

Table of Content

1. Introduction	1
1.1. Contents	2
1.2. General objective	3
1.3. Specific objectives	3
1.4. Common abbreviations	4
1.5. Contribution statement	4
1.5.1. Labyrinthine pattern transitions (Physical Review Research 2, 042036)	4
1.5.2. Localized states with nontrivial symmetries: Localized labyrinthine patterns (Physical Review E 105, L012202)	4
1.5.3. Localised labyrinthine patterns in ecosystems (Scientific reports 11, 18331)	5
1.5.4. Vegetation covers phase separation in inhomogeneous environments (Chaos, Solitons & Fractals 163, 112518)	5
1.5.5. Effect of heterogeneous environmental conditions on labyrinthine vegetation patterns (Physical Review E 107, 054219)	5
1.5.6. Localized dissipative vortices in chiral nematic liquid crystal cells (Phys- ical Review Research 4, L022021)	5
1.5.7. Emergence of disordered branching patterns in confined chiral nematic liquid crystals (Proceedings of the National Academy of Sciences 120, e2221000120)	5
1.5.8. Morphological transition of labyrinthine patterns in frustrated chiral nematic liquid crystals (Liquid Crystals XXVI 12207, 75-81)	5
2. Theoretical framework	6
2.1. Dissipative Dynamical Systems	6
2.2. Bifurcations	7
2.2.1. Saddle-Node bifurcation	7
2.2.2. Transcritical bifurcation	8
2.2.3. Supercritical Pitchfork bifurcation	9
2.2.4. Subcritical bifurcation with reflection symmetry	9
2.3. Extended Systems	10
2.3.1. Interfaces	11
2.3.2. Pattern Formation	12
2.4. Vegetation self-organization	15
2.5. Chiral nematic liquid crystals	17
2.5.1. Nematic liquid crystals	17
2.5.2. Continuum theory: Frank-Oseen free energy	19

2.5.3. Chiral nematic liquid crystals	20
3. Labyrinthine pattern transitions (Physical Review Research 2, 042036)	24
3.1. Perspectives	33
4. Localized states with nontrivial symmetries: Localized labyrinthine patterns (Physical Review E 105, L012202)	34
4.1. Perspectives	48
5. Localised labyrinthine patterns in ecosystems (Scientific reports 11, 18331)	49
5.1. Perspectives	62
6. Vegetation covers phase separation in inhomogeneous environments (Chaos, Solitons & Fractals 163, 112518)	63
6.1. Perspectives	73
7. Effect of heterogeneous environmental conditions on labyrinthine vegetation patterns (Physical Review E 107, 054219)	74
7.1. Perspectives	86
8. Localized dissipative vortices in chiral nematic liquid crystal cells (Physical Review Research 4, L022021)	87
8.1. Perspectives	100
9. Emergence of disordered branching patterns in confined chiral nematic liquid crystals (Proceedings of the National Academy of Sciences 120, e2221000120)	101
9.1. Perspectives	123
10. Morphological transition of labyrinthine patterns in frustrated chiral nematic liquid crystals (Liquid Crystals XXVI 12207, 75-81)	124
10.1. Perspectives	132
11. Conclusions	133
Bibliography	135