

RICERCATORI IN ALGEBRA E GEOMETRIA 2020

TITOLI & ABSTRACTS

ANNA BARBIERI

From stability conditions to special functions. The Gamma function studied by Bernoulli appear all over mathematics and in particular whenever we study special contour integrals. We will review a class of special functions called Barnes multiple Gamma functions that generalize the Gamma function and we will see how they appear in the study of a class of stability conditions with a very simple Donaldson-Thomas theory. This goes through solving a Riemann-Hilbert-Birkhoff (RHB) boundary value problem induced by the wall-crossing formula for DT counting invariants. Based on a joint work with T. Bridgeland and J. Stoppa.

FEDERICO BINDA

GAGA type conjecture for the Brauer group via derived geometry. In Brauer III, Grothendieck considered the problem of comparing the cohomological Brauer group $Br(X) = H_{\text{et}}^2(X, G_m)$ of a scheme X , proper and flat over a henselian DVR R , and the inverse limit of the Brauer groups $\varprojlim_n Br(X_n)$, where $X_n = X \otimes_R R/m^n$. He proved that the canonical map $Br(X) \rightarrow \varprojlim_n Br(X_n)$ is injective under a number of restrictions, and left as an open problem the question on whether the formal injectivity holds in a fairly general setting. Thanks to the machinery of derived algebraic geometry and the results of Toën on derived Azumaya algebras and derived Morita theory, we are able to rephrase Grothendieck's question in terms of a formal GAGA-type problem for smooth and proper categories, enriched over the ∞ -category $QCoh(X)$ of quasi-coherent O_X -modules. In this framework we can show that Grothendieck's injectivity conjecture always holds for a proper derived scheme $X \rightarrow S$ where S is the spectrum of any complete Noetherian local ring, if we are willing to replace the inverse limit $\varprojlim_n Br(X_n)$ with the Brauer group $Br(X)$ of the formal scheme \mathfrak{X} given by the colimit of the thickenings X_n . The obstruction involving the inverse system $Pic(X_n)$ considered by Grothendieck appears naturally in the Milnor sequence for a certain tower of spaces. This is a joint work with Mauro Porta (IRMA, Strasbourg).

LAURA CAPUANO

An overview of some problems of unlikely intersections. What makes an intersection unlikely? If we study the dimension, we expect that the intersection of two varieties X and Y and s is empty if the dimension of X is strictly less than the dimension of Y , unless there is some geometric relation between the two varieties. This philosophy inspired the formulation of many conjectures in number theory, due to Bombieri-Masser-Zannier and Zilber in the case of tori and by Pink in the more general context of mixed Shimura varieties. After giving an introduction to this kind of problems, I will describe some results obtained in collaboration with Fabrizio Barroero in the context of families of abelian varieties, and applications to other problems of diophantine nature.

MARTINA LANINI

Totally nonnegative Grassmannians, Grassmann necklaces and quiver Grassmannians. Totally nonnegative (tnn) Grassmannians are subvarieties of (real) Grassmannians which have been widely investigated thanks to the several applications in mathematics and physics. In a seminal paper on the subject, Postnikov constructed a cellularisation of the tnn Grassmannians whose

cell closure relation is encoded in the purely combinatorial defined poset of Grassmann necklaces. In this talk I will report on joint work with Evgeny Feigin and Alexander Puetz, in which we consider a linear algebraic analogue of Grassmann necklaces which gives rise to a quiver Grassmannian X . Grassmann necklaces encode also in this case some geometric information: they parametrise the fixed point set of an algebraic torus acting on our quiver Grassmannian, and as a poset they coincide with the poset coming from a cellular decomposition of X .

VALERIO MELANI

Representations of affine Kac-Moody algebras and opers with two singularities. Let G be a complex reductive algebraic group. The local geometric Langlands correspondence is a (partly conjectural) picture relating local systems on the punctured disc with representations of the loop group $G((t))$. Recently, E. Frenkel and D. Gaitsgory started studying a “categorical” version of this correspondence, showing how to construct categories with a $G((t))$ -action starting from opers on the punctured disc. Their construction is based on a theorem of B. Feigin and E. Frenkel, which identify functions on the space of opers with the center of a certain completed enveloping algebra. We present an extension of (some of) the results of Frenkel and Gaitsgory to the case of opers with two singular points. This is joint work with G. Fortuna, D. Lombardo, and A. Maffei.

SALVATORE STELLA

Compatible cluster structures on Poisson-Lie groups. In a series of papers spanning the last ten years, M. Gekhtman, M. Shapiro, and A. Vainshtein introduced the notion of compatibility in between a cluster algebra structure on the coordinate ring of a Poisson manifold and its Poisson bracket. In particular they conjectured, and proved in the special case of GL_n , that any Poisson-Lie group admits compatible cluster structure. Their construction, unfortunately, uses some ad-hoc functions built by hand and does not generalize naturally to other Poisson-Lie groups.

In this seminar I will present some ongoing work with A. Vainshtein giving an improved description of these functions in terms of generalized minors and their directional derivatives.

FABIO TONINI

Cox rings and Algebraic stacks. We will discuss the notion of Cox ring for an algebraic stack, which extends the classical notion for varieties, via the language of torsors. We will then present some applications and possible direction of research.