

SFB 1601 Student Seminars – Summer 2026

Date & Time: 18th May, 2026 (Monday), 15:00 - 17:00+

Venue: Kosma room, Main Physics building, University of Cologne [[map](#)]

Social event: from 17:00

15:00 - 15:05	Welcome + Introduction	
15:05 - 15:30	On the Origin of Velocity Dispersion in the Warm Interstellar Medium	Wajdee Chayeb (PH1)
15:35 - 16:00	Exploring the epoch of reionisation via [CII] line intensity mapping with FYST/CCAT and cross-instrument statistics	Jonathan Clarke (PH1)
16:05 - 16:30	Properties of NbTiN-Nb-Al/AlO _x /Nb tunnel junctions in dependence of Nb interlayer thickness	Damián Peregrina García (PH1)
16:30 - 17:00	Open discussion about the Student Council & its activities + Feedback	
17:00 —	Snacks and Social Event	

Coffee and drinks will be provided during the seminar. You can bring your own cup of coffee.

Abstracts on the next pages.

List of Abstracts

On the Origin of Velocity Dispersion in the Warm Interstellar Medium

speaker: Wajdee Chayeb (PH1)

Abstract: Observation of the velocity dispersion of atomic hydrogen show a characteristic value of ~ 10 km/s in many disk galaxies indicating the presence of random motions at galactic scales. The trend of velocity dispersion seems to be constant with galactocentric radius for the Milky Way and declines for other galaxies. We conduct several adaptive mesh simulations of the gaseous disk of the Milky Way embedded in a static stellar disk and a static dark matter halo. This is done to investigate the role of spiral arms, galactic bar, bulge, shearing motions, and cooling in driving velocity dispersion. Furthermore, we explore the physical forces responsible for the origin of such dispersion in each direction and what controls its trend with galactocentric radius. We conclude that stellar spiral arms, induced as rigidly-rotating density waves in the stellar potential, can drive the observed velocity dispersion, while the contribution of the bar is only limited to regions of its extension. In addition, cooling and differential rotation, significantly. Finally, we find that the radial dispersion is mostly caused by the gravitational forces of the stellar arms, while azimuthal one is mainly caused by the shear induced by the arms. The interplay between these forces may suggest the origin of such dispersion at scales > 100 pc.

Exploring the epoch of reionisation via [CII] line intensity mapping with FYST/CCAT and cross-instrument statistics

Speaker: Jonathan Clarke (PH1)

Abstract: Line intensity mapping (LIM), a developing field of observations which can scan over wide sky areas whilst probing the dim end of galaxy luminosity functions, will be implemented by the Fred Young Submillimeter Telescope (FYST/CCAT) to probe the [CII] line. In this way, we will examine a key star formation tracer at $3.5 < z < 8.2$, the tail end of the epoch of reionisation (EoR), thereby providing information on the history of galaxy formation. However, CO foregrounds and atmospheric concerns are significant contaminants for most frequency bands. Two techniques developed to mitigate these are masking based on foreground catalogues to target excess foreground signal, as well as cross-instrument cross-correlation of tomographic maps, which causes non-correlated contaminants to fall out. Both of these techniques provide new opportunities for [CII] signal recovery, though masking is still limited by instrumental noise and cross-correlation opportunities are limited by available instruments scanning the same areas of the night sky. In this talk I present preliminary results on promising cross-correlations, as well as how masking can be used to optimise their results.

Properties of NbTiN-Nb-Al/AlO_x/Nb tunnel junctions in dependence of Nb interlayer thickness

Speaker: Damián Peregrina García (PH1)

Abstract: The CCAT Observatory will equip, among other instruments, CHAI, a heterodyne array instrument covering two spectral bands: the Low-Frequency Array (LFA, 455–495 GHz) and the High-Frequency Array (HFA, 800–820 GHz), each comprising 64 pixels. The mixers for LFA rely on SIS junctions fabricated with the standard Nb/Al-AlN/Nb process. While these junctions can mix radiation across both bands, the integrated tuning structure that is formed by the Nb base layer outside the junction dissipates at HFA frequencies, thus requiring its removal via dry etching. Replacing this base layer with a higher-gap superconductor such as NbTiN will drastically improve the performance, although it introduces fabrication challenges. To address them, a thin Nb buffer layer was deposited on the NbTiN electrode to take advantage of the well-known excellent interface between Nb and Al. It was expected that if this layer were thin enough and there was a high Nb-NbTiN interface transparency, it would be proximity-coupled in such a way that the resulting superconducting gap of the composite NbTiN-Nb layer is high enough for HFA radiation, thus allowing to avoid the dry etching step that would otherwise compromise the yield of the 256 junctions for the array. It was found that a tunnel barrier can be successfully grown on a Nb layer of a thickness down to 2 nm. The gap voltage decreases with thinner buffer layers, contrary to the expected behaviour of a film in proximity with NbTiN. Nevertheless, a comparison with a standalone Nb film suggests a weak proximity-coupling.