Center for Mathematics and Theoretical Physics

COLLOQUIUM LEVI-CIVITA

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Euclidean field theories and interacting Bose gases

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Aula Dal Passo, Dipartimento di Matematica
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Abstract. Euclidean field theories have been extensively studied in the mathematical literature since the sixties, motivated by high-energy physics and statistical mechanics. Formally, such a theory is given by a Gibbs measure associated with a Euclidean action functional over a space of distributions. In this talk I explain how some such theories arise as high-density limits of interacting Bose gases at positive temperature. This provides a rigorous derivation of them starting from a realistic microscopic model of statistical mechanics. I focus on field theories with a quartic, local or nonlocal, interaction in dimensions ≤ 3. Owing to the singularity of the Gaussian free field in dimensions higher than one, the interaction is ill-defined and has to be renormalized by infinite mass and energy counterterms. The proof is based on a functional integral representation of the interacting Bose gas. Based on joint work with Cristina Caraci, Jurg Fröhlich, Alessio Ranallo, Benjamin Schlein, Vedran Sohinger, and Pedro Torres Giesteira.