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6TH ITALIAN CONFERENCE ON MAGNETISM

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BOOK OF ABSTRACTS

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The 6th Italian Conference on Magnetism, MAGNET2019, is promoted by the **Italian Magnetism Society** and organized by the University of Messina.

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Straight motion of magnetic defects in Fe-N thin films with stripe domains

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In thin magnetic films with perpendicular magnetic anisotropy, an up-down stripe-domain structure can be originated, due to the competition between short-range exchange coupling and long-range magnetic dipole-dipole interaction. Even in the absence of quenched disorder, topological defects can develop in the stripe pattern due to large amplitude fluctuations occurring in two dimensions. In this work we investigate the field-dependent motion of magnetic edge dislocations in a N$^-$implanted Fe film, with thickness t=78 nm and stripe domain period P=100 nm (Fig.1).[1] Combining evidence from magnetic force microscopy data, micromagnetic simulations and a theory based on the Thiele equation, the defects were found to undergo a straight displacement. When a moderate magnetic field is applied in plane along the stripes axis, the displacement may be either in the direction of the applied field or in the opposite direction, depending on the in-plane magnetization in the topological magnetic defects, but irrespective of the out-of-plane magnetization in the stripe domains. Moreover, this straight trajectory is found to be due only to the external force and the dissipative force, which are both parallel to the stripes axis, while the gyrotropic force on an edge dislocation, is shown to vanish owing to the periodic stripe domain pattern. In comparison with skyrmions which have a gyrotropic motion when they are subjected to a magnetic field, the straight motion of magnetic edge dislocations could be advantageous for their use as information carriers in defect-based spintronics.

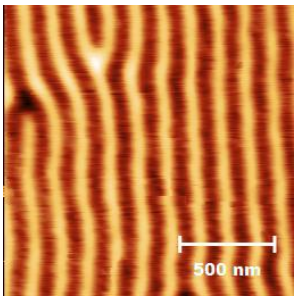

Fig. 1 Stripe domains observed in the FeN film by magnetic force microscopy

[1] S. Fin, R. Silvani, S. Tacchi, M. Marangolo, L.-C. Garnier, M. Eddrief, C. Hepburn, F. Fortuna, A. Rettori, M. G. Pini and D. Bisero, Sci. Rep. **8**, 9339 (2018)