

# TOPOLOGICAL QUANTUM FIELD THEORIES AND COHOMOLOGY OF KNOT SPACES IN ANY DIMENSION

RICCARDO LONGONI

*Joint work with A. S. Cattaneo, P. Cotta-Ramusino*

The real cohomology of the space of imbeddings of  $S^1$  into  $\mathbb{R}^n$ ,  $n > 3$ , is studied both by using configuration space integrals and by considering the restriction of classes defined on the corresponding spaces of immersions. Nontrivial classes are explicitly constructed.

The cohomology classes obtained by configuration space integrals generalize in a nontrivial way the Vassiliev knot invariants obtained in three dimensions from the Chern–Simons perturbation theory. There is a diagrammatical representation of these classes, since one can define complexes of decorated diagrams  $(\mathcal{D}_o, \delta_o)$  and  $(\mathcal{D}_e, \delta_e)$  and chain maps

$$\begin{aligned}(\mathcal{D}_o, \delta_o) &\rightarrow H_{DeR}^*(\text{Imb}(S^1, \mathbb{R}^n)) \text{ for } n \text{ odd} \\(\mathcal{D}_e, \delta_e) &\rightarrow H_{DeR}^*(\text{Imb}(S^1, \mathbb{R}^n)) \text{ for } n \text{ even.}\end{aligned}$$

If only trivalent diagrams are considered these chain maps are proved to be injective.

These classes have also a topological-field-theoretical interpretation as expectation values of generalization of Wilson loop observables for BF theories in any dimension in the Batalin-Vilkovisky framework [2].

## REFERENCES

- [1] A. S. Cattaneo, P. Cotta-Ramusino, R. Longoni: “Configuration spaces and Vassiliev classes in any dimension,” [math.GT/9910139](#)
- [2] A. S. Cattaneo, P. Cotta-Ramusino, C. Rossi: “Loop observables for BF theories in any dimension and the cohomology of knots,” [math.QA/000307](#) *Lett. Math. Phys.* to appear

DIPARTIMENTO DI MATEMATICA — UNIVERSITÀ DI GENOVA — ITALY  
*E-mail address:* [riccardo.longoni@mi.infn.it](mailto:riccardo.longoni@mi.infn.it)