Skyrmionic topology perspective on Lehmann clusters

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When two parallel coplanar dislocations with opposite Burgers vectors are brought by action of a stress into a collision in solid crystals, they annihilate each other.

In cholesterics with the pitch p, in certain conditions, colliding dislocations with Burgers vectors b=p and b=-p are immune against annihilation and form stable twin-like pairs known as Lehmann clusters [1,2].

We point out that this immunity is due to the escape into the third dimension of the director field. We show that from topological point of view the Lehmann clusters can be seen as skyrmion tubes [3] embedded in a helicoidal background and their extremities have topology of monopoles (Figure 1).

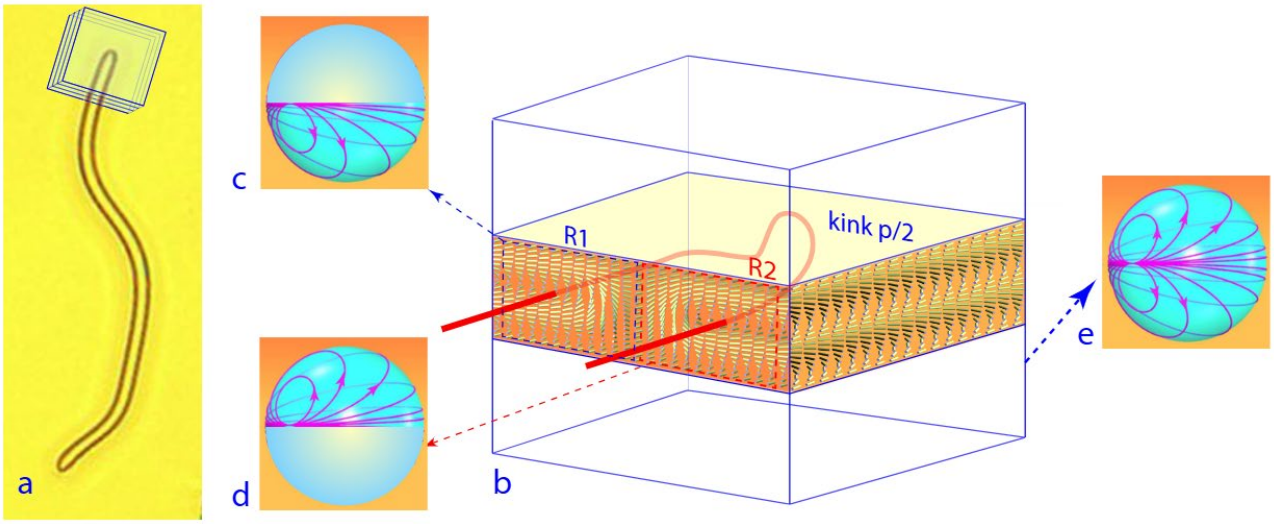

Figure 1. Monopole located at an extremity of a skyrmion tube. a) Lehmann cluster of finite length is equivalent to a skyrmion tube. One of its extremities is located inside a cuboid box. b) Director field on surfaces of the cuboid. c) Director field from the rectangle R1 covers the south hemisphere. d) Director field from the rectangle R2 covers the north hemisphere. e) Director field from the whole surface of the cuboid covers the whole unit sphere. This is the fingerprint of a monopole.

References

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