Fachgruppe Physik und Astronomie Universität Bonn

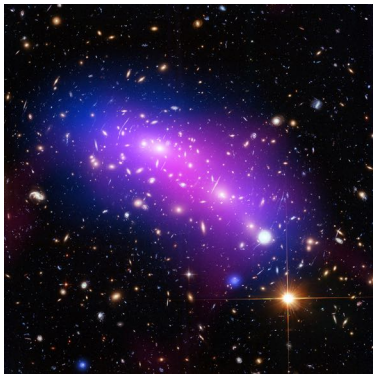
Physikalisches Kolloquium
Fachgruppe Physik/Astronomie der Universität Bonn

UNIVERSITÄT BONN

Friday, 24.11.2023, 1:15 p.m.
in Lecture Hall I of the Physics Institute

Dominique Eckert
University of Geneva

„Probing the nature of dark matter and modified gravity with massive galaxy clusters“



In spite of its numerous successes, the LambdaCDM model of cosmology is fundamentally incomplete, in the sense that 95% of the postulated matter-energy content is in an unknown form. Specifically, the LambdaCDM model postulates the existence of an unknown matter component, dubbed dark matter, which outweighs all the normal matter content of galaxies by a factor of 5-6. The gravitational effects of dark matter can be studied exquisitely well by observing the dynamics of the most massive structures in today's Universe - galaxy clusters. In this respect, deep X-ray observations of nearby galaxy clusters play a key role in our understanding of the gravitational field of collapsed halos. Indeed, galaxy clusters are filled with a hot, tenuous plasma - the intracluster medium (ICM) - which contains the vast majority of their baryons and shines predominantly in X-rays. The pressure exerted by the hot gas equilibrates the gravitational force, such that the total enclosed mass can be derived point-by-point from the thermodynamic properties of the ICM. I will present recent studies aiming at determining the gravitational field of galaxy clusters from the thermodynamic properties of 12 massive, nearby systems. I will show how such observations can be used to constrain the self-interaction cross section of dark matter and how the measured gravitational field sets constraints on modified gravity theories. Finally, I will present a new approach combining galaxy cluster observables (X-ray, weak gravitational lensing, Sunyaev-Zeldovich effect) to reconstruct the underlying gravitational field, minimizing the systematic uncertainties associated with each individual method.

Credit Picture: X-ray: NASA/CXC/SAO/G.Ogrean et al.; Optical: NASA/STScI; Radio: NRAO/AUI/NSF

Everybody is welcome, especially students of all semesters.

Coffee and tea will be available after the colloquium.

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