomyosin networks with turnover

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Contracting actomyosin networks have essential roles in many processes including cell division, intracellular transport and cell motility. To fulfill these functions, the networks must undergo continuous reorganization facilitated by rapid actin turnover. Despite extensive research, the contractile network behavior in the presence of turnover is still not well understood. To address this issue, we rely on an *in vitro* system based on cytoplasmic *Xenopus* egg extracts encapsulated into cell-sized water-in-oil droplets. Thanks to the presence of physiological turnover rates, our system exhibits contractile flows that persist for hours and self-organize into a wide array of spatiotemporal patterns. Interestingly, we observe a size-dependent transition in the contractile behavior of the system, going from continuous contraction in smaller droplets to periodic contraction in the form of waves and spirals in larger droplets. The periodicity increases with network contraction rates while the characteristic length-scale for the appearance of waves decreases. Computational modeling suggests that the coupling of the contractile gel mechanics with turnover is indeed key to the pulsatile behavior in large droplets.