## Abstract Submitted for the MAR14 Meeting of The American Physical Society

Twisted Ribbons: Theory, Experiment and Applications<sup>1</sup> JULIEN CHOPIN, COPPE-UFRJ, BENJAMIN DAVIDOVITCH, UMASS-Amherst, FLAVIO A. SILVA, ROMILDO D. TOLEDO FILHO, COPPE-UFRJ, ARSHAD KUDROLLI, Clark University — We investigate, experimentally and theoretically, the buckling and wrinkling instabilities of a pre-stretched ribbon upon twisting and propose strategies for the fabrication of structured yarns. Our experiment consists in a thin elastic sheet in the form of a ribbon which is initially stretched by a fixed load and then subjected to a twist by rotating the ends through a prescribed angle. We show that a wide variety of shapes and instabilities can be obtained by simply varying the applied twist and tension. The observed structures which include helicoids with and without longitudinal and transverse wrinkles, and spontaneous creases, can be organized in a phase diagram with the tension and twist angle as control parameters [J. Chopin and A. Kudrolli, PRL (2013)]. Using a far-from-threshold analysis and a slender body approximation, we provide a comprehensive understanding of the longitudinal and transverse instabilities and show that several regimes emerge depending on subtle combinations of loading and geometrical parameters. Further, we show that the wrinkling instabilities can be manipulated to fabricate structured yarns which may be used to encapsulate amorphous materials or serve as efficient reinforcements for cement-based composites.

<sup>1</sup>COPPETEC / CNPq - Science Without Border Program

Julien Chopin COPPE-UFRJ

Date submitted: 15 Nov 2013 Electronic form version 1.4