Multiple Zeta Values Seminar

Miércoles, 26 de noviembre de 2014

16:15 h., Aula Gris 2 (ICMat, Campus de Cantoblanco)

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Renormalization theory and multiple zeta value

Resumen:

Far from being a liability of quantum field theory or a reason for divorce between mathematics and physics (D) (as it was viewed until not so long ago) renormalization theory has become a common playground for physicists and mathematicians. In the (Bogolubov-) Epstein–Glaser approach position space renormalization is reduced to the extension of distributions, originally defined for non-co-inciding arguments: one never has to speak of subtracting infinities. In a dilation invariant massless theory we are dealing with analytically regularized associate homogeneous distributions that are meromorphic functions of the regularization parameter. The residue of the pole of a primitively divergent amplitude is independent of the renormalization ambiguity and is a period in the sense of (KZ). Most of the periods in low order Feynman amplitudes (in particular, all periods in the ϕ^4 theory up to including six loops (S)) are found to be linear combinations with integer coefficients of multiple zeta values. The periods of an infinite sequence of n-loop graphs (the "zig-zag graphs") were proven to be rational multiples of a single zeta value, $\zeta(2n-3)$, (BS) We review and discuss these results and their relevance to the renormalization program for amplitudes that include integration over internal vertices.

Referencias

(BS) F. Brown, O. Schnetz, *Proof of the zig-zag conjecture*, arXiv:1208.1890v2.

(D) F.J. Dyson, *Missed opportunities*, Bull. Amer. Math. Soc. 78:5 (1972) 635-652.

(GGV) J.M. Gracia-Bondia, H. Gutiérrez-Garro, J.C. Várilly, *Improved Epstein-Glaser renormalization in x-space. III. Versus differential renormalization*, arXiv:1403.1785.

(KZ) M. Kontsevich, D. Zagier, *Periods*, in: Mathematics Unlimitted 2001 and beyond, B. Engquist, W. Schmid, eds., Springer, Berlin et al. 2001, pp. 771-808.

(NTS) N.M. Nikolov, R. Stora, I. Todorov, *Renormalization of massless Feynman amplitudes in configuration space*, Rev. Math. Phys. 26:4 (2014) 1430002 (65 pages); arXiv:1307.0854.

(S) O. Schnetz, *Quantum periods: A census of ϕ^4 transcendentals*, Commun. Number Theory Phys. 4:1 (2010) 1-46; arXiv:0801.2856v2.

(T) I. Todorov, *Polylogarithms and multizeta values in massless Feynman amplitudes*, Bures-sur-Yvette preprint, IHES/P/14/10.